Proceedings of the

19th European Conference on Innovation and Entrepreneurship

Hosted by CESI, Paris-Nanterre, France

26-27 September 2024



Stephanie Buisine and Muriel Davies

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Proceedings of the
19th European Conference on Innovation and Entrepreneurship
ECIE 2024
26-27 September 2024

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Edited by

Dr Stéphanie Buisine

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About the 19th European Conference on Innovation and Entrepreneurship, 2024

The European Conference on Innovation and Entrepreneurship (ECIE) is a prominent academic conference that has been held annually for 19 years. The conference serves as a vital forum for scholars, researchers, entrepreneurs, and practitioners to explore the latest trends, research findings, and practical applications in the fields of innovation and entrepreneurship. ECIE is committed to advancing the understanding of how innovation and entrepreneurship drive economic growth, competitiveness, and societal progress.

ECIE is recognized for its rigorous peer-reviewed conference proceedings, which ensure that the research presented is of high academic quality and practical relevance. The Proceedings of the 19th ECIE, 2024 includes academic research papers, PhD research papers and Master's research papers as well as work-in-progress papers, which have been presented and discussed at the conference. The proceedings are of an academic level appropriate to a research audience including graduates, post-graduates, doctoral and post-doctoral researchers. All papers have been double-blind peer reviewed by members of the Review Committee.

Aims and Scope

The primary aim of ECIE is to foster a comprehensive understanding of innovation and entrepreneurship by bringing together, from around the world, diverse perspectives from academia, industry, and policy-making. The conference seeks to bridge the gap between theory and practice, offering insights into the processes that fuel innovation and entrepreneurial ventures. ECIE encourages the exploration of new ideas, the development of innovative business models, and the identification of best practices that can be applied across different sectors and regions.

The scope of the conference is broad and interdisciplinary, encompassing a wide range of topics related to innovation management, entrepreneurial ecosystems, and the role of technology in driving business growth. ECIE also emphasises the importance of education and training in fostering entrepreneurial skills and mindsets, as well as the role of policy and government in supporting innovation and entrepreneurship.

Topics Covered

ECIE covers a diverse array of topics that reflect the dynamic and evolving nature of innovation and entrepreneurship. The call for papers asked for contributions that considered the following topics. In addition, the committee welcomed papers on a number of specialist mini-tracks which can be seen at the end of this list.

Innovation Management:

- Innovation Processes and Models
- Managing R&D and Product Development
- Innovation in SMEs and Large Enterprises.

Entrepreneurial Ecosystems:

- Startup Ecosystems and Incubators
- Social Entrepreneurship
- Corporate Entrepreneurship and Intrapreneurship

Technology and Digital Innovation:

- Digital Transformation
- Emerging Technologies
- Innovation in the Digital Economy

Entrepreneurship Education and Training:

- Entrepreneurial Mindset Development
- Curriculum Design and Pedagogy
- Experiential Learning

Innovation and Entrepreneurship Policy:

- Government Policies and Support Programs
- Regional and National Innovation Systems
- Public-Private Partnerships

Sustainable Innovation and Entrepreneurship:

- Sustainability and Green Innovation
- Circular Economy
- Impact of Innovation on Society

Global Perspectives on Innovation and Entrepreneurship:

- International Entrepreneurship
- Innovation in Emerging Markets
- Cross-Cultural Entrepreneurship

Research Methods in Innovation and Entrepreneurship:

- Quantitative and Qualitative Approaches
- Action Research and Participatory Methods
- Innovation Metrics and Impact Assessment.

Mini Tracks

Experts in the field proposed mini tracks on the following topics. Papers accepted on these topics after the double-blind peer review process were presented as mini tracks at the conference and are also published in these proceedings.

- Entrepreneurship Education and Learning
- Twin Green and Digital Innovation
- Management and Enterprise Development

The programme from the 2024 conference can be downloaded from here and full details about the conference can be seen from the conference website: https://www.academic-conferences.org/conferences/ecie/

ECIE Preface

These proceedings represent the work of contributors to the 19th European Conference on Innovation and Entrepreneurship (ECIE 2024), hosted by CESI, Paris-Nanterre, France on 26-27 September 2024. The Conference and Programme Chairs were Stephanie Buisine and Muriel Davies both from CESI Paris, France

ECIE is a well-established event on the academic research calendar and now in its 19th year the key aim remains the opportunity for participants from around the world to share ideas and meet the people who hold them. The subjects covered illustrate the wide range of topics that fall into this important and ever-growing area of research. ECIE is recognised for its rigorous peer-reviewed conference proceedings, which ensures that the research presented is of high academic quality and practical relevance. The conference serves as a key venue for the dissemination of cutting-edge research, the exchange of best practices, and the development of new ideas that can drive innovation and entrepreneurship in a rapidly changing global economy.

The opening keynote presentation was given by Stephanie Buisine, CESI, Paris-Nanterre, France who spoke on "*Meaningful Innovation*". The second day of the conference opened with an address from Olivier Hamant, INRAE, Ecole Normale Supérieure, Lyon, France on the topic of "*Suboptimality: The Inefficient Truth*".

With an initial submission of 245 abstracts, after the double blind, peer review process there are 122 Academic research papers, 8 PhD research papers, 3 Masters Research papers, and 6 work-in-progress papers published in these Conference Proceedings. These papers represent research from Australia, Belgium, Brazil, Bulgaria, Cambodia, Croatia, Cyprus, Czech Republic, Egypt, Estonia, Finland, France, Germany, greece, INDIA, Iran, Ireland, Israel, Italy, Japan, Latvia, Lithuania, Malaysia, Netherlands, Nigeria, Norway, Oman, Pakistan, Perú, Philippines, Poland, Portugal, Saudi Arabia, Serbia, Slovakia, South Africa, Switzerland, Thailand, Tunisia, Türkiye, UK, USA, Vietnam, and Zimbabwe.

We would like to thank everyone who participated in this event.

Dr Stéphanie Buisine

CESI
Nanterre
France

September 2024

Biographies of Chairs and Keynote Speakers

Conference and Programme Chairs



Stéphanie Buisine is Research Director at CESI, Paris, France and leads innovation research at LINEACT laboratory. Her career has taken her from technological innovation issues (ex: Human-Computer Interaction) to the methodological and strategic dimensions of innovation (ex: Creativity, Prospective on future needs), up to organizational innovation. Through innovation, her research aims to support self-determination of users, designers and collaborators.



Muriel Davies first studied engineering and management and then started a career working for 14 years in the textile industry on several plants as both a supply chain and quality manager. She then joined CESI, Paris, France in 2009 as a pedagogical manager, and then LINEACT CESI 8 years ago as a researcher. Today she conducts research on culture and organizational innovation with the current socio-environmental challenges as structural framework.

Keynote Speakers



Olivier Hamant is a biologist and a Director of Research at INRAE (the French institute for research on agriculture, food and environment) at Ecole Normale Supérieure in Lyon. He is also a Director of the Michel Serres Institute where he contributes to several projects in the fields of art, science and education around the existential issues of the Anthropocene. He has published approximately 100 scientific articles on biophysics and plant development. His research topic has also shed a new light on the question of the robustness of living organisms. In 2022, he published “La Troisième Voie du Vivant” (“The Third Way of Life”, Ed. Odile Jacob) soon to be translated into English.

Mini Track Chairs



Nasser Abouzakhar is an entrepreneur and the director of Anzar Property Investment Limited, which was founded in 2017. He is the author of the book Real Estate Investment: In the Pursuit of Building Income producing Assets to Grow Your Wealth. Nasser is a TEDx speaker, award-winning author, and a regular guest on the BBC TV channel for over 100 live TV interviews, including the Homes Under the Hammer TV show. Between 2004 and 2019, he worked at different universities in the UK as an academic, teaching and researching different technology-related subjects.



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Artificial Intelligence-Based Solution Model for Real Estate Business and Entrepreneurial Operations: Case Study

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Abstract: Artificial Intelligence (AI) is a collection of algorithms, tools and solution models that offer entrepreneurs a platform for managing and systemising their SMEs and business operations. Recently, AI opened new venues for smart activities and cost-effective solutions, saving time and money for start-ups and established enterprises. Advanced AI tools use high-efficiency algorithms such as machine learning to assess markets, evaluate product and service prices, and reduce maintenance costs. AI has radically disturbed many industries and sectors, offering opportunities to and allowing entrepreneurs to innovate and develop smart solutions in a competitive market. However, this disruption presents new challenges for entrepreneurs in dealing with AI technologies and establishing their 'smart' businesses. Investing in AI requires proper planning and understanding of the risks and challenges of applying new technologies and tools. Therefore, entrepreneurs must acquire the necessary skills and build competent teams of talents or experts to support them in maximising their returns and minimising risks. This paper presents a real-life scenario about some of the challenges faced by business enterprises in general and property businesses in particular. An AI-based innovation model for a real estate business comprising six primary services: Data analysis and strategy, Finance, Legal, Property Development, Property management, and Facility management has been introduced. This paper covers some of the entrepreneurial activities and AI-based solutions developed to improve the quality of their operations, manage their business processes, and maintain effective service delivery. Generative AI or Gen AI has significantly impacted many impressive real-life applications, delivering real value to many sectors, including finance, real estate, business management, research and development (R&D) projects, and entrepreneurial operations. Gen AI uses machine learning and neural network algorithms trained using big data text, images, audio and video. This paper introduces the main Gen AI types and covers real-life examples of applying Gen AI techniques to property business problems. It presents our GPT-based AI-powered property consultant application that uses GPT to help property developers, investors, and professionals, offering them solutions to business challenges such as property design and conversion options. If necessary, the user prompts the application, which responds with options for possible solutions like design solutions or converting office buildings or commercial properties to multiple residential flats and houses.

Keywords: AI-based models for businesses and entrepreneurial operations, Gen AI, Automated services, Optimisation of business systems and processes

1. Introduction

AI is becoming essential for innovation and analysing extensive data from across areas of sectors, offering compelling predictive insights and developing efficient, cost-effective solutions for many industries; it undoubtedly will transform our lives. AI tools have been instrumental in business operations, enabling new developments in finance, market predictions, property development and investment, and forecasting. With the support of machine learning techniques and predictive analytics, AI technologies can gather and analyse large amounts of data, like market conditions and sales data, to predict prices, allowing businesses and professionals to make informed decisions and minimise risks. AI has revolutionised how we perform many activities, manage business operations, predict and detect disease, develop marketing and sales strategies, etc.; the possibilities are endless (Mollick, 2024). Figure 1 shows what the author believes the main features offered by AI solutions, as follows:

- Data Analytics: ability to analyse big data and learn of that data to perform exciting tasks
- Effectiveness: improve the quality of business operations
- Cost Reduction: keep business costs and expenses as minimal as possible
- Efficiency: ability to reduce the time required to complete business tasks and operational activities



Figure 1: Artificial Intelligence Features

Advanced AI models like Gen AI, a subset of Artificial Neural Networks (ANNs), can process and analyse data to generate new content or data such as natural language or video. This newly generated content is based on patterns Gen AI recognised and similar to the data they were trained on; hence, the name Generative AI. Gen AI tools use high-efficiency algorithms like machine learning to evaluate product and service prices and reduce maintenance costs. For example, ChatGPT can initiate communication with potential clients, start the negotiation process to learn about their needs, get basic information about their situation based on their prompts, and then assess the available resources and offer them cost-effective solutions (Erne, 2023).

According to Forbes, AI is expected to grow 37.3% from 2023 to 2030, reflecting the rising impact of AI technologies in optimising business operations. About 25% of businesses adopt AI to address labour shortages and offer compensation for the lack of qualified employees. Furthermore, 77% of employees are concerned about losing their jobs because of the introduction of AI in 2024, showing a widespread concern among the majority of the workforce. However, AI is projected to introduce about 97 million new job opportunities, countering the job loss concerns. The impact of AI could reach 400 million workers worldwide, affecting around 15% of the global workforce.

2. Literature Review

Although Gen AI is considered by many as a game changer that is capable of showing interesting creativity and the ability to deliver real value in research and development (R&D), entrepreneurial operations and innovation, there is potential for more impressive content generation, design works, and scientific research. This offers good support to entrepreneurs and various enterprises across various industries to gain significant operational support; however, Gen AI needs to catch up in producing original ideas and content that human creative authors can make. Gen AI models are large algorithms trained on human intelligence using massive datasets, growing Internet content, and its expansion. These intelligent models can be tailored to specific sectors like education, finance, real estate, etc., offering disruptive applications across many industries.

Gen AI tools allow companies to provide high-quality services or develop enhanced products, opening new markets and clients. However, businesses must build pilot projects and plan for testing Gen AI tools and their

impact, which implies a lot of learning and education and making informed decisions. This should help them gain the necessary knowledge and build their understanding of how to deal with this extraordinary technology. It should also equip them with the right skills that will support them in achieving their business goals and objectives. Gen AI focuses on two major categories, Generative AI and Discriminative AI, as follows:

- Generative AI models analyse data to learn probability distributions of sub-categories within a dataset, which makes them capable of generating content similar to the training data. They offer content generation, create personalised content such as text, images, sound, and videos, and transform text into images or video, making Gen AI a significant model for producing creative content such as ChatGPT.
- Discriminative AI models are about summarisation and predictive analytics. They are based on ANN models that can classify data by identifying features. They offer exciting applications like speech recognition and analytics, AI-powered applications, document summarisation, chatbots, etc. Such smart tools can be trained on previous customer communications and interactions, creating exciting applications that support many businesses and organisations and offer quality customer service.

2.1 Gen AI Types

Gen AI has become an attractive tool for business intelligence, market assessment, and property legal matters, using online accessible data repository platforms to extract valuable information. For instance, property investors and developers became aware of the power of Gen AI and started using it to analyse the real estate market and for evaluation and assessment purposes. OpenAI tools such as ChatGPT use a large language model (LLM) designed to respond to user questions efficiently. LLM is an AI algorithm that uses deep neural network (DNN) learning techniques to process and summarise big data and predict new content. It is closely connected to Gen AI and designed to help generate content. This makes LLM capable of predicting the best output response textually or verbally to text-based queries or input questions. Different types of Gen AI (Abdullahi, 2024) (Almeida, 2024) can be distinguished based on the input and output content type, as shown in Figure 2 below.

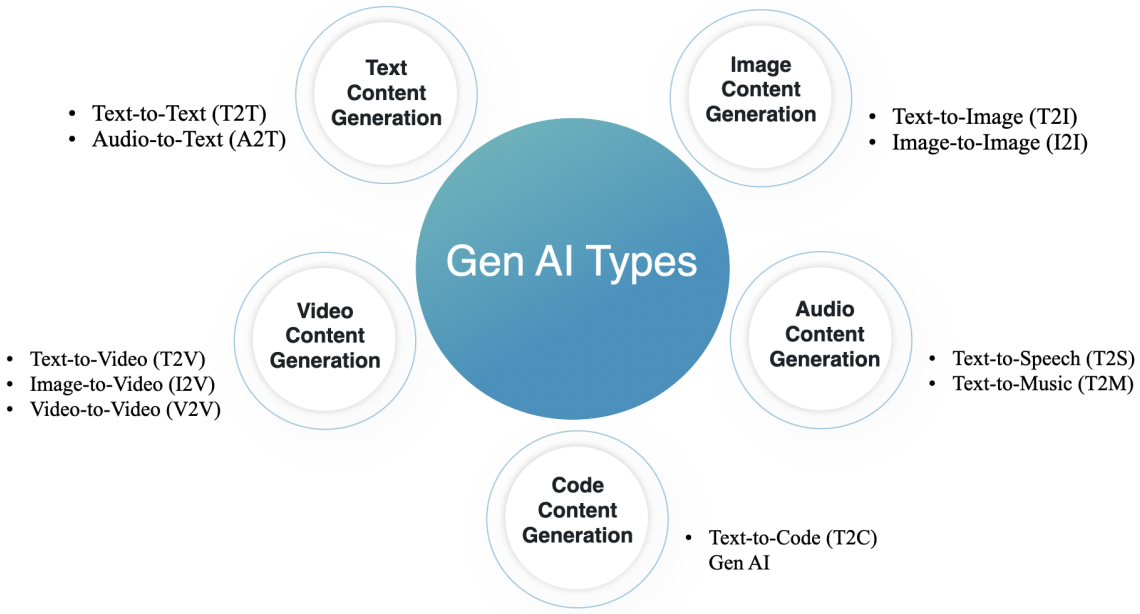


Figure 2: Gen AI Types

- Text Content Generation: Text AI generators are trained on large amounts of text from different sources, such as websites, e-books, and publications, to identify patterns and relationships between features in natural language. This makes them capable of generating new text such as reports, blogs, poetry, etc. There are two categories of text content generation, as follows:
- *Text-to-Text (T2T) Gen AI*
- *Audio-to-Text (A2T) Gen AI*
- Image Content Generation: This type of Gen AI analyses image datasets and their text descriptions and learns their features and concepts to create new images. There are two categories of image content generation, as follows:

- *Text-to-Image (T2I) Gen AI*
- *Image-to-Image (I2I) Gen AI*
- Audio Content Generation: Audio AI generators can analyse sounds and their metadata from different audio genres and associated text or song lyrics to learn features and patterns. There are two categories of audio content generation, as follows:
- *Text-to-Speech (T2S) Gen AI*
- *Text-to-Music (T2M) Gen AI*
- Video Content Generation: These generators can analyse visual, sound, and text content to learn how to generate new videos and apply effects if necessary. There are three categories of video content generation, as follows:
- *Text-to-Video (T2V) Gen AI*
- *Image-to-Video (I2V) Gen AI*
- *Video-to-Video (V2V) Gen AI*
- Code Content Generation: These AI generators are trained from large, accessible code datasets for different programming languages. This helps identify patterns and language structure and then write or develop program code to perform various tasks, whether for producing new programs or debugging purposes. There is only one category of code content generation, as follows:
- *Text-to-Code (T2C) Gen AI*

2.2 Gen AI Tools

Many Gen AI tools are currently available for businesses to help them with their operations and business challenges. These tools use LLM models trained on extensive data to learn how to generate human-like content, such as predicting the highly likely word to follow a previous one in T2T Gen AI. Figure 3 shows six tools: OpenAI's ChatGPT, Google's Gemini, Inflection's Pi, Anthropic's Claude, Microsoft's Copilot, and Adobe's Firefly (Kothari, 2024); Table 6.1 shows a brief comparison between all these tools (Kothari, 2024), (Abdullahi, 2024) (Almeida, 2024).

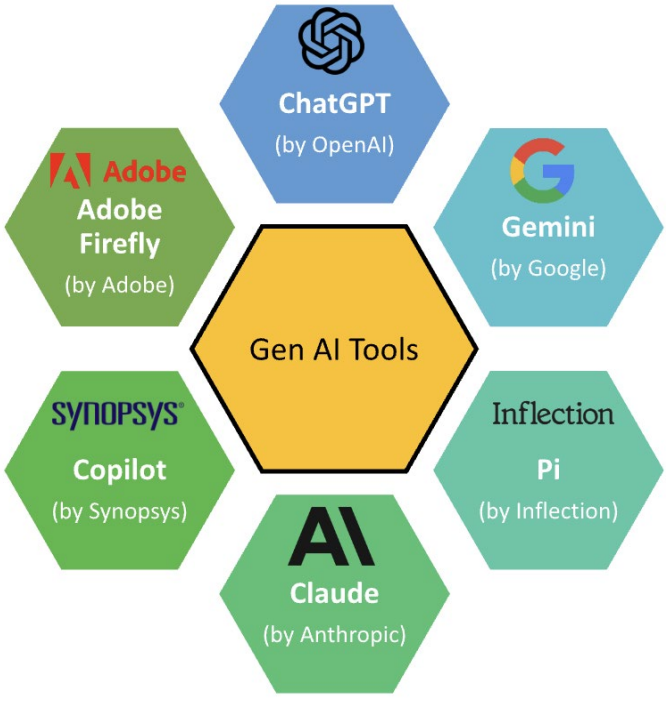


Figure 3: Gen AI Tools

Table 1: A Brief Comparison Between Gen AI Tools

Tool	Model	Code generation	Context window	Message limit
ChatGPT	GPT 4+ & Turbo	Yes	32k & 128k	40-80 per 3h
Gemini	Gemini Ultra	Yes	1 m	~ Limitless
Pi	Inflection-2.5	No	?	?
Claude	Claude 3 Opus	Yes	200k	100 per 8h
Copilot	GPT 4+	Yes	?	100 per day
Adobe Firto efly	Diffusion	Yes	1k	?

These tools use a large language model (LLM) to respond efficiently to user questions and use many resources to gather information, such as published research papers and articles, technical reports, social media, programming code, and online communications. These resources and LLM allow these tools to respond to users and offer helpful content using human-like smart AI functionalities. Therefore, communicating with Gen AI tools is essential to getting a helpful output or response to your query, such as an exciting image, useful video, or article. However, you must provide the Gen AI tool with the correct input or prompt, use the right words, structure requests correctly, and communicate clearly to receive the perfect response and desired information (Patel, 2024). For example, prompts instruct or ask ChatGPT or Google Gemini a question to generate a response in text, images, or both. ChatGPT can respond to customers' questions or queries, providing helpful information and efficient support, offering customers a superior experience and satisfaction. ChatGPT is a large AI-based natural language processing model, and its name ChatGPT combines 'Chat', which uses the AI chat feature used by chatbots, and 'GPT', which stands for Generative Pre-trained Transformer, an LLM.

Getting the best of Gen AI tools requires a proper understanding of how to instruct "prompt" those innovative tools to generate the results you are aiming for. It is not always guaranteed to receive the desired output; it is just about increasing the opportunity to get the desired results. Regardless of the content of your prompt, the way you structure and frame it would significantly improve the generated response and results. In other words, the quality of your prompt determines the quality of the tool's response. The better you write and frame your prompt, the better the output. Examples of valuable prompts will be introduced in the following sections, illustrating some techniques you must be aware of to produce well-framed prompts for Gen AIs.

With its intelligent features, the Internet has improved the real estate business regarding property market assessment, valuation, conveyancing, etc., but it has brought benefits and limitations. Bringing real estate businesses online helped interested customers check property prices, locations, and neighbourhoods. However, the Internet has limitations and cyber security challenges, threats, risks, and vulnerabilities. Many Internet and AI tools have become available to property businesses to speed up and simplify previously paid services that are often costly. Those tools cooperate to create an ecosystem that offers efficient and effective services to their customers. AI tools can help property investors and professionals like estate agents, letting agents assess the property market and improve their customers' experience (Fielden, 2024).

Many of these features and services were not possible ten years ago and were time-consuming and intensive. Today, we can look for a property and view it virtually; if we like it, we can offer our price, apply for a mortgage on the same website, and start purchasing the property on the same day. With such innovative online services, advertising and selling a property has become much easier and faster. They simplify and expedite the communication between buyers and sellers or tenants and landlords, thus saving time for all parties involved

(Mather, 2019). AI technology and online services resolve many complex problems and challenges impacting businesses, as follows:

- Keep them operating effectively and productively, delivering their services to their customers.
- Monitor operations and more measurability of results and completed tasks.
- Ensure agility and accountability to minimise errors
- Speed up activities and workflow and improve service support
- Minimise wastage in effort and time and avoid the use of ad hoc measures
- Develop a dynamic and efficient business that is capable of resolving its problems and challenges and able to change
- Better satisfaction of business members and employees
- Minimise the risks of human errors and make informed decisions

3. Methodology

AI has radically disturbed many industries and sectors, and the real estate sector is not an exception, offering opportunities to and allowing property business entrepreneurs and start-ups to innovate and develop intelligent solutions in a competitive market. However, this disruption presents new challenges for entrepreneurs in dealing with AI technologies and establishing their 'smart' businesses. AI tools such as machine learning can assess the property market, evaluate prices, and improve the customer experience. With the introduction of such tools, the role of real estate businesses such as asset management, buy-to-let companies, and letting agents or estate agents will develop and change. Figure 4 shows our AI-based innovation model for a real estate business comprising six primary services, as follows:

- Data Analysis and Strategy: Analysing the current property markets at different geographical locations and the demand and supply levels is essential in the real estate business. Applying AI mechanisms and its learning models can help predict future changes to market behaviour.
- Finance: Offer digital mortgage brokering, providing online access to capital and proposing different types of loans. Moreover, auto search tools for the best suitable mortgage products offer a comparison platform and options for borrowing beyond banks, providing an efficient, transparent mortgage/loan application process that speeds up lending. Furthermore, it helps find and close the best deals faster, eliminating intermediaries and reducing costs.
- Legal: Blockchain technology is a platform capable of processing smart contracts and managing and electronically signing property-related legal documents. It is a decentralised system capable of verifying identities using the personal digital key to authenticate and authorise a smart contract or transaction (Wu, B. and Wu, B., 2023). Using the blockchain and smart contracts can improve the contract management process, speed up a transaction process, ensure transparency and avoid extra costs. The blockchain can transfer and record transactions and real estate titles and makes background checks on all entities involved.
- Property Development: Digitally manage the development planning stage and develop the project life-cycle using smart tools such as Building Information Modelling (BIM). BIM can simulate the planning and development process, visualise all the milestones of construction projects, design buildings, estimate costs, and analyse them before construction.
- Asset Management: It is about ensuring the growth and success of the investment through the property's income generation and capital appreciation. AI tools can be used to monitor the property's performance, stay current with market trends, make critical decisions, and mitigate risk on behalf of the investors. This includes two main activities.
- *Property Management: Online marketplaces are used to find potential tenants; chatbots filter unqualified applicants, assess those qualified ones, select successful applicants, and use auto-filling tools to prepare tenancy agreements. This helps property managers properly manage their property's occupancy using cost-effective solutions and supports potential tenants in overcoming geographical barriers.*
- *Facility Management: The facility manager can use smart tools and applications to monitor and optimise efficiency, control costs, regulate property usage, and report to the property owner in real-time. This helps to optimise regular checks and routine maintenance, anticipate repairs, and respond to problems and breakdowns in the property.*



Figure 4: AI-based Real Estate Innovation Model

A Gen AI application using a feed-forward ANN model has been developed to help property investors and professionals develop appropriate real estate projects such as market analysis, commercial conversions, etc. The application has multiple built-in features using ChatGPT to interact with the backend model to analyse the user's input(s) and provide the necessary output(s). The following section details the application prototype and its main features.

We developed a Gen AI application prototype using a GPT, an ANN model that uses the Transformer Gen AI model, which can learn the context of the input data using feed-forward NNs, deciding the weights of the input data to determine the relationships between different parts of the input content. It is commonly used in natural language processing and AI applications like ChatGPT. The developed application is a GPT-based AI-powered property Consultant using ChatGPT to support property investors and professionals. Figure 5 shows four prompt options and an input field, allowing property developers, investors and professionals to use the application for various services. The application is designed to help them analyse properties, property locations and markets and obtain information about converting large properties into multiple flats and houses, as follows:

- Analyse any property market using SWOT (Strengths, Weaknesses, Opportunities, and Threats) and PESTEL (Political, Economic, Social, Technological, Environmental, and Legal) analysis.
- Identify supply and demand for residential properties in any city or country.
- Get information about a property use class and building conversion options.
- Design options for property conversion, such as commercial-to-residential conversion projects.

- Evaluate and optimise the property conversion design process to efficiently use a space, offering cost-effective solutions.

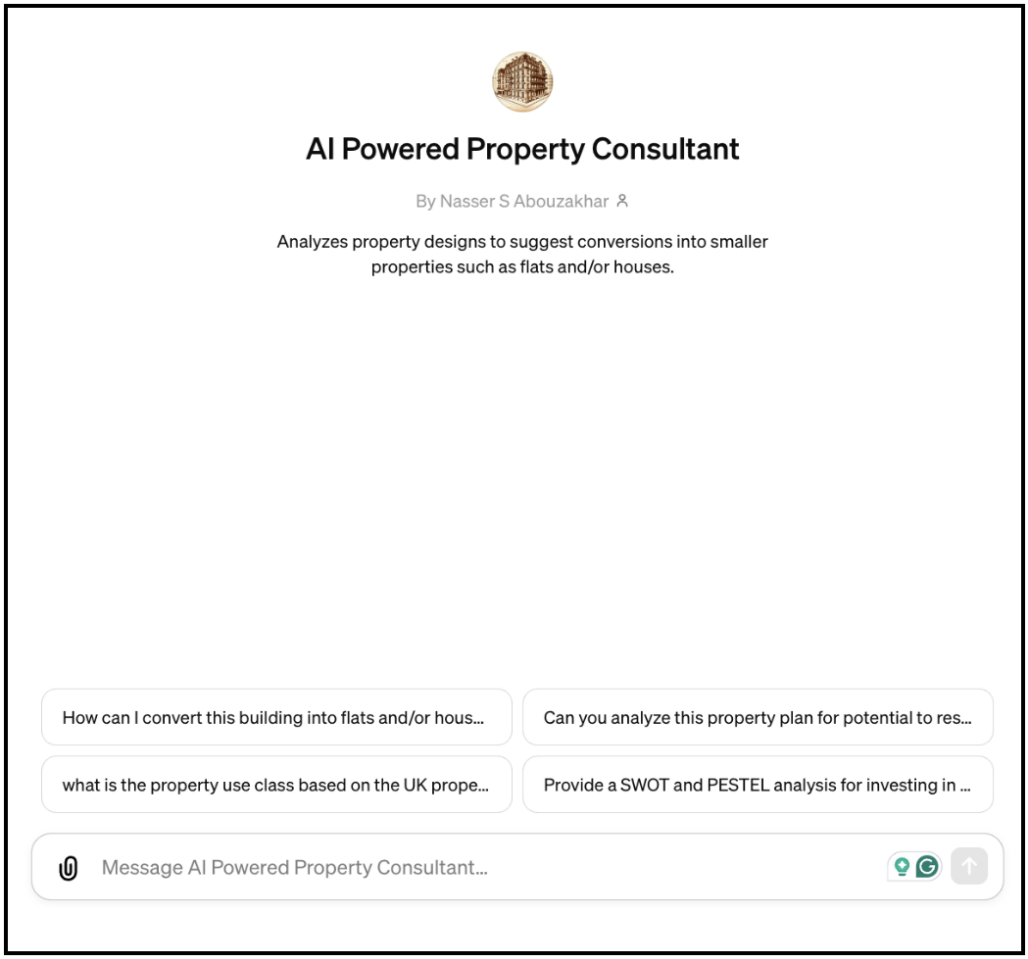


Figure 5: AI-Powered Property Consultant

Gen AI transforms how planners and developers approach business activities, offering practical tools to explore, experiment, and create innovative solutions. The application uses input parameters to offer its users innovative solutions and optimises the property conversion and design process regarding development time and renovation works. This makes the application capable of analysing each scenario option against the user's predefined criteria. The AI-powered property Consultant uses an iterative process supported by powerful Gen AI algorithms operating in the background, capable of proposing helpful solutions. Each suggested solution is analysed against predefined criteria such as building design, number of floors, area of the building or floor, etc., considering the building requirements and regulations.

The application offers the user an incredible way to explore various design and property conversion possibilities, ensuring efficient use of the available resources and space and allowing the user to compare and contrast multiple designs and select the best option based on the desired output. This app can accept a property design plan, such as Figure 6, which shows a four-story residential building with a basement used as input to the application to provide a conversion option for this property into multiple flats. The application's proposed solution output is shown in Figure 7 (a), offering detailed design options for all the apartments at each property level. Figure 7 (b) shows the remaining part of the output, which includes extra suggestions from the application.

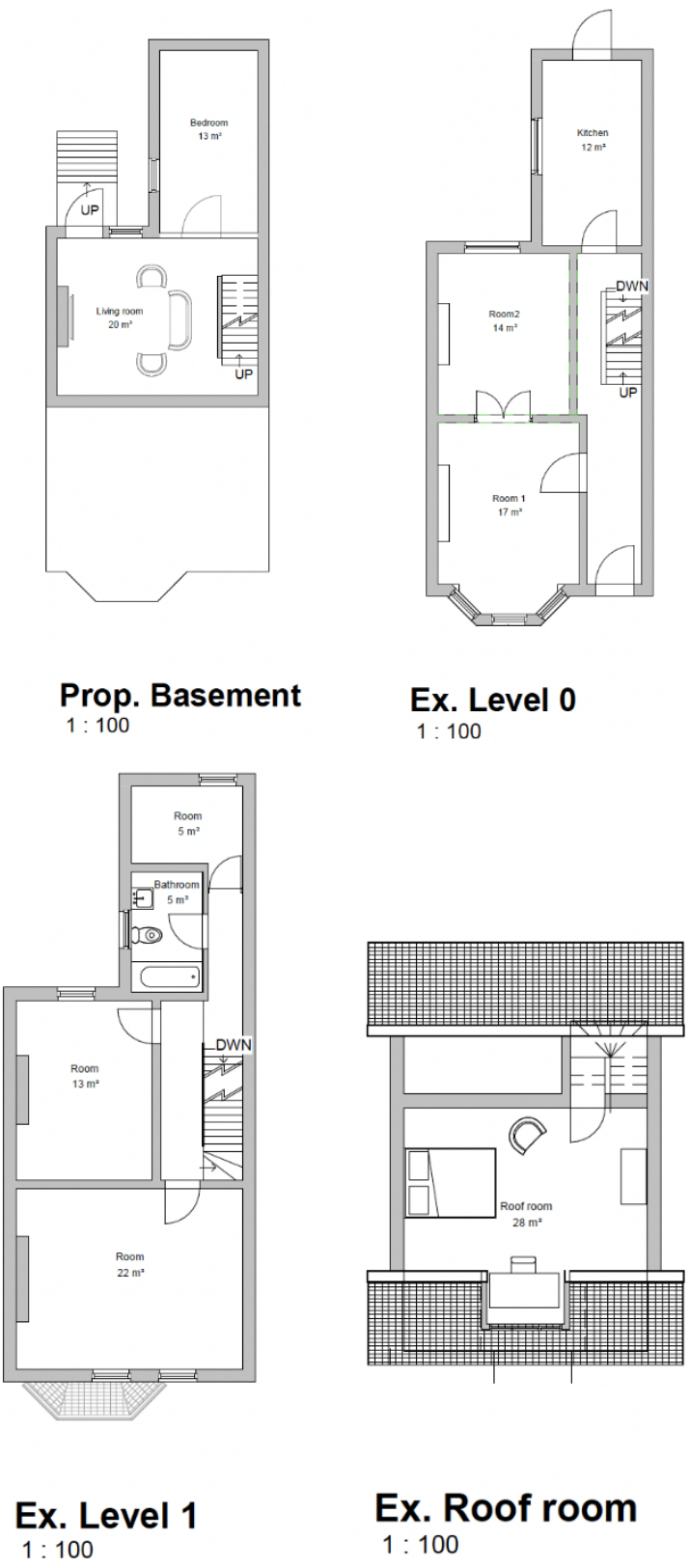


Figure 6: Property plan

AI Powered Property Consultant

Thank you for providing the floor plans. Based on the layout provided, here are some suggestions for converting this building into flats:

Proposed Basement:

- The existing living room can be converted into an open-plan living/kitchen/dining area.
- The current bedroom could be maintained as is, or if there's enough natural light, potentially split into two smaller bedrooms.

Existing Level 0:

- Room 1 can be an open-plan living/kitchen/dining area.
- Room 2 can remain as a bedroom.
- The kitchen area could be converted into a bathroom if the existing one isn't sufficient.

Existing Level 1:

- The largest room (22 sqm) can be converted into an open-plan living/kitchen/dining area.
- The 13 sqm room can be kept as a bedroom, or if there's another space for a kitchen, it could be split into two smaller rooms.
- The smallest room can be an office or a small bedroom.

Existing Roof Room:

- This could make a spacious studio flat with an open-plan living/kitchen/dining area and a separated sleeping area.

Figure 7 (a): The generated output

General Suggestions:

- Ensure each flat has at least one source of natural light and ventilation.
- All flats should have a bathroom with a toilet, sink, and bath or shower.
- Kitchens should be designed with efficiency in mind, possibly with integrated appliances to save space.
- Consider soundproofing between floors to improve the quality of living for residents.
- Compliance with fire safety regulations is critical; ensure there are sufficient escape routes and fire-resistant materials.
- Check if a change of use permission is required from residential to multiple dwellings.
- Make sure to comply with the minimum space standards and natural light requirements for new dwellings.
- Consider the accessibility requirements for all residents, including those with mobility issues.

These are preliminary suggestions and would need to be reviewed by an architect and in accordance with local building regulations and planning permissions. Always consult with a professional to ensure all conversions are legal and safe.

Figure 7 (b): The generated output

4. Discussion

AI has disturbed the real estate industry, providing opportunities for investors and entrepreneurs to develop smart systems that help them deal with various business challenges, such as market analysis, cost management, customer experience, etc. The role of the developed AI-Powered Property Consultant application prototype is to support its users in terms of analysing property markets at different geographical areas including the demand and supply levels and offering business opportunities for development strategies such as commercial conversions. Such support is essential for various property businesses to find the best deals and minimising costs. The application prototype can play a major role in business growth and investment success, staying with market trends, mitigating risks and making informed decisions about property development and significant conversion projects.

The developed application prototype can support property developers, investors and professionals in developing successful property projects using ChatGPT features. The application analyses the users' prompts and provides the results as requested according to relevant property markets, locations and local situations, providing SWOT and PESTEL analysis. The necessary details for property conversions, such as use classes, design and conversion options, can also be offered. The application can provide cost-effective development projects and evaluate the process effectively.

5. Conclusion

AI has radically disturbed many industries and sectors, offering opportunities to and allowing entrepreneurs to innovate and develop intelligent solutions in a competitive market. AI opened new venues for smart activities and cost-effective solutions, saving time and money for start-ups and established enterprises. Advanced AI tools use high-efficiency algorithms such as machine learning to assess markets, filter unqualified clients/applicants, evaluate product and service prices, and reduce maintenance costs. An AI-based innovation model for a real estate business comprising six primary services: Data analysis and strategy, Finance, Legal, Property Development, Property management, and Facility management has been introduced. This paper introduced a real-life scenario about some challenges and the ongoing change in the property business landscape and operations. It also covers some of the entrepreneurial activities and AI-based solutions implemented to improve the quality of its operations, manage property business processes, and maintain effective service delivery.

Gen AI has significantly impacted many real-life applications, such as content generation, design works, scientific research, and experimentation. It uses machine learning and ANN algorithms trained using big data text, images, audio and video. This paper covered the main Gen AI types, including the main tools of Gen AI, and presented some real-life scenarios of applying Gen AI techniques to property business problems. A GPT-based AI-powered property Consultant application has been introduced. This application can support property developers, investors, and professionals by offering solutions to various design and property conversion problems. It can analyse user prompts and property plans and provide options for converting office buildings or commercial properties to multiple flats and houses.

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Entrepreneurial Competences Development of University Students in the Czech Republic

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Abstract: Entrepreneurship and entrepreneurial activities represent driving force of developed economies from national economic point of view. From individual point of view of each entrepreneur, it mainly represents possibilities of applying and developing potential innovative business ideas and ensuring independent and freer future existence of individuals. Small and medium-sized enterprises form a significant part of the economy in developed economies and are characterized by many positives in the current turbulent world. Also, for these reasons, European Union support the development of entrepreneurial activities and the development of entrepreneurship appears as an important topic in the educational environment as well. Today, there are already identified approaches to the development of entrepreneurship at the European level, which enable the effective development of relevant entrepreneurship competence, especially in primary and secondary education level. Entrepreneurship Competence Framework - EntreComp, is interconnected with other frameworks for the development of wide range of competences among pupils. From theoretical point of view, pull and push factors can be identified to support entrepreneurship among future entrepreneurs, which motivate future entrepreneurs to enter business. In our paper, we focus on identification of the situation in implementation of entrepreneurship support in the Czech Republic in the broader concept of education policy, with subsequent focus on possibilities of developing entrepreneurship among university students in Brno. We analyse the motivation of students for entering a university course focused on the development of practical competences leading to the possibility of active action in the role of entrepreneur. We connect the results of the analysis with the theoretical approach to the development of entrepreneurship and with the approaches of the official education policy in the Czech Republic. We hope that this will confirm the correctness of our approach to the development of entrepreneurship competence and support the development of other activities in this area.

Keywords: Entrepreneurship, Entrepreneurship competence, Motivation for entrepreneurship

1. Introduction

Small and medium-sized enterprises play a significant role in the creation of employment and gross domestic product in developed economies. They are perceived as a stabilizing element of the economy because they are characterized by higher flexibility, ability to adapt to sudden changes in the economy, ability to respond to changes in the purchasing behaviour of consumers, and ability to fill gaps in the market. At the same time, they represent the potential of applying entrepreneurial ambitions among the younger generation together with another form of applying entrepreneurial ambitions through self-employment or trade.

If we deal with the issue of young entrepreneurs and possibilities of their entry into business, this issue is linked to area of motivation. Motivation can be defined as impulse to perform a certain activity. Usually, motivation is associated with achieving certain goal and is therefore purpose-oriented towards meaningful activity. Motivation therefore influences human behaviour and its regulation, organization, and stimulation to activity (Marinič et al., 2014). Motivation as stimulation to activity can take two forms, which depends on origin of source of the motivation. First form is effort to use external opportunities as source of motivation according to the pull theory. Second form is effort to avoid internal usually negatively perceived phenomena as source of motivation according to the push theory. We can also distinguish two types of entrepreneurs, opportunity entrepreneurs connected with the pull theory and necessity entrepreneurs connected with the push theory (Humbert & Drew, 2010).

Pull theory assumes that individuals are motivated by attractive incentives that as opportunity entrepreneurs can identify in business environment. Usually, this type of motivation affects opportunity entrepreneurs with more significant results and for longer time. Such attractive incentives include possibility of use one's own talent, innovative approach, and identification of interesting business opportunity or gap in the market (Giacomin et al., 2023). Push theory assumes that individuals as necessity entrepreneurs feel tension between current situation and situation in which they would like to be. Usually, this type of motivation affects necessity entrepreneurs more intense but for shorter time. Negatively perceived working conditions, low evaluation of provided work performance, underappreciation of working abilities, and threat of dismissal or unemployment can be identified as the tensions necessity entrepreneurs feels (Amid & Muller, 1995). At the same time, previous research shows that opportunity entrepreneurs are more successful, achieve higher profits and

contribute more to economic growth, innovation, and job creation (Reynolds et al., 2002). On the other hand, necessity entrepreneurs are older, less educated, have less experience, and are worse at predicting the future (Robichaud et al., 2010).

We can therefore state that for development of entrepreneurship competence among young generation we should focus on attractive incentives as motivation according to the pull theory to form young individuals as opportunity entrepreneurs. Thus, the *main goal of the paper is to analyse motivation of university students to attend the course aimed at development of entrepreneurship competence according to pull and push theory of entrepreneurship motivation*. At the beginning we analyse the curricular documents focused on development of entrepreneurship competence to recognize approach to the topic at primary and secondary education level in the European Union and the Czech Republic. We would like to point out continuity of the approach to the topic at all levels of education system in the Czech Republic, its link to European documents, and emphasis on attractive incentives according to the pull theory of motivation as basic approach to entrepreneurship competence development.

2. Methodological Approach

We searched for relevant curricular documents at the European level and in the Czech Republic that focus on entrepreneurship competence development and analysed approach contained in these documents according to push and pull theory of entrepreneurship motivation. We analysed 112 questionnaires used for entry to the course implemented at the Mendel University in Brno between 2019 and 2022 to identify university students' motivation to enrol in the course aimed to develop entrepreneurship competence. The questions "*What motivates you to enrol in the course?*" and "*What do you expect from the course?*" were part of the questionnaire. Qualitative approach was used for the analysis of the obtained data due to open nature of these questions and freely formulated answers.

3. Entrepreneurship and Entrepreneurship Competence in the Curricular Documents

Entrepreneurship and its development are considered important by the European Union. It is necessary to develop entrepreneurship and appropriate entrepreneurship competence already at young age of individuals so they can widely use entrepreneurship competence not only in the field of business but also in their future life in general. The European Union therefore developed frameworks as certain form of unification of education in the individual member states to ensure greater comparability of initial conditions in education for the young population.

Key competences for lifelong learning (European Commission, 2019) were formulated because education is currently understood as never-ending process. This document is also used as suitable framework for developing key competences at all levels of the education system. The individuals will then use obtained competences not only during their further educational journey, but also in working and personal life throughout whole their lifetime. The competence focused on entrepreneurship is also included among the key competences. As key competence, entrepreneurship competence is defined as ability to act on opportunities and ideas and transform them into values for others. This competence is based on development of creativity, critical thinking and problem-solving skills, development of ability to take initiative and cooperate in implementation of plans and projects that have cultural, social, and financial value.

In the area of knowledge, it is mainly about understanding that there are different circumstances and opportunities for fulfilment of ideas and activities leading to realization of projects; understanding that there are different resources and processes for each project to achieve them. Knowledge within the entrepreneurship competence also relates to ethical issues and sustainability, to ability to identify strengths and weaknesses. In the area of skills, it involves development of creativity, imagination, critical thinking and problem-solving skills. It also involves innovative approach and strategic thinking, ability of individual and cooperative activity, and sustainable use of available resources. Integral part of the skills are economic skills to assess financial impact of individuals' decisions and understanding connection between financial side of and risk associated with the decisions. In the area of attitudes, entrepreneurship competence refers to the development of proactive approach to life, ability to take initiative and courage to achieve goals, motivating others while maintaining empathy, and responsibility in ethical matters (European Commission, 2019).

The Entrepreneurship Competence Framework – EntreComp (Bacigalupo et al., 2016) provides concretization of the approach to entrepreneurship competence development. The framework is built on the approach of bridging education and practical working environment. Its implementation is not intended to be strict and

precise but rather inspirational; to encourage active incorporation into national education frameworks and usage by individual schools or teachers. The framework defines entrepreneurship as activity based on opportunities and ideas with aim of transforming them into value for others in financial, cultural, or social form. Entrepreneurship can take many forms, including intrapreneurship, social entrepreneurship, green entrepreneurship, or digital entrepreneurship. Entrepreneurship competence applies to wide range of areas in individuals' lives and enables them to develop their personalities, contribute to society development, jobs creation or self-employment, establishment of start-ups or scale-up ventures (Bacigalupo et al., 2016).

Entrepreneurship competence is also directly mentioned among key competences in current framework education programmes in the Czech Republic for primary and lower-secondary education (ISCED 1 & ISCED 2). Specifically, the competence includes orientation in basic activities needed to carry out business plan and its implementation, understanding the essence of goals and risks of business, and developing one's entrepreneurial thinking. The key competences also include problem-solving skills and critical thinking or abilities for cooperation and valuation involvement of others like the European framework. Among other competences they contain also civic competence including topics of ecological and environmental problems and sustainable development or digital competence including safe use of digital technologies. Newly prepared framework education programme in the Czech Republic refers directly to entrepreneurship competence as ability of individual to develop ideas, opportunities and challenges, and create new values in social, cultural, environmental, and economic context, as well as values associated with personal development. These skills also lead to successful coping with changes, uncertainty, eventual failure in various areas of life, and support adaptability. Pupils' practical experience in planning and implementing activities or projects are priority. Similarly, the entrepreneurship competence is directly listed among the key competences also for upper-secondary general education (ISCED 3). For the upper-secondary vocational education and training (ISCED 3) also vocational competences are included in the framework education programmes. Chosen areas of entrepreneurship competence are included among the vocational competences specified as ability to optimally use one's personal and professional prerequisites for successful usability in the world of work, building and developing one's own professional career, and related need for lifelong learning.

Comparison of characteristics of the European and the Czech competence frameworks indicates significant similarity in arrangement of competences, their definitions, as well as delineation of their components. Increase in the similarity over time can be seen due to ongoing revisions of framework education programmes in the Czech Republic. Even though the Entrepreneurship Competence Framework should be inspirational, its parts are transcript into Czech curricular documents verbatim. Skills and abilities with positive connotation, i.e. those that relate to pull theory of entrepreneurship motivation, are significantly dominant among components of entrepreneurship competence. This can thus be considered appropriate, because motivation forming opportunity entrepreneurs have a longer-term effect and more positive impact on individuals and society.

4. Entrepreneurship and Entrepreneurship Competence Among University Students in Brno

The next part of the paper presents the results of the analysis of entrepreneurship motivation among 112 university students at Mendel University in Brno who decided to enrol in course of entrepreneurship and entrepreneurship competence development from 2019 till 2022. Presented results follow and enrich findings of previous research conducted on the same research sample (Adamec & Hrmo, 2023). In current paper we used other students' statements to be able to connect information from enrolment questionnaire with the pull and push theory of entrepreneurship motivation. We briefly present the South Moravian Region and the city of Brno as centre of support and development of entrepreneurship and entrepreneurship competence.

4.1 Entrepreneurship Development in South Moravian Region and Brno

Brno is the second largest city in the Czech Republic and the centre of the South Moravian Region. The city is important centre of higher education with almost 65,000 university students in a wide range of fields of technical, natural, and social sciences. In the field of business support, the South Moravian Innovation Centre (abbreviated as JIC in Czech language) is an important institution which focuses on the support of commercial use of research and development of universities located in Brno, mediates the connection of universities and scientific research institutions with the business sphere, helps innovative companies, students with original ideas, researchers, and inventors. Brno as region supporting the development of entrepreneurial activities and entrepreneurship competence received the European Entrepreneurship Region Award, based on developing

tailored activities supporting entrepreneurs across the entire funnel, from students and pre-entrepreneurs to start-ups, scale-ups, and global champions (“Famalicão…”, 2023).

There are several options for supporting the development of entrepreneurship and entrepreneurship competence among university students within the three largest universities in Brno (Masaryk University, Brno University of Technology, Mendel University in Brno). Courses are available for students at these universities to develop entrepreneurship, either in the form of entrepreneurship competences development, or through the support of practically oriented knowledge, skills, and abilities for active business. These universities also have contests between students to identify and support interesting student business ideas.

4.2 Evaluation of Feedback From University Students of Entrepreneurship Course

At the Mendel University in Brno, the “START-UP Mendel” course is one of the activities aimed at development of entrepreneurship and entrepreneurship competence among enrolled students. The course is voluntary and is not part of any study program or required for finishing any study of the students at the university. Data for analysis were obtained through the enrolment questionnaire which students were supposed to fulfil to be enrol in the course. As part of enrolling process students answer the question: "*What motivates you to enrol in the course?*" and "*What do you expect from the course?*". These seemingly simple questions indicate not only their motivation for the course but also for entrepreneurship itself. The answers then show students' internal readiness and motivation for entrepreneurship and its multi-layered nature due to wide range of motives.

We obtained data from 52 students in the academic year 2019/2020, form 30 students in the next year, and from 20 students in the year 2021/2022. According to our data 38 students (73% of enrolled students) in the academic year 2019/2020 had prior business idea, the year later 15 students (50% of enrolled students), and in 2021/2020 only 8 students (40% of enrolled students) had prior business idea. The data indicate decrease in number of enrolled students and students with a priori business idea before enrolling in course. We also identify changes in number of students already in team before enrolment in course. Twelve students created teams before enrolment in 2019/2020, in 2020/2021 it was only 2 students, and in 2021/2022 students created team in 6 cases. In first two years students in teams also had business idea already before enrolment in course, but only one pair in 2021/2022 had such idea. Other 4 students in 2021/2022 wanted to work in teams but had no business idea. Changes in interest and motives of students during the time indicated by the data can be seen as decrease of interest in entrepreneurship and entrepreneurship competence development through the course, but it could be caused also by the pandemic situation after 2020.

As supposed, motives of students are mostly based on interest in entrepreneurship and practical side of doing business. However, there are also students whose interest in courses can be characterized as purely pragmatic at any university. In the university environment it is understandable because their motivation lies in the fulfilment of study obligations. This pragmatic motive we can see in the student’s statement:

> *"...motivation for me is two beautiful ECTS credits that I can get by finishing this course, because as I already know every credit is useful and counts."*

We also supposed that the motivation of students would be in attractive incentives according to the pull theory of entrepreneurship motivation. But we were able to identify also statements associated with previous negative experiences in the role of employee or effort to avoid negatively perceived role as employee in the future. These external influences connected with the push theory of entrepreneurship motivation as necessity entrepreneurs are illustrated by students’ statements:

> *"...going to temporary jobs, where I work according to instructions and where I invest my time and energy to satisfy predominantly financial expectations of owners, is meaningless to me. In addition, contractual employment relationships are often poorly financially valued."*

> *"...in my several years as a part-time worker for all kinds of companies and individuals, I found out that being employed all my life is really not what I want in the future. If I were in job, I would be afraid that I would be stuck in time, and I wouldn't be able to develop.''*

> *"...I don't enjoy the classic model of an employee, as I am very creative and thoughtful, so it is problem for me that even if I do more on part-time job, I still get paid the same. I like to create and build new things. I have the business plan that could help those around me and generate profit for me at the same time. Now I am involved in the global business in which I work with the team of approximately 6 people.”*

> *"...I definitely don't want to spend the rest of my productive life in so-called 'rat race'. I want to learn how to turn ideas into sustainable business."*

These statements indicate that the students already have lot of experience in developing their own business ideas, and even in international cooperation. The development of wide range of competences and personal development is clearly important for those students. The idea to be employee after graduation does not seem attractive to the students. The issue of the negative concept of the classic role of employee is stressed. Other student also pointed to the failure to meet one's own goals and the low financial evaluation of employees' work related to the push theory of entrepreneurship motivation as necessity entrepreneurs. The last statement simultaneously points to already developed concept of entrepreneurship, as it refers to "rat-race" used by Robert Kiyosaki.

On the other hand, positive influence of previous entrepreneurial experience can be identified in the form of already implemented business and in long-term thinking about business. This positive previous entrepreneurial experience can be seen as positive internal factors according to the pull theory of entrepreneurship motivation as opportunity entrepreneurs. It can be demonstrated by students' statements:

> *"…I have been interested in entrepreneurship for several years and have (already) launched the first project. However, I would like to expand my knowledge, motivate and possibly share some of my ideas with team of active people."*

> *"...I have been running my own business for about two years now and at the same time I am working on other projects. I also have lot of other ideas for possible business, and I expect possible help with implementation of one of them. At the same time, I expect opportunity to contribute to someone else's ideas."*

This indicate that students not only expect additional information for further entrepreneurship competence development, but also expect opportunity to share their previous entrepreneurial experience with others.

Enrolment to the course is associated with the expectation of obtaining decisive motive for realization of the long-intended goals and plans in the field of business. It seems that students may have business plans in their minds for long time, but for various reasons they have not been able to implement them until now. These motives can also be recognized as internal positive factors according to pull theory of entrepreneurship motivation and hopefully can be used for starting active entrepreneurial life of students after the course. This type of motivation can be seen in students' statements:

> *"...I have been carrying the business ideas in my head for 3 years. I expect this unique opportunity will help me group all my ideas into one concrete and feasible plan and start the business in it. And most importantly, successfully."*

> *"…since I studied at secondary grammar school, I have been thinking of various things that would be good for business. Since then, countless ideas have crossed my mind. Looking back, some of them were unrealizable, but some were great, and often someone came up with the same thing. However, I never had enough courage to take risk and start my own startup. I often did market research, project plan, but as obstacles started to appear, I lost courage even though I believed in my idea. I expect the course to give me courage to start something of my own and I will pursue my goals more confidently and meet new people who are as passionate about entrepreneurship as I am, who will enrich me with their thoughts and approach to business."*

This demonstrates active approach to entrepreneurship, but it is limited by various fears, lack of determination and courage.

The development of entrepreneurship through the course can represent the fulfilment of long-term dream for students. Especially with the very positive approach to the entrepreneurship which can be identified as factor of pull theory of entrepreneurship motivation. We can see it in the students' statements:

> *"…I love entrepreneurship, motivating myself and others, multitasking, innovation, and constant improvement in what I enjoy. I've dreamed of entrepreneurship since I was a child"*

> *"...school period is ideal for acquiring new skills. I have always admired people who have built something, I would also like to build something of my own to realize myself and develop. They say that environment shapes a person, that's why I would like to be in environment where others will think the same way."*

> *"...I didn't even think that it would be possible to learn something about business from the real side while studying. I think it's absolutely great idea."*

The enthusiasm shown in statements is combined with certain degree of surprise that entrepreneurship competence can also be developed through practical course during university studies. Students appreciated developing their entrepreneurial skills and abilities connected to entrepreneurial activities, but also the entrepreneurship competence development linked to general personality development. They also point out that this approach will give them advantage compared to other students who do not use such opportunity. They draw attention to the fact that it is environment that has significant influence on complex formation of person and the university should be such environment forming person appropriately and comprehensively.

We also identified the influence of the wider environment on motivation to develop entrepreneurship and entrepreneurship competence among students. South Moravian Region and the city of Brno really seems to be suitable environment that contributes to the positive motivation of students to become entrepreneurs. Students perceive very positively cooperation of the South Moravian Innovation Centre (JIC) in this course and the involvement of experts from the centre to teaching activities. This can be seen in students' statements:

> *"...this course interested me due to connection with JIC. I have been following this organization for long time and I am determined to establish cooperation. I was often messing around with the idea of my own project/business. However, more thoughts and ideas run through my head, and I don't know how to decide. However, I would very much like to expand my horizons with managerial skills and try to refine my philosophy for my future business."*

> *"...I heard about JIC for the first time during my work at the marketing agency with which they cooperated at the time. I like the idea of the centre that guides students in important direction and toward meaningful activities. I like comprehensive and modern approach, and this is also what I expect from the course."*

> *"...in 2020/2021 I participated in online lectures and workshops from JIC, and it was absolutely great. That's why I would like to move forward in some real project with other students."*

The analysis of students' motivation to develop entrepreneurship and entrepreneurship competence through the university course shows specific examples of motives that are directly related to the pull and push theory of entrepreneurship motivation. As expected, the data points to dominant influence of positive internal factors according to pull theory of entrepreneurship motivation that increase students' interest in entrepreneurship and entrepreneurship competence development. Among these factors there were positive previous experiences as well as long-term thoughts about entrepreneurship. These also demonstrate positive influence of appropriately designed curriculum at lower levels of education in the Czech Republic, aimed to develop entrepreneurship and entrepreneurship competence.

5. Discussion

The analysis of university students' motivation to enrol in the course "Start-up Mendel" at Mendel University in Brno points to their previous entrepreneurial experience, or at least interest in entrepreneurship, which can be seen as attractive incentives according to the pull theory of entrepreneurship motivation. In this sense, our current analysis points to the same motivation that has been identified among university students at Masaryk University in previous research (Marinič, et al., 2014; Marinič, 2016; Marinič & Záthurecký, 2016). Although previous research was carried out in the period 2013-2015, when relatively high unemployment rate even among young population in the Czech Republic was recognized, the motives according to pull theory of entrepreneurship motivation were more dominant than motives according to push theory of entrepreneurship motivation. Students with entrepreneurship motivation according to push theory were also identified, although to lesser extent. In other words, students seem to be permanently more motivated by positive image of entrepreneurship, rather than negative concerns about employment or threat of unemployment.

The analysis of the competence frameworks shaping European education policy shows that the entrepreneurship competence is perceived as important part of the education process (European Commission, 2019). The importance of the entrepreneurship competence is also enhanced by its processing in separate framework, even though this framework does not necessarily have to be implemented verbatim, but rather used as summary of recommendations for the effective development of entrepreneurship competence (Bacigalupo et al., 2016). We can also see the interconnection of European competence frameworks and Czech curricular documents. In the national concept, the development of entrepreneurship competence is treated

similarly, and over time the emphasis on the development of entrepreneurship competence is increasing. We can see positive approach to the development of entrepreneurship competence according to the pull theory of entrepreneurship motivation in those documents. Emphasis is placed on comprehensive development of personalities, on proactive approach to entrepreneurship, development of creativity and innovation, with current development of critical thinking and responsibility. Those areas are developed among pupils at primary and secondary level of education and create suitable basis for entrepreneurship competence development among university students as can be seen in motives of analysed university students.

Students who show interest in the entrepreneurship and entrepreneurship competence development can use wide range of support within university environment. As we pointed out, in the South Moravian Region and in the city of Brno, not only students have significant support for the development of entrepreneurship and entrepreneurship competence. The region in cooperation with universities creates appropriate conditions for the development of entrepreneurship, but also the possibilities for the realization of specific business ideas of students. The time that students spend at the university correspond to the period of their greatest personality development and it is also the time when students can already develop business activities legally.

6. Conclusion

Entrepreneurship represents important area in persons development and has benefits for society in economic, social, cultural, ecological, and other areas. Therefore, great emphasis is placed on entrepreneurship and entrepreneurship competence development in the European Union. This is reflected in inclusion of entrepreneurship competence between key competences to be developed among pupils and students across education system. Entrepreneurship competence development must be motivated as any other learning process. We can distinguish two approaches to entrepreneurship motivation, according to the pull and push theory. Pull theory of entrepreneurship motivation consists of positive attractive incentives for entrepreneurship. Pull theory of entrepreneurship motivation consist of effort to avoid negatively assessed states and to see entrepreneurship as solution. Entrepreneurship competence in the European frameworks, but also in the Czech curriculum documents, are based on positive approach connected with the pull theory. Students are predominantly positively motivated especially through motives related to pull theory of entrepreneurship motivation according to our current analysis of the university students' motivation for enrolment in the course about entrepreneurship and entrepreneurship competence development. They acquire knowledge and skills in business and gain advantage towards other students in their future life. At the same time, they are motivated by possibility of sharing their own experience and sharing experience with experts, which can help them to start of their own real business.

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Management of Innovation in Digital Brands: An Integrative Review

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Abstract: The present paper explores how innovation management is manifested in digital brands. The objective of this study is to analyze the approaches to innovation management within digital brands. The methodology adopted is an integrative review with a qualitative approach. Innovation management in digital brands has become increasingly crucial in today's dynamic business landscape. Digitalization has revolutionized the way brands interact with consumers, requiring constant innovation to remain competitive. This study aims to shed light on the strategies and practices adopted by digital brands to manage innovation effectively. The methodology has a qualitative approach through integrative review, which allows for the synthesis of existing literature on innovation management in digital brands. Through research and analysis of academic articles, this article identifies key themes and trends in innovation management in the digital context. Themes such as open innovation, co-creation with consumers, agile development methodologies, and digital transformation strategies emerge as central components of innovation management in digital brands. A conceptual framework is developed to provide a structured understanding of the various dimensions of innovation management in digital brands. This framework serves as a guide for professionals and researchers seeking to navigate the complex landscape of innovation in the digital age. The results of this study reveal a multifaceted approach to innovation management in digital brands. Also it includes the development of a descriptive figure conceptual of innovation management in digital brands. In conclusion, this integrative review highlights the importance of effective innovation management in digital brands. By adopting innovative strategies and embracing digital technologies, brands can drive growth, improve customer experiences, and maintain competitiveness in today's digital economy. Furthermore, this study contributes to the academic discourse by offering insights into the evolving nature of innovation management in the digital sphere. By understanding these dynamics, organizations can adapt their strategies to thrive in an increasingly digital-centric marketplace.

Keywords: Management, Innovation, Digital brands, Integrative review

1. Introduction

In today's ever-evolving business environment, the management of innovation has become a cornerstone for the success and sustainability of digital brands. The advent of digitalization has not only reshaped consumer behaviors but has also significantly altered the dynamics of brand-consumer interactions. As a result, digital brands are faced with the imperative need to continually innovate to stay relevant and competitive in an increasingly crowded marketplace.

As digital technologies continue to advance and consumer preferences evolve, traditional paradigms of brand management are being challenged. Consequently, digital brands are compelled to adopt innovative strategies to not only meet but exceed consumer expectations. By prioritizing the needs, preferences, and behaviors of consumers, brands can create more relevant and impactful innovations. User feedback and participation can drive the development of new products and services that are closely aligned with consumer expectations. Additionally, fostering a culture of continuous improvement and agility within the organization enables brands to quickly adapt to changing market conditions and consumer trends. By embedding user-centric principles into their innovation strategies, digital brands can enhance customer satisfaction, loyalty, and ultimately, their market position.

Exploring the nuances of innovation management in digital brands, this study seeks to unearth the underlying principles and practices that drive successful innovation initiatives. The methodology employed in this research entails an integrative review, which allows for the synthesis of existing literature on innovation management within digital brands. By systematically analyzing and synthesizing a diverse range of scholarly articles, this study endeavors to offer valuable concepts into the multifaceted nature of innovation management in the digital realm.

Furthermore, the rapid pace of technological advancement and the proliferation of digital channels have democratized access to information and empowered consumers like never before. This shift in power dynamics necessitates that digital brands not only innovate in terms of product and service offerings but also in how they engage with and empower their audience. From personalized marketing campaigns to interactive brand experiences, the landscape of brand-consumer interactions is undergoing a profound transformation. Understanding and effectively managing this transformation is essential for digital brands seeking to maintain relevance and forge meaningful connections with their target audience.

In this context, the main objective of this study is to delve into the intricacies of innovation management within digital brands, examining the various approaches and strategies employed to foster innovation in this dynamic landscape. Overall, this research aims to contribute to the existing body of knowledge on innovation management by shedding light on the strategies and practices employed by digital brands to drive innovation and maintain competitiveness in today's digital era. Through a qualitative analysis of the literature, this study seeks to provide actionable ideas for practitioners and scholars alike, fostering a deeper understanding of the complexities of innovation management in the digital landscape.

2. Theoretical Development

According to the literature, an innovation management (Keupp, Palmié and Gassmann, 2012) is a set of interconnected and interactive elements aimed at creating value (Den Ouden, 2012). It provides a common framework for developing and deploying innovation resources, evaluating performance, and achieving intended outcomes. The following principles form the foundation of the innovation management system:

- Value creation (Sjödin et al, 2020);
- Future-focused leadership (Zipp et al, 2024);
- Strategic direction (Hunsaker and Knowles, 2021);
- Culture; (Lounsbury et al, 2021);
- Exploration of insights; (Storey and Salaman, 2009);
- Uncertainty management; (Grote, 2004);
- Adaptability; (Tuominen, Rajala and Möller, 2004);
- Systemic approach. (Fischer, 2002).

So, it emphasizes the importance of integrating innovation into the overall strategy of an organization, fostering a culture that encourages creativity and risk-taking, and effectively managing the uncertainties inherent in the innovation process.

Moreover, innovation refers to the process of translating an idea into a product or service that creates value for customers, it is essential to entrepreneurship (Bessant and Tidd, 2007).

Thus, by adhering to these principles, organizations can establish a robust innovation management system that drives continuous improvement and sustainable growth.

3. Methodology

Through an integrative review (Souza, Silva and Carvalho, 2010) with a qualitative approach, this research aims to provide a comprehensive understanding of how digital brands navigate the complexities of innovation management. A qualitative approach with integrative review was adopted, encompassing a broad range of studies, from empirical research to theoretical analyses and literature reviews, to capture the richness and complexity of this intersection between archetypes, brand communication, knowledge dissemination, and innovation. Two databases were selected for the search: Scopus (4.601 results) and Web of Science (445 results). Search string: "Management" AND "Innovation" AND "Digital". Timeframe: 2021 to 2023. Only open-access articles in English were considered. Moreover, the exclusion criteria was: articles that addressed the topics only in a general manner or focused solely on physical brands. So, after these selected criteria, out of a total of 237 articles, a final selection of 7 articles was chosen for the analysis and discussion in the paper. After the final selection of articles and a thorough analysis of the literature, the results found are presented.

4. Results

As results, presented below is a synthesis matrix table:

Table 1: Thematic Synthesis - Management, Innovation and Digital

Authors	Title	Objective	Methods	Results
Mancuso, I., Petruzzelli, A. M. and Panniello, U. (2023).	Digital business model innovation in metaverse: How to approach virtual economy opportunities	This paper aims to understand the mechanisms of value creation and capture in the metaverse resulting from	The paper analyzes the cases of four cross-industry incumbents—Gucci, Samsung, Hyundai, and Nike—pivoting their business	The paper provides a framework for innovating business models, supporting companies in leveraging the metaverse for value

Authors	Title	Objective	Methods	Results
		continuous evolutions in digital technologies, and how organizations can develop them.	models in the metaverse to identify value mechanisms. It provides a framework for BM innovation in the metaverse, considering both "phygital" transformations and virtual immersions.	creation while contributing to academic knowledge on metaverse impact on BM innovation.
Mariani, M. and Dwivedi, Y. K. (2024).	Generative artificial intelligence in innovation management: A preview of future research developments. Journal of Business Research, 175, 114542.	This study aims to outline future research opportunities in Generative Artificial Intelligence (GenAI) within innovation management by combining a review of academic literature with the findings of a Delphi study involving leading scholars in the field.	The study utilizes a combination of a literature review and the results from a Delphi study involving prominent scholars in innovation management to identify major research themes at the intersection of GenAI and innovation management. Ten significant research themes emerged from this analysis.	including the relationship between GenAI and different types of innovation, its impact on intellectual property and new product development, as well as considerations regarding creativity, ethics, regulation, and organizational design.
Liao, J., Pang, J. and Dong, X. (2023)	More gain, more give? The impact of brand community value on users' value co-creation.	This article aims to investigate whether users who derive more value from brand communities are more inclined to engage in value co-creation activities,	Drawing from reciprocity theory, this study employs structural equation modeling to analyze survey data and archival data, combining quantitative methods to explore the relationship between brand community value, value co-creation, and users' self-presentation within the community.	Furthermore, the influence of information value on value co-creation is contingent upon the level of self-presentation, with higher levels of self-presentation enhancing the effect.
Lu, H. T., Li, X., and Yuen, K. F. (2023).	Digital transformation as an enabler of sustainability innovation and performance– Information processing and innovation ambidexterity perspectives.	This study aims to assess the impact of digital transformation factors on sustainability innovation ambidexterity and sustainability performance in firms operating in the maritime industry.	A survey questionnaire was distributed to 187 maritime professionals holding relevant roles in innovation, performance management, sustainability, or digitalization. Structural equation modeling was employed to analyze the collected data.	The analysis revealed that digital capabilities, alignment between digital technology and business strategy, sustainability exploration innovation, sustainability exploitation innovation, and digital flexibility were the primary factors influencing sustainability performance, ranked in decreasing order of importance.
Di Vaio, A., Palladino, R., Pezzi, A. and Kalisz, D. E. (2021)	The role of digital innovation in knowledge management systems: A systematic literature review.	This article aims to explore the role of digital innovation in knowledge management systems (KMS) and its impact on business governance.	A comprehensive survey of the scientific literature on digital innovation in KMS was conducted to understand its implications for new business models and knowledge optimization. A bibliometric analysis was performed on a database comprising 46 English-language articles published between 1990 and 2020.	Digital transformation tools are shown to contribute to the long-term value creation process. This research adds to the existing literature on KMS by examining it through the lens of digital innovation processes, emphasizing the importance of fostering new knowledge creation and sharing initiatives to support

Authors	Title	Objective	Methods	Results
				global and inclusive growth.
Pynnönen, S., Haltia, E. and Hujala, T. (2021)	Digital forest information platform as service innovation: Finnish Metsaan. fi service use, users and utilisation.	This study aims to explore the engagement of forest owners with the Finnish state-funded Metsaan.fi e-service portal as a service innovation, considering factors influencing their activity and perceptions of the service.	Both quantitative and qualitative analyses are conducted to understand forest owners' views on the Metsaan.fi e-service. The quantitative analysis identifies factors explaining forest owners' activity in using the service, while the qualitative analysis employs theories of innovation diffusion and e-service quality to analyze open-ended survey questions.	The findings emphasize the importance of considering attitudinal patterns of intended users when designing governmental e-services and suggest integrating innovation adoption theory and service-research theory for deeper insights into the value creation and service needs of different user groups.
Bril et al (2021)	Improving personnel management by organizational projects: Implications for open innovation.	The aim of this study is to analyze and develop clear criteria for assessing the effectiveness of projects aimed at improving personnel management systems at Russian enterprises across various industries and types of activities.	The study presents the methodology and basic elements of a one-stage economic assessment process for organizational projects related to personnel management.	The "maximum costs of the HRM" model offer a systematic approach for decision-making in HR management and facilitate future digitalization efforts within organizations

Source: (Own authorship, 2024)

Therefore, this table provided a comprehensive overview of the themes found in literature. In this sense, below is a discussion of these results.

5. Discussion

Despite focusing on different topics, several patterns emerge from these findings:

- User-Centric Design and Service Innovation: designing e-services with a deep understanding of user attitudes and needs is crucial for enhancing user engagement and satisfaction. Integrating theories of innovation adoption and service research can provide deeper insights into user behavior and preferences, thereby facilitating the creation of more effective and user-friendly digital services.
- Knowledge Management and HR Management: digital innovation processes, such as knowledge management systems and human resource management, are essential for facilitating organizational growth and fostering innovation. The studies advocate for the integration of innovative technologies and methodologies to optimize knowledge creation, sharing, and decision-making processes.
- Sustainability and Digital Transformation: digital transformation tools play a significant role in enhancing sustainability performance by enabling organizations to innovate and adapt to changing environmental and market conditions. The studies emphasize the need for alignment between digital technology, business strategy, and sustainability objectives to drive long-term value creation.
- Co-Creation and Community Engagement: understanding user behavior and engagement within brand communities is crucial for fostering value co-creation. Factors such as information value, social value, and self-presentation influence users' willingness to engage in value co-creation activities, highlighting the importance of nurturing positive community dynamics.
- Value Creation and Innovation: the studies highlight the importance of leveraging emerging technologies and digital platforms, such as the metaverse and Generative Artificial Intelligence (GenAI), to innovate business models and drive value creation. They underscore the role of

information value, social value, and digital capabilities in fostering innovation and supporting organizational performance.

Consequently, the integration of user-centric design, advanced knowledge management, digital transformation, community engagement, and technological innovation collectively drive the success of digital brands. These patterns demonstrate that a holistic approach to innovation, balancing technology with human-centric strategies, is essential for thriving in the digital age. By leveraging these key components, organizations can navigate market complexities, create significant value, and maintain a competitive edge.

With this, there are some relationships between the studies:

All studies highlight the central role of digital technology in facilitating innovation. Whether through the creation of new experiences in the metaverse, the implementation of GenAI in innovation management, or the digitization of knowledge management systems, technology is seen as a fundamental catalyst.

Also Highlights the Importance of Co-creation and Engagement: active user involvement and value co-creation are recurring themes. Brand communities and digital platforms are examples of how companies can foster user participation, increasing perceived value and encouraging collaborative innovation.

Ambidexterity in Innovation: the need to balance the exploration of new opportunities with the exploitation of existing capabilities is a common theme. Companies must continuously innovate while optimizing current processes to maintain sustainability and competitiveness.

Strategic Adaptation and Flexibility: the ability to quickly adapt to technological and market changes is emphasized. Companies that can align their strategies with digital innovations and adjust rapidly to new realities tend to be more successful.

Continuous Evaluation and Improvement: systematic evaluation and continuous improvement of organizational processes are essential for success.

Therefore, the results of studies also highlight that effective digital innovation and management depend on deep technology integration, a balance between exploring new innovations and exploiting existing ones, active user engagement, strategic adaptability, and a systematic approach to continuous evaluation and improvement. These patterns provide valuable guidance for companies and researchers seeking to understand and implement innovative practices in a rapidly evolving digital environment.

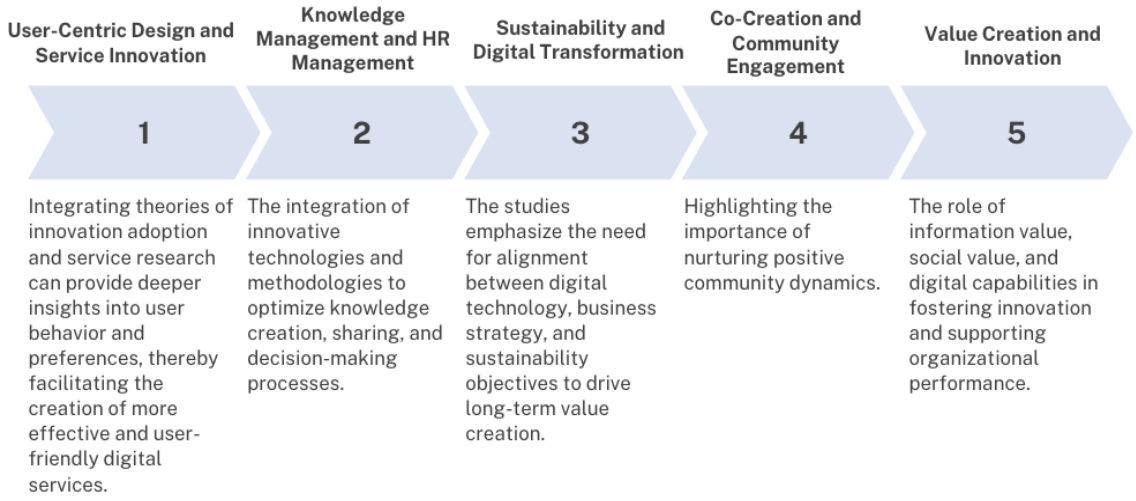
In summary, these findings underscore the transformative potential of digital technologies and innovative management practices in driving value creation, fostering community engagement, promoting sustainability, and optimizing organizational performance. Thus, organizations can develop more effective strategies for navigating the complexities of the digital age and achieving sustainable growth.

Additionally, the adoption of digital technologies and forward-thinking management strategies can bolster organizational flexibility and adaptability to swiftly changing market dynamics. This flexibility is paramount for maintaining a competitive edge in industries characterized by rapid shifts in consumer preferences. Through nurturing a culture of experimentation and continual enhancement, enterprises can effectively harness digital innovation to promptly refine their product and service offerings, catering precisely to evolving customer demands and seizing emerging market opportunities.

Furthermore, the integration of digital tools empowers organizations to collect and analyze extensive datasets, facilitating well-informed decision-making and predictive analytics. By capitalizing on insights derived from data-driven analysis, businesses can uncover invaluable patterns, forecast market trends, and tailor personalized experiences for their clientele.

In addition to enhancing organizational flexibility, the integration of digital technologies fosters a culture of innovation and adaptability within organizations. By embracing digital tools and fostering an environment that encourages experimentation and continuous improvement, companies can stay agile and responsive to evolving market trends.

This proactive approach enables enterprises to swiftly iterate on their offerings, adapt to changing consumer preferences, and capitalize on emerging opportunities, thus maintaining a competitive advantage in dynamic market environments. This data-centric approach not only amplifies operational efficiency but also empowers organizations to craft finely tuned marketing initiatives, optimize resource allocation, and foster innovation across diverse operational domains. As result, an Infographic was created as shown in figure 1:



Source: Author's own work (2024)

Figure 1: Effectively manage innovation in digital brands

So, the Figure 1 illustrates the key components necessary to effectively manage innovation in digital brands. The transition from points 1 to 5 follows a logical and interconnected progression that covers the essential aspects of innovation and success for digital brands. Here's an explanation of how these points are connected and why the sequence makes sense:

User-Centric Design and Service Innovation is the starting point because it emphasizes understanding user attitudes and needs, which is crucial for enhancing engagement and satisfaction. Without a deep understanding of users, any innovation or service is likely to fall short. This focus on the user naturally leads to the need for robust systems to manage this knowledge, connecting seamlessly to Knowledge Management and HR Management. Effective digital innovation processes, such as knowledge management systems, are essential for capturing, sharing about users, thus facilitating organizational growth and fostering innovation.

Building on effective knowledge management, Sustainability and Digital Transformation become the next logical step. Digital transformation tools play a significant role in enhancing sustainability performance by enabling organizations to innovate and adapt to changing environmental and market conditions. This alignment between digital technology, business strategy, and sustainability objectives is crucial for driving long-term value creation. As digital transformation improves internal processes and technology infrastructure, it also enhances the ability to engage and co-create with the community, which is addressed in Co-Creation and Community Engagement. Understanding user behavior and engagement within brand communities fosters value co-creation, which is essential for maintaining dynamic community interactions and innovation.

Finally, Value Creation and Innovation highlight the importance of leveraging emerging technologies and digital platforms to drive business model innovation and value creation. By utilizing advanced technologies like the metaverse and Generative Artificial Intelligence (GenAI), companies can create significant value and support organizational performance. This final point underscores the cumulative impact of the previous steps: user-centric design informs knowledge management, which drives digital transformation, fostering community engagement, and ultimately leading to innovative value creation. This sequence shows how each element builds a foundation for the next, creating a cohesive and continuous cycle of innovation and growth for digital brands.

By integrating these components into a cohesive framework, organizations can navigate the complexities of the digital landscape and drive sustainable growth and competitiveness in today's dynamic market environment. So, these concepts demonstrate how various concepts intersect and complement each other to drive innovation, value creation, and organizational success in the digital age.

6. Final Considerations

This study provided an in-depth analysis of innovation management in digital brands, revealing the growing importance of this practice in a dynamic and highly competitive business landscape. By examining the approaches adopted by digital brands to manage innovation, we identified key themes such as open innovation, co-creation with consumers, agile development methodologies, and digital transformation strategies. So, value

creation and innovation; co-creation and community involvement; sustainability and digital transformation; HR knowledge and management; and User-Centered design and service innovation have relationships between these concepts and are promising for future research.

Thus, they can be worked on and built with the bases for the development of a conceptual model that encompasses such constructs. The development of a conceptual framework provides a structure to understand the different dimensions of innovation management in digital brands, guiding professionals and researchers in navigating this complex environment.

To conclude, our findings underscore the multifaceted approach required to effectively manage innovation in digital brands, highlighting the importance of adopting innovative strategies and embracing digital technologies to drive growth and maintain competitiveness in today's digital economy. Thus, by fostering a culture of innovation and leveraging digital tools to their fullest potential, organizations can position themselves as leaders in their respective industries, driving sustainable growth and delivering value to both customers and stakeholders alike.

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An Empirical Study of Entrepreneurial Intentions of the University Students From Mountainous Region of Pakistan

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Abstract: Pakistan is an emerging country, that needs to understand the importance of entrepreneurship, which can support its developing economy. Particularly in mountainous region, educated entrepreneurs can develop new business ventures with their innovative ideas and plans. The Hofstede National Culture and the Theory of Planned Behavior are the primary subjects of this research study. The quantitative research approached is used and the data was collected by the questionnaire from the 362 sample of university students from Gilgit-Baltistan with the probability sampling method. The data was tested empirically and analyzed with the help of PLS-SEM. The research findings show positive responses, indicating that students of Gilgit-Baltistan have positive entrepreneurial intentions. The results further revealed that the variable of attitude towards behaviour, subjective norms and perceived behavioral control have significant role in developing entrepreneurial intentions. However, the moderating variable of individualism plays an insignificant role in developing entrepreneurial intention. The main contribution of this research was the identification of the various factors which influence the entrepreneurial intention of the university students of Gilgit-Baltistan.

Keywords: Entrepreneurial intentions, Individualism, Theory of planned behavior, National culture

1. Introduction

Rural entrepreneurship plays a major part in the development and improvement of national economies. It functions as the engine of the economy, generating income and a variety of new job prospects (Gherghina et al., 2020). In addition, entrepreneurship fosters and advances social equality and political continuity, commercial possibilities, creative ideas and goods, and healthy rivalry among companies (Ali et al., 2023). According to Audretsch and Thurik (2001), it lessens the issue of youth unemployment and increases entrepreneurial opportunities and financial independence. Many nations successfully managed the problem of unemployment while encouraging an entrepreneurial culture within their borders (Kumar & Raj, 2019). According to Urbano and Guerrero (2013), educationists, scholars, and strategists all agreed that entrepreneurship has a number of beneficial effects on the socioeconomic growth of developing and emerging countries.

Recently entrepreneurship gained more importance in Pakistan, however very few numbers of studies conducted on the entrepreneurial intention of the youth particularly in the remote and mountainous areas of Pakistan (Ali & Yousuf, (2019). The progress of small-medium size enterprises (SMEs) may be considered a reflection of entrepreneurial business although this sector is mainly confined to the urban areas of Pakistan. Sustainable development requires the equal participation and progress of every part of the country in economic activities. Despite its remote area, Gilgit-Baltistan maintains a strong position in the development of Pakistan. It has an abundance of natural resources, tourism places and trade routes. One of the most famous and important trade routes, Karakorum Highway, passes through Gilgit-Baltistan, connecting China and Pakistan. The recent China-Pakistan Economic Corridor (CPEC) program has further enhanced the role of Gilgit-Baltistan. The main route of the CPEC door starts and passes from Gilgit-Baltistan. Entrepreneurship development initiatives in Gilgit-Baltistan will definitely uplift the life of local people and communities. Government rational consideration increases entrepreneurship opportunities while exploring the natural beauty, valuable minerals, indigenous products and tourism spots (Ahmad, 2021).

2. Literature Review

2.1 Entrepreneurship

The idea of entrepreneurship arose in the early 1700s. Entrepreneurship has been defined and characterized according to the setting and environment by numerous authors such as (Schumpeter, 1954). The "Global Entrepreneurship Monitor" (2022) defined "Any attempt at new business or new venture creation, such as self-employment, a new business organization, or the expansion of an existing business, by an individual, a team of individuals, or an established business." Earlier researcher on entrepreneurship concur that entrepreneurship can promote economic advancement (Jena, 2020).

2.2 Entrepreneurial Intentions

Entrepreneurial intention, according to Remeikiene and Startiene (2013), is an active mindset that pushes people to look for new business prospects or breakthroughs in the industry. According to Bird (1988), entrepreneurial intention is essentially the first step in the decision-making process for launching a new company. It primarily serves as a predictor of the anticipated level of entrepreneurship-related behavioral commitment. Bird (1988) went on to say that intention is a specific emotion that is sparked by the surroundings and real-world experiences. Entrepreneur and intention have a strong relationship, mainly, the intention of starting new business ventures are developed in advance (Henley, 2007). The intention is basically the accumulation of relevant information, which can be helpful in the formation of new entrepreneurial businesses (Choo & Wong, 2009). The planning and formation of a new business venture is not like an event, it's a long way process which requires years to complete and success (Ali *et al*., 2023). Van Gelderen et al. (2008) argued that entrepreneurial intention is the main element of the entrepreneurial process and support for creating new businesses.

2.3 Theory of Planned Behaviour (TPB)

The theory of planned behaviour (TBP) is basically derived from the theory of reasoned action and it was initially proposed (Fishbein & Ajzen, 1977). The main objective for developing the theory of planned behaviour was to describe the relationship among attitude, subjective norms, perceived behavioral control and entrepreneurial intentions. Rogers et at. (2008), described that people's decision is based on the expected outcomes which they derived from the performance of particular behavioral activities. Doswell *et al*., (2011) further argued that the theory of planned behaviour supports understanding people's volunteer behaviour and act as a predictive variable. Entrepreneurial intentions mostly depend on the variable of ATB, SN and PBC. These three elements would constitute the explanatory variables of intention.

2.3.1 Attitude towards behaviour

The perception of the entrepreneur plays very important role in gaining the expected future opportunities and benefits. People's ideas shape their attitudes when they engage in particular behaviour. According to Ajzen & Fishbein (2005), behavioral beliefs, expected results, or benefits and costs are believed to influence behaviour. The majority of recent research has also looked at how the intention of starting a new firm is influenced by implicit beliefs or perceived outcomes of entrepreneurship. Entrepreneurial intentions are sparked by the personal benefits that come with starting a firm (Volery et al., 2013). An attitude toward entrepreneurship has shown a consistent and strong impact on entrepreneurial intention in most of the research in various cultural settings (Almobaireek and Manolova 2013).

2.3.2 Subjective norms

Azjen, 2005 Subjective norms are social forces that people absorb from society and have a significant impact on whether or not they engage in particular behaviors. Individual family members, relatives, coworkers, colleagues, fellows, and possibly experts in the conduct of interest make up the group of other key individuals. Individuals experience social pressure to engage in actions that others of their social group deem acceptable, and this compels them to carry out these acts. Following up on Ajzen's research study, Lapista et al. (2012) found that people are more interested in launching companies that their entrepreneurial acquaintances have already taken up. Study of Otuya et al. (2013) also corroborate the importance of subjective norms on the purposeful behavior for initiating new business operations.

2.3.3 Perceived behavioral control

The term "perceived behavioral control" refers to the subjective evaluations that individuals use to gauge their aptitude for engaging in specific behaviour. “Ajzen and Cote (2008) it can be established from the control belief concerning the accessibility of factors that may support or obstruct performance of the behaviour”. Ajzen (2012) defined the internal and external factors as those that either maximize or minimize the perceived difficulty in carrying out the behaviour in question. These factors include “facilities, opportunities, knowledge, skills, obligations, dependence, personal behavioral experience, information, past experiences of other people” and other factors. According to Linan *et al*., (2013) people feel more at ease and motivated to engage in entrepreneurial activities when other members of the community acknowledge, appreciate, and value their decisions. “The social and internal environment also play a significant role in developing the positive perception about entrepreneurial activities, which in turn affect the perceived control behaviour”.

2.4 Culture and Entrepreneurial Intentions

Every country and society have naturally different landscape, physical environment, weather conditions, economic opportunities, technological facilities and multiple culture. People of the particular country have to adopt culture friendly, environmentally suitable and technologically supported types of businesses for the success and personal satisfaction, Sharpero and Sokol (1982), the culture has a unique characteristic as different form socio-political, economic and technological environment, has a strong significant in shaping the economic entrepreneurial behaviour of individuals. The significant role of culture in predicting people intention in starting new business is documented by (Zeffane, 2014). Most research studies on entrepreneurship, including Farrukh et al. (2017), incorporate the cultural variable as suggested by Hofstede national culture. Hofstede's research identifies how culture manifests in various forms and how “individual and community-level cultural norms” are influenced by national culture.

2.4.1 Individualism verses collectivism

The concept of individualism represents preferences of doing for the personal and close household interest, although the dimension of collectivism gives important for the benefit holistic things in order to gain their loyalty and support. The people of individualistic communities prefer of personal independence, self-rule and personal benefit and interest (Habermas, 1990). On the other hand, the people of collective communities feel more dependent on each other, working for common goal, strongly committed for team performance and cohesive in teams.

In individualistic societies people mainly focus on materialistic grown and progress and financial benefit in common which motivate and support for entrepreneurship business activities in the long-run (Gupta *et al*., 2010). Moreover, various research scholar also highlighted the important role national culture and entrepreneurial intention (Dheer 2017; Farrukh et al. 2017). Although, there are limited studies on the moderating role of national culture on the entrepreneurial intention particularly in the context of rural areas (Mfazi & Elliott, 2022). Hence this study analyzed the moderating role individualism on the relationship between ATB and entrepreneurial intentions.

3. Methodology

The survey data were collected from the public sector universities located in Gilgit-Baltistan of Pakistan. The questionnaire from the earlier studies was utilized, and the components were measured using a 5-point Likert scale that ranged from 1 (strongly disagree) to 5 (strongly agree). The TPB and EI questionnaires utilized in this study were adopted from the previous research of (Ali *et al*., 2023). Similarly, the variable of individualism was adopted from the research conducted by (Farrukh *et al.,* 2017).

The survey questionnaire was closed-ended and made up of “5-point Likert scale”, starting from strongly disagree, agree, neutral, disagree and strongly agree. Furthermore, given the exploratory nature of this study, Smart PLS-SEM was utilized for data analysis, consistent with the methodological guidelines of (Zeb *et al*., 2020). As a widely adopted tool in the social sciences for theory testing and empirical study, it is well-suited for analysing complex relationships among latent variables.

4. Result and analysis

4.1 Descriptive Statistics

The demographic descriptions of the respondents are elaborated in the table-1 below follow by gender, age, program, semester, university and father occupations. As mentioned previously the respondents of this study is the university students from Gilgit-Baltistan. The respondent's characteristics observed included gender, age, program, semester, university and father occupations. The respondents profile was analysis by using SPSS version 22.

Table 1: Demographic profile

Sr. No	Attributes	Frequency	Percentage (%)
Gender			
1	Male	251	69.3%
2	Female	111	30.7%
Age			
1	21-25	177	48.8%
2	26-30 years	95	26.2%
3	31-35 years	63	17.4%
4	36 & above	27	7.40%
Program			
1	BS	208	57.4%
2	Master	119	32.8%
3	MS/M.Phil.	35	9.60%
University			
1	KIU Gilgit campus	105	29.0%
2	KIU Ghizer campus	66	18.2%
3	KIU Hunza campus	63	17.4%
4	KIU Diammer campus	59	16.2%
5	UOB Skardu	69	19.0%
Father occupation			
1	Government job	167	46.1%
2	Private job	44	12.1%
3	Own business	97	26.7%
4	Agricultural work	54	14.9%
Total		362	100%

The above descriptive results show that almost 70% responds are male and 30% are female students. The results further disclosed the gender inequality among the rural areas of Pakistan which need to be revisited for the equal participation (Arshad et al., 2016). Similarly, the age of the respondents falls 48.8% between the age limit of 21-25 and vice versa. Moreover, the degree program distribution shows that 57.4% students are from the BS degree program and rest are from the Mater and M.Phil. degree programs.

Accordingly, the number of students from KIU Gilgit campus is very high compared to the other campuses. KIU Gilgit is the main campus and the pioneer university of Gilgit-Baltistan. Similarly, the father occupation shows highest number belong to the government sector employees. The father occupation tells us that entrepreneurial

business is rare in Gilgit-Baltistan. Moreover, the inclusion of father's occupation as a variable is justified by the reality that, in rural areas, men typically occupy dominant roles across various spheres of life, influencing economic and social dynamics.

4.2 Data Analysis

The research model was analysed while applying the Smart PLS-SEM version 4.0 one of the widely use software for structural equation modeling (Ringle *et al*., 2015). According to Sarstedt *et al*., (2014) most of the business studies used the "structural equation modeling" for the data analysis. Moreover, it is more suitable for the theory testing and examination of latent variable relation (Fornell and Larcker, 1981). Additionally, it supported to find the effect of TBP and Individualism on the entrepreneurial intention of the university students of Gilgit-Baltistan. Two-way data analysis approached is followed first one is the measurement model, and the second one is the structural model.

4.3 Results Measurement Model

The measurement model has assessed the entrepreneurial intention, theory of planned behaviour national culture dimension of individualism along with the latent construct and items. The reliability was measured by applying the Cronbach alpha, "composite reliability and average variance extracted" was used for the test of convergent validity. The detail of the factor loading, Alpha value, Average Variance Exerted and Composite Reliability are presented in the table 1.4 below.

Table 2: Result of the measurement model

Constructs	Items	Factor Loadings	Alpha value	AVE	C.R
Attitude towards behavior			0.833	0.640	0.876
	ATB1	0.847			
	ATB2	0.830			
	ATB3	0.724			
	ATB4	0.793			
Subjective norms			0.732	0.626	0.833
	SN1	0.731			
	SN2	0.734			
	SN3	0.898			
	SN4	Deleted			
Perceived behavioral control			0.791	0.601	0.857
	PBC1	0.687			
	PBC2	0.789			
	PBC3	0.875			
	PBC4	0.737			
Individualism			0.803	0.631	0.871
	IC1	0.699			
	IC2	0.892			
	IC3	0.875			
	IC4	0.690			

The results show that factor loading of all the items are above 0.7 as recommended by Hair at al., (2010), however one item from the construct of subjective norm is deleted (SN4) due to low factor loading. Similarly, the Cronbach's alpha values of all the constructs are above 0.7 as recommended by Yusoff *et al*., (2011).

Moreover, the convergent validity was evaluated by AVE and CR whose values are above 0.5 which are significant according to (Zeb *et al.*, 2019).

4.3.1 Discernment validity

Fornell and Larcker (1981) set a criterion to assessed the discernment validity called the "Fornell-Larcker Criterion". Moreover, Fornell and Larcker criterion is one of the popular tool used for the measurement of the discriminant validity. Similarly, the second criteria for the assessment of discernment validity is Heterotrait-Monotrait (HTMT) introduced by (Henseler *et al*., 2015).

Table 3: Fornell-Larcker Criterion

Constructs	1	2	3	4
ATB				
IC	0.491			
PBC	0.214	0.255	0.217	
SN	0.096	0.230	0.219	0.129

Table 4: HTMT Criterion

Constructs	ATB	SN	PBC	IC
1 ATB	0.797			
2 IC	0.375	0.795		
4 PBC	0.169	0.203	0.200	
5 SN	0.064	0.194	0.181	0.101

The standard set by Fornell and Larcker described that the square root of all respective construct's average variance exerted should be greater than the following values of other constructs that confirmed the sufficient discernment validity. Similarly, as the criterion set by HTMT method, all values were less than the 0.85 criterion thus further confirming the desired discriminant validity among the constructs.

4.4 Structural Model

The path of the structural model measurement validates and confirms the strengthen of the direct and indirect relationship between the exogenous variable and the endogenous variable. Moreover, the path coefficient shows the effect of an independent variable on a dependent variable. The structural model path coefficient was performed via bootstrapping. The results of the structural path coefficients are presented in table 4.10 below.

Table 5: Summary of the hypotheses results

Hypothesis	Relationships	β values	t values	p values	Decision
H1	ATB -> IE	0.280	9.032	0.001	Accepted
H2	SN -> IE	0.356	6.614	0.000	Accepted
H3	PBC -> IE	0.119	2.667	0.004	Accepted
H4	IC x ATB -> IE	-0.110	1.748	0.081	Not Supported
H5	IC x SN -> IE	-0.040	0.678	0.498	Not Supported
H6	IC x PBC -> IE	-0.029	0.443	0.658	Not Supported

The path coefficient of attitude towards subjective norms on entrepreneurial intention of the university students show significant effect (β = 0.280, t = 9.032, p = 0.001), hence hypothesis H1 is accepted. Similarly, the path coefficient of subjective norms on entrepreneurial intention of the university students are significant (β = 0.356, t = 6.614, p = 0.000), hence the hypothesis H2 is also accepted. Similarly, the path coefficient of perceived behavioural control on the entrepreneurial intention of the university students is also significant (β = 0.119, t = 2.667, p = 0.004), according the hypothesis H3 is also accepted.

However, the moderation effect is not significant as the path coefficient shows that individualism does not strengthen the relationship between ATB and entrepreneurial intention (β = -0.110, t = 1.748, p = 0.081), hence

the hypothesis H4 is not accepted. Similarly, the path coefficient of Individualism on the relationship between SN and entrepreneurial intention is not significant (β = 0.040, t = 0.678, p = 0.498), hence the hypothesis H5 is also not accepted. Finally, the last hypothesis H6 IC x PBC -> IE also show insignificant result (β = -0.029, t = 0.443, p = 0.658), there hypothesis H6 is not accepted accordingly.

5. Discussion and Findings

Previous research scholars have identified various factors that influence the entrepreneurial intention of the university students. However, limited knowledge exists regarding the specific context of Gilgit-Baltistan. The geographical location, environment, context and economic conditions are different from other places of the country. The comprehensive literature reviews and empirical studies found some new insights about the entrepreneurial intention of the university students of Gilgit-Baltistan. The empirical findings disclosed the effect of behavioral and culture factors on the entrepreneurial intention of the G-B university students. The results further revealed the positive affect of the independent on the dependent variable. All the behavioral factors positively influence the entrepreneurial intentions of the university students of G-B. Moreover, the variable of subjective norms and attitude towards behaviour and have strong effect as compared to perceived behavioral control variable.

Gilgit-Baltistan has a strong community culture, where family and friends play a significant role in shaping individual decisions. Students might be more likely to consider entrepreneurship if they perceive their family and friends supporting and encouraging it. Similarly, a positive attitude towards entrepreneurship, shaped by personal beliefs and perceptions of its desirability and feasibility, can significantly drive intention. The research finding of Hassan, (2021) also validated that the students in Gilgit-Baltistan might have a more positive attitude towards entrepreneurship due to the region's unique strengths, such as its natural beauty and potential for tourism and eco-friendly businesses. They might see entrepreneurship as a way to capitalize on these resources and create their own success stories. The challenging environment of Gilgit-Baltistan could foster a spirit of innovation and problem-solving among students, making them more open to the entrepreneurial venture as a means to address local challenges and create change. Moreover, the harsh and unpredictable environment of Gilgit-Baltistan might cultivate a sense of resilience and perseverance among students.

The moderation affect shows some contrasting and interesting results. The association between the independent and dependent variables is not strengthened by individualism's moderating influence. The results further validated the appropriateness of the research findings, as the people of Gilgit-Baltistan mostly lived in a combine family system and their culture values are contradictory to the individualistic norms and values. Gilgit-Baltistan, despite its diverse population, might have a relatively low degree of variation in individualistic values compared to other populations studied in research on entrepreneurship and culture. Ali *et al*., (2023). This lack of variation could weaken the ability of individualism to moderate the relationship between the independent and dependent variables. Moreover, the stronger collectivist influence: the culture of Gilgit-Baltistan might be predominantly collectivistic, where family, community, and social norms play a stronger role in shaping individual decisions than individualistic values. This could overshadow the potential moderating effect of individualism. The nature of entrepreneurial opportunities and challenges in Gilgit-Baltistan might not be directly influenced by individualistic values. For example, access to resources, infrastructure, and social networks might be more critical factors than individual preferences for independence and self-reliance.

The research findings also make a practical contribution to the policymakers, the interested individuals and the institutions. The results show the important factors that play an important role for entrepreneurial intention development, particularly in the context of the university students of Gilgit-Baltistan. The research shows a positive relationship between the theory of planned behaviour except for the individualism factor. The results provide new insights for the policymaker to formulate policies based on the research findings.

The following major recommendations are suggested on the base of the research findings and literature study for the government institutions, universities and stakeholders. The university students of Gilgit-Baltistan showed a positive response towards entrepreneurial activities. Based on the research findings, it is suggested that practical entrepreneurial programs should be arranged inside and outside the universities. Moreover, business exhibitions and industrial tours will further enhance the entrepreneurial skills of university students. It is also suggested to develop, implement and teach case studies during their study course. This method will motivate students towards business activities and coping with the challenges. Similarly, business incubators or entrepreneurship development centers should be established.

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Unpacking Saudi Family Firm Performance Benefits of Entrepreneurial Orientation, Digitalization, Ambidexterity, and Involvements

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Abstract: This study aims to enhance family firm research by introducing contemporary concepts such as entrepreneurial orientation, digitalization, and ambidexterity. It develops hypotheses to examine their impacts on family firm performance, while also exploring the influence of family and generational involvements on the relationship between entrepreneurial orientation and family firm performance. Furthermore, the study investigates the mediating role of innovation ambidexterity in the relationship between entrepreneurial orientation and performance. Using a quantitative approach, this study analyzed data from 256 Saudi family firms through structural equation modeling (SEM). The findings indicate that both firm digitalization and entrepreneurial orientation significantly affect innovation ambidexterity. Additionally, entrepreneurial orientation and innovation ambidexterity have significant impacts on family firm performance. However, firm digitalization does not demonstrate a significant effect on family firm performance. Moreover, innovation ambidexterity mediates the relationship between digitalization (fully) and entrepreneurial orientation (partially) with family firm performance. This research highlights the importance for family firms seeking to combine entrepreneurial orientation with a high degree of digitalization to explore and leverage innovative practices, especially when family involvement holds greater significance than generational involvement. These findings reinforce the notion of revitalizing entrepreneurial orientations by involving new, well-educated generations. The study also calls for further empirical research on the potential of Saudi family firms and their generations to engage in entrepreneurial behaviors, ensuring their sustainability and modernization in the digital era.

Keywords: Entrepreneurial orientation, Innovation ambidexterity, Firm digitalization, Family involvement, Generational involvement, Family firm performance

1. Introduction

Saudi family firms are considered as the backbone of the Middle East's and GCC's economies accounting for an estimated 63% of all businesses in the Kingdom (Adileh, 2022; Ramadani et al., 2023). They are growing during the last decades and the dynamics of their business model are changing (Aloulou, 2018; Aloulou & Alshaeel, 2023; Aloulou, 2023b). They contributed of $216 billion to the GDP of the country, and had employed about 7.2 million people, representing a 52 percent of the total workforce (Alsharif, 2019). These statistics prove how important are family businesses in the Saudi economy. In GEM report of 2018, Saiz-Alvarez et al. (2022) highlighted the prevalence of family businesses in Saudi Arabia over the entire population of the study. There are significant percentages of individuals involved in the ownership and management of family businesses.

92 percent of the family businesses are in major areas of the country with 45% in Riyadh, 28% in Makkah and 18% in the Eastern Province. The largest percentage of Saudi family companies fall under the legal form of limited liability company, as they are more in line with the reality and composition of Saudi families (according to a study by the Business Sector Observatory (Marsad) of the Riyadh Chamber) (Asharq Al Awsat, 2021).

Family businesses contribute more than 800 billion riyals ($213.3 billion) or 32 percent annually to the Kingdom's domestic income and provide many job opportunities for citizens. For instance, the family business sector is vital and plays a prominent role in the development of the national economy in addition to its distinction in the process of localizing national talents of both genders (Saudi Gazette, 2018). More than 80% of the total workers in the private sector work in family businesses, which stresses the need to strengthen and build the capabilities of family businesses, increase their adaptation to the new economic environment imposed by "Vision 2030", and benefit from the promising investment opportunities generated by it.

The mechanisms through which entrepreneurial orientation impacts firm performance remain incompletely understood (Rauch et al., 2009; Kollmann & Stöckmann, 2014; Wales et al., 2021). Potential mechanisms may influence this relationship in a family firm context. To address the potential gap in a such relationship, numerous scholars have investigated the link using several intermediary variables (mostly mediators), such as exploratory and exploitative innovations (Kollmann & Stöckmann, 2014; Wales et al., 2013); innovation and resilience capabilities (Freixanet et al., 2021; Mendoza-Silva, 2021; Aloulou, 2023a); and using several moderators such as family involvement (Aloulou, 2018) or generational involvement (Cherchem, 2017).

This study aims to enhance family firm research by introducing contemporary concepts such as entrepreneurial orientation (EO), firm digitalization (FD), and innovation ambidexterity (INNOVAMBI). It develops hypotheses to examine their impacts on family firm performance (FFP), while also exploring the influence of family (FI) and generational (GI) involvements on the relationship between EO and FFP. Furthermore, the study investigates the mediating role of INNOVAMBI in the EO-FFP relationship.

This study draws on the resource-based view (RBV) and the strategy-conduct-performance framework to examine the mechanisms through which EO influences FFP. It develops a model of EO-capabilities-performance linkages based on a quantitative study design and data from 256 Saudi family firms to simultaneously test the different hypotheses.

The study also calls for further empirical research on the potential of Saudi family firms and their generations to engage in entrepreneurial behaviors, ensuring their sustainability and modernization in the digital era.

The paper is organized into four primary parts. The first part, Section 2, offers an extensive examination of the existing literature on EO, FD, INNOVAMBI, FFP and FI, and GI. This section focuses on the theoretical framework and the development of hypotheses. Moving on to Section 3, the study's methodology is outlined, covering the sampling approach, data collection procedures, measurement instruments for the key variables, and the analysis strategy. In Section 4, the paper presents a comprehensive overview of the study's findings. Finally, the last section delves into a discussion of these findings, emphasizing their implications for theory and practice, addressing research limitations, suggesting potential directions for future studies and concluding with key remarks.

2. Theoretical Background and Hypotheses Development

2.1 Resource-Based View, Information Processing Theory and Organizational Capability Perspective

From the Resource-Based View (RBV) perspective, firms seek unique resources and capabilities to achieve higher performance (Barney, 2001). To foster innovation, firms must continuously develop and integrate their skills and abilities (Teece et al., 2016). Firm resources and capabilities are critical for sustaining competitive advantage. EO is recognized as a strategic resource for family firms to enhance performance (Zhou et al., 2005). From a perspective of organizational capability, innovation ambidexterity enables firms to translate EO into performance outcomes (Kollmann & Stöckmann, 2014; Aloulou, 2023a). Adopting the strategy-conduct-performance paradigm (Aloulou, 2023a; 2024), we investigate the role of innovation ambidexterity as organizational capability in converting strategic orientations into higher performance.

Drawing from the information processing theory, this study explores the influence mechanisms between firm digitalization and performance, building on prior research (Ribeiro-Navarrete et al., 2021; Issah & Calabro, 2024). Firm digitalization involves using digital technology to organize, process, and store data. To achieve long-term success, firms must integrate digital technologies into innovation activities, fostering stronger capabilities and creating growth opportunities (Aloulou, 2029b; Felipe et al., 2020; Cai et al., 2019). Developing higher-order capabilities, such as innovation ambidexterity, is crucial for leveraging strategic resources like EO and lower-order capabilities (technological resources) like firm digitalization (Aloulou, 2023a; 2024; Enrique et al., 2022; Felipe et al., 2020; Zhang et al., 2016; Zhou & Wang, 2021).

2.2 Key Concepts Defined and Linked

2.2.1 Entrepreneurial orientation

EO is a vital concept in entrepreneurship, supported by scholars (Rauch et al., 2009; Runyan et al., 2012). It comprises three dimensions: Innovativeness, Proactiveness, and Risk-taking. Innovativeness involves embracing novelty and creativity to develop new products or processes. Proactiveness enables firms to anticipate and respond to changes, staying competitive. Risk-taking reflects a firm's willingness to pursue activities with potential outcomes, even if failure is possible (Covin and Slevin, 1989; Lumpkin and Dess, 1996).

2.2.2 Firm digitalization

Firm digitalization refers to the integration and utilization of digital technologies and processes within an organization's operations, strategies, and business models. It involves leveraging digital tools such as cloud computing, data analytics, artificial intelligence, and automation to enhance efficiency, productivity, and customer experiences (Hao & Song, 2016; Yu et al., 2017).

2.2.3 Innovation ambidexterity

Innovation ambidexterity is the ability of an organization to balance and integrate both exploratory and exploitative innovation, combining the pursuit of new possibilities with optimizing existing capabilities for long-term growth and adaptation (Raisch et al., 2009; O'Reilly & Tushman, 2013).

2.2.4 Family and generational involvements

Active participation of family members in a family business, known as family involvement, impacts operations and outcomes (Sciascia & Mazzola, 2008). The level of family involvement shapes the direction and success of family enterprises. Generational involvement refers to the number of family generations simultaneously involved as the primary steward in the management of the firm (Cherchem, 2017; Zahra et al., 2007; Alrubaishi et al., 2021).

2.2.5 Family firm performance

Within the field of family business studies, family firm performance refers to the overall effectiveness and achievement of a business that is owned and operated by a family, encompassing financial success, sustainability, and the ability to pass the business to future generations (Williams Jr, 2018). When objective data is scarce, subjective measurements of family firm performance (FFP) have been deemed suitable (Singh et al., 2016). This study emphasizes FFP, which is assessed based on Top Management's satisfaction with firm results and influenced by strategic and technological resources (e.g., EO and FD) as well as firm capabilities (INNOVAMBI).

2.3 Hypotheses Developed

2.3.1 EO and family firm performance

Entrepreneurial orientation (EO) is positively linked to family firm performance, as it enables firms to innovate, take risks, and proactively respond to market changes for an enhanced competitiveness, growth, and sustainability. EO fosters a culture of entrepreneurship in terms of innovativeness, proactiveness and risk-taking, driving family firms towards superior performance outcomes (e.g., Wales et al., 2013; Aloulou, 2018*;* Kallmuenzer et al., 2018). We can state the following:

H1: There is a positive relationship between EO and FFP.

2.3.2 FD and family firm performance

Firm digitalization positively impacts family firm performance by enhancing operational efficiency, improving decision-making, and increasing innovation capabilities and leading to improved financial performance, competitiveness, and sustainability. Digitalization enables family firms to respond effectively to market changes, driving superior performance outcomes (Suder et al., 2022; Ribeiro-Navarrete et al., 2021; Issah & Calabro, 2024). The following hypothesis can be stated:

H2: There is a positive relationship between FD and FFP.

2.3.3 INNOVAMBI- family firm performance

The role of innovation ambidexterity in enhancing firm performance is significant as it allows firms to simultaneously pursue exploratory and exploitative activities. These activities can lead to enhanced competitive advantage, adaptability, and long-term success.

Innovation ambidexterity also positively influences family firm performance and enables them to simultaneously innovate and optimize existing capabilities, leading to improved financial performance, growth, and survival (Van Doorn et al., 2020; Stubner et al., 2012). The following hypothesis can be stated:

H3: There is a positive relationship between INNOVAMBI and FFP.

2.3.4 EO, innovation ambidexterity and family firm performance

EO is positively linked to family firm performance, as it fosters a culture of entrepreneurship, driving family firms towards superior performance outcomes. However, the relationship between EO and performance is not direct; rather, it is mediated by innovation ambidexterity.

The importance of innovation ambidexterity in driving family firm performance is also supported by theoretical perspectives on organizational ambidexterity (O'Reilly & Tushman, 2013).

Innovation ambidexterity plays a crucial mediating role in the EO-performance relationship (Raisch et al., 2009). Innovation ambidexterity allows firms to simultaneously pursue new opportunities and optimize existing capabilities, leading to enhanced performance outcomes.

EO enables family firms to develop innovation ambidexterity by encouraging experimentation, risk-taking, and learning from failures. In turn, innovation ambidexterity enables family firms to translate EO into tangible performance outcomes.

The mediating role of innovation ambidexterity suggests that family firms with high EO are more likely to develop innovation ambidexterity, which ultimately leads to superior performance outcomes. Several studies have emphasized the mediating role of innovation ambidexterity in the EO – (firm, new product…) performance relationship (Kollmann and Stöckmann, 2014; Mirbaha et al., 2019; Huang et al., 2020; Lisboa et al., 2011). We ca advance the following hypotheses:

H4: There is a positive relationship between EO and INNOVAMBI.

H5: INNOVAMBI mediates the relationship between EO and FFP.

2.3.5 Firm digitalization, innovation ambidexterity and family firm performance

Firm digitalization refers to the adoption and integration of digital technologies and capabilities (digital platforms, data analytics…) into the operations and processes of a firm (Gupta et al., 2020). It involves leveraging digital tools, platforms, and data to enhance efficiency, innovation, customer experience, and overall firm performance.

Innovation ambidexterity is critical in the context of firm digitalization because it enables firms to simultaneously explore and exploit digital technologies and opportunities. It also plays a mediating role between firm digitalization and firm performance. In fact, firms that can develop and maintain innovation ambidexterity are more likely to translate the benefits of digitalization into improved financial and non-financial performance outcomes. Innovation ambidexterity allows firms to fully realize the performance benefits of their digitalization efforts (Oduro & De Nisco, 2023; Fengel et al., 2022). From above, we can advance the following hypotheses:

H6: There is a positive relationship between FD and INNOVAMBI.

H7: INNOVAMBI mediates the relationship between FD and FFP.

2.3.6 Moderating roles of FI and GI in the EO-FFP relationship

Several studies suggested that high levels of family involvement strengthened the positive relationship between EO and firm performance in family firms. This may be due to the alignment of family values, long-term orientation, and commitment to the firm's success, which amplifies the impact of EO on performance outcomes (Kammerlander et al., 2020; Arzubiaga et al., 2018). In addition, family involvement can influence the implementation and effectiveness of EO in family firms. Family members' involvement in decision-making processes and in implementing entrepreneurial strategies can shape the extent to which EO is embraced and translated into action. We can state the following hypothesis:

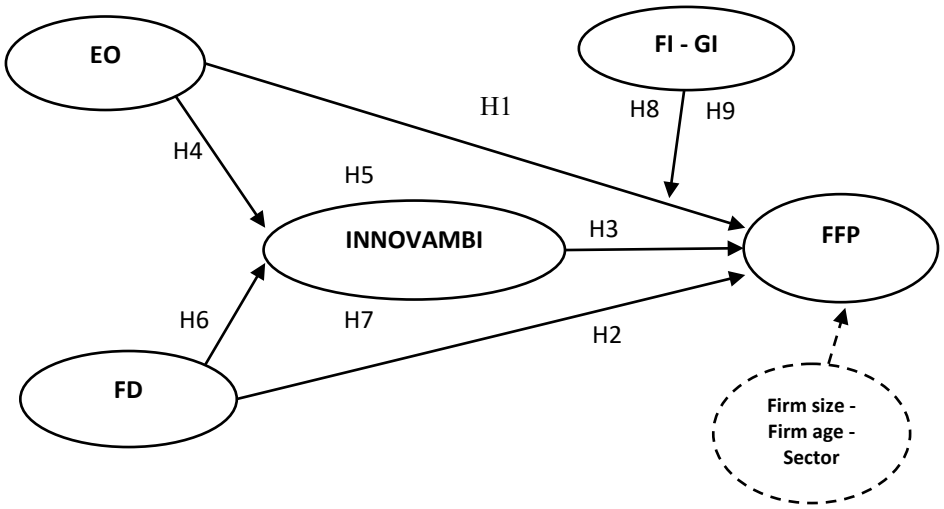
H8: FI moderates the relationship between EO and FFP.

Generational involvement refers to the active participation and influence of different generations within the family firm, including both senior and next-generation family members. The interplay between different generations can have a moderating effect on the EO-performance relationship in family firms. generational involvement can influence the adoption and adaptation of EO strategies. Different generations may have varying perspectives, values, and preferences regarding entrepreneurial activities. Research suggests that next-generation involvement can bring fresh ideas, innovation, and a greater willingness to take risks, which can contribute to the effectiveness of EO in family firms. However, senior generation involvement can provide stability, experience, and resources to support the implementation of EO strategies (Cherchem 2017; Sciascia & Mazzola, 2008). Therefore, other studies stated that family firms with a high degree of generational involvement had a stronger alignment between EO and family goals, leading to improved firm performance (Alrubaishi et al., 2021; Liew & Loo, 2023). From above, we can hypothesize the following:

H9: GI moderates the relationship between EO and FFP.

2.4 Research Model

Figure 1 showed the research model and hypotheses suggesting the influence of EO and FD on FFP through INNOVAMBI.



H1-H4, H6: Direct relationships

H5; H7: Indirect effects (mediation)

H8-H9: Indirect effects (moderation)

Figure 1: Research Model

3. Methodology

3.1 Sampling and Data Collection

This empirical study was conducted among Saudi family firms. To identify them, we selected them from different sources: official sources (national chambers of commerce, and National Center of Family Businesses) and personal sources (social network and personal contacts). Five regions are taken into consideration and main industries: manufacturing, trading and service are covered by this study. Senior and middle managers were selected to be respondents because of their knowledge about the context and topics of the study.

After ensuring the accuracy and appropriateness of the language in the questionnaire, an online version of the questionnaire was set up and a link was generated. Data were gathered during the period from October 2022 to June 2023 with the help of three paid assistant researchers. They helped the researcher disseminate the questionnaire link through emails and social media platforms (e.g., WhatsApp contacts and groups).

Data were collected from 256 family firms. 63% of these firms are from Riyadh and 37% from the other Saudi regions. 42.6% of these firms have one generation, the rest have two or more generations. 40.6% of firms have a percentage of family involvement 5% and high. Most of the respondents are male (87.9%). 36.3% are owner/CEO, 31.6% are departmental executive officers or middle-level managers. 32.4% are members of the board of directors or senior consultant of the firms.

3.2 Measures

We collected the measures of the following constructs using a multi-item five-point scale ranging from 1 (strongly disagree) to 5 (strongly agree):

Entrepreneurial orientation (EO): it is measured with 9 items from Covin & Slevin (1989). EO is conceptualized as a strategic posture that reflects a firm's propensity of innovativeness, proactiveness and risk-taking. The construct was validated in different contexts (Kreiser et al., 2002; Runyan et al., 2012; Dess et al., 2011).

Firm IT/Digital capability (F-IT/DT): it is measured with 6 items adapted from Hao & Song (2016) and Yu et al. (2017). It is referred to as the use of IT/digital technology for facilitating technical and market knowledge creation, for internal and external communication, for marketing and promotion purposes, for moving toward automation or digitalization of processes and for developing new products and/or services.

Innovation ambidexterity (IA): it is measured using 11 items from Zhang et al., (2016). It denotes the capacity of a company to effectively engage in both exploration (learning and acquiring knowledge, technology and skills, product development, management, and markets entirely new to the firm) and exploitation (enhancing product quality, processes, and knowledge; upgrade competences; and expedite product and process advancements to improve overall attributes) activities, maintaining a delicate balance while acknowledging the trade-offs involved. The two dimensions (exploration and exploitation) were measured independently, then added to form a single index for innovation ambidexterity.

Family Firm Performance (FFP): it is measured using 7 items from scales developed and adapted from previous studies (Aloulou, 2019a; 2023a). This measure exhibits subjective attributes to assess performance, incorporates a competitive assessment and addresses the notion of performance over time (Chen et al., 2014; Singh et al., 2016). A sample item is: “The extent to which your firm’s performance during the last 2 or 3 years, relative to all other competitors, our profitability has been substantially better” from “Much below the average” to “Much above the average”.

Family Involvement (FI): is measured as the share of family executives in top management (i.e., dividing the number of family top managers by the total number of top managers), aligning with prior research approaches (e.g., Minichilli et al., 2010; Sciascia et al., 2013; Sciascia & Mazzola, 2008; Zahra et al., 2007; Kammerlander et al., 2020)

Generational Involvement (GI): it is measured by involving a clear and straightforward question to respondents: "How many generations are presently involved in business management and strategic decision-making?" Respondents can indicate a single generation, two generations, or multiple generations (three or more) in consistency with previous studies (e.g., Cherchem, 2017).

Control variables: firm size, firm age and sector of activity are the control variables used in this study. (Aloulou, 2018).

3.3 Analysis Strategy

In our study, we employed SPSS software for an exploratory factor analysis (EFA) to uncover underlying latent factors. Subsequently, with AMOS software (version 21.0) a confirmatory factor analysis (CFA) was conducted to refine and empirically validate the measures and a structural equation modeling (SEM) analysis with maximum likelihood estimation (MLE) was used to test simultaneously the hypothesized relationships in the conceptual model.

3.4 Common Method Bias

Given that this study relied on self-reporting for all variables, the potential issue of common method bias was considered. Following MacKenzie and Podsakoff's (2012) approach, Harman's one-factor test was performed to assess common method bias. The results revealed that 5 factors were drawn out and the largest factor explained 26.716% (<50%) of the total variance. No single factor accounted for a majority of the total variance, indicating the absence of common method bias. To further examine the measurement model, a confirmatory factor analysis (CFA) was conducted, comparing a multifactor model to a single overall latent factor model. The fit indices for the multifactor model [x2/DF = 1.318; RMR = 0.047; CFI = 0.965; TLI = 0.961; GFI = 0.877; RMSEA = 0.035; NNFI = 0.870] demonstrated significantly better fit compared to the one-factor model [x2/DF = 6.216; CFI = 0.400; TLI = 0.360; GFI = 0.407; RMSEA = 0.143; NNFI = 0.363]. These results indicate that common method bias is not a significant concern in this study.

3.5 Reliability and Validity of the Measurement Model

The reliability and validity of the constructs are examined. The findings of the exploratory factor analysis reveal that the factor loadings are significant and higher than 0.5, the KMO index is higher than 0.6 and the constructs are reliable with Cronbach’s Alphas exceeding 0.7 and composite reliability indexes exceeding 0.84. Convergent validity is also demonstrated with an average variance extracted (AVE) higher than 0.5 for each construct. The discriminant validity also was demonstrated. The square root of the AVE estimated for each construct is verified to be greater than the correlation between that construct and all other constructs in the model (Hair et al., 2019).

The descriptive statistics show significant and positive correlations among main variables (independent, mediator and dependent). Significant and positive correlations were found between control variables (Firm size and firm age) and EO, FFP and generational involvement. Discriminant validity was demonstrated and

showed that the values of square root of the AVE are superior to values of correlations between constructs (Fornell & Larcker, 1981).

4. Results

After checking for the model fit [x2/DF = 1.245; RMR = 0.065; CFI = 0.963; TLI = 0.959; GFI = 0.864; RMSEA = 0.031; NNFI = 0.841], the findings indicate that both FD (estimate = 0.250***, p<0.001) and EO (estimate = 0.123**, p< 0.01) significantly affect INNOVAMBI. Thus, hypotheses H4 and H6 were supported. Additionally, EO (estimate = 0.337***, p < 0.001) and INNOVAMBI (estimate=0.211**, p < 0.01) have significant impacts on FFP. Hence, hypotheses H1 and H3 were supported. However, FD does not demonstrate a significant effect on FFP (estimate= 0.055, p=.290) and hypothesis H2 was not supported. Moreover, we followed the recommendations of Zhao et al., (2010) to test the mediation hypotheses and used the bootstrapping technique to observe the indirect effects of EO of FD on FFP. The results showed that INNOVAMBI mediates the relationship between FD (fully) and EO (partially) with FFP. Consequently, hypothesis H5 was partially supported and H7 was fully supported.

Therefore, FI moderates the relationship between EO and FFP (estimate of the interaction = 0.108*, $p < 0.01$) while GI did not moderate this relationship (estimate of the interaction = 0.116, $p = 0.079$). Hypothesis H8 was supported and hypothesis H9 rejected. Merely, GI can moderate this relationship for p <0.1. This result may be considered with precaution. The significant interactions should be probed to explore how the relationships change at different levels of the moderators.

5. Discussion, Implications, Limitations, and Future Perspectives

This paper examines the relationship between EO and FFP, as well as the relationship between FD and FFP, with a focus on the mediating role of INNOVAMBI. The study highlights the complementary roles of EO and FD in enhancing the ability of family firms to balance exploration and exploitation activities, leading to improved performance. The strategic orientation associated with EO and the technological resources associated with FD enable Saudi family firms to explore and experiment with new digital technologies and business models, while also exploiting digital capabilities to drive innovation and performance. The findings indicate that Saudi family firms consider the unique characteristics of the family (family members, relying on new well-educated generations) in guiding their strategic choices, utilizing digital technologies, and pursuing simultaneous exploration and exploitation to achieve superior performance.

The theoretical implications of the study are twofold. Firstly, the research goes beyond previous studies that focused on individual antecedents to ambidexterity by considering EO and FD in the research model. Secondly, the study contributes to the literature on EO, FD, and INNOVAMBI by providing insights into the mediating role of INNOVAMBI in the relationships between EO and performance, as well as FD and performance. The study demonstrates that INNOVAMBI serves not only as a balance between exploration and exploitation but also as a mechanism through which strategic and technological resources can translate into enhanced performance.

From a practical standpoint, the findings have important implications for family firm managers. Family firms pursuing exploration and exploitation activities from an INNOVAMBI perspective should be mindful of their strategic (EO) and technological (FD) resources. The study suggests that INNOVAMBI serves as a suitable mechanism for family firms to simultaneously leverage the benefits of EO and FD to enhance firm performance.

However, the study has several limitations that suggest potential avenues for future research. Firstly, it highlights the importance of investigating the interaction between EO and FD and their impact on INNOVAMBI as an organizational capability. Future research could delve deeper into this interaction. Secondly, the use of cross-sectional data limits the ability to establish causal relationships between EO, FD, INNOVAMBI, and performance. Future research could adopt longitudinal designs to examine the effects of EO and FD on INNOVAMBI and performance over time.

6. Concluding Remarks

In summary, this study examines the factors influencing innovation ambidexterity (INNOVAMBI) and its impact on firm performance. It emphasizes the simultaneous effects of entrepreneurial orientation (EO) and firm digitalization (FD) in developing INNOVAMBI. Additionally, it demonstrates how innovation ambidexterity serves as a valuable mechanism for firms to leverage their unique resources and achieve superior performance. By shedding light on the intricacies of innovation ambidexterity and its performance outcomes,

this research contributes new insights to the field. It also advances our understanding of the mechanisms underlying the relationships between EO-performance and FD-performance. It also builds the basis for undertaking further research comparisons between Saudi family and non-family firms to test these two key relationships.

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Constraints to Green and Digital Transition in the Greek Agri-Food Sector

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Abstract: The European Union's Green Deal and the United Nations' 2030 Agenda are key strategic frameworks that aim to transform all nations towards a climate-neutral continent. At the heart of achieving this ambitious goal is the need for greater policy coherence, particularly concerning the digital Green Deal. The adoption of digital technologies in green sustainability initiatives requires a comprehensive update of existing policies to properly exploit all the opportunities offered by digitalisation. This study focuses on identifying constraints to environmental and digital advancement in the agri-food sector. In particular, it examines existing policies and those that need to be implemented to facilitate the green and digital transition of agri-food enterprises. The research methodology comprises in-depth, semi-structured interviews with fifteen (15) policymakers at the national, regional, and local levels in Greece, all of whom are responsible for decision-making in the agri-food sector. The findings underline the need for a substantial reform of the current institutional framework to make it more favourable to agri-food enterprises, especially for very small enteprises and SMEs, for whom the barriers are even greater. Improving access to financial support is also highlighted as a critical need. To ensure a smooth twin transition towards environmental sustainability and digitalisation, the study advocates improving the educational background and promoting digital literacy among stakeholders. These measures are considered necessary to increase the competitiveness of agri-food enterprises in today's global landscape. The study essentially highlights the central role of a strong policy framework for the environmental and digital transition of the agri-food sector. By addressing the barriers identified in the study through the implementation of appropriate policies, agri-food entrepreneurs can adopt sustainable practices and harness the transformative potential of digital technologies.

Keywords: Agri-food sector, Policies, Sustainability, Green transition, Digitalisation

1. Introduction

Alongside the exceptional crises, it is imperative to acknowledge the pivotal role of climate change and its tangible, particularly evident impacts across the globe in recent times. Furthermore, the rapid advances in technology and the subsequent digital transformation brought about by the 4th Industrial Revolution need to be taken into account (Apostolopoulos et al, 2021; Pistikou et al, 2023). The European Green Deal is an ambitious initiative by the European Union (EU) to achieve climate neutrality by 2050 in full compliance with the 17 United Nations Sustainable Development Goals and the Paris Climate Agreement (European Commission, 2017; Castillo-Díaz et al, 2023). This agreement has promoted the transition to a sustainable and circular economic model, supporting the use of clean energy sources and the adoption of green practices in all sectors of the economy (Agoraki et al, 2023; Apostolopoulos et al, 2023; Paris et al, 2023), including the agri-food sector. The integration of digital technologies in agriculture, such as precision agriculture and production monitoring systems, have been central elements of this strategy (European Commission, 2019).

The green and digital transformation of the agri-food sector has been a key issue in efforts to ensure sustainable and resilient agri-food systems (Saviolidis et al, 2020). However, this transition is not without challenges and obstacles that affect the effectiveness and efficiency of the initiatives involved. Despite the recognition of the importance of digitalisation, access to advanced technologies has remained limited in many areas, particularly in rural areas (Ferrari et al, 2022). This weakness is due to a number of factors. First, the financial difficulties especially of very small and small-medium agri-food enterprises make it difficult to invest in new technologies (Klerkx et al, 2019). Funding is therefore a critical factor. Despite increased investment in Research and Development (R&D), the financial resources available to support agri-food enterprises toward green and digital transformation has been insufficient (Cao et al, 2021). The lack of investment incentives and

the high cost of the initial investment required for digitalisation and the implementation of sustainable practices act as a deterrent.

The institutional framework has been an equally important barrier (Apostolopoulos et al, 2020; Liargovas et al, 2017). In many cases, regulations are not in line with the needs of modern agriculture and technological progress. The lack of coherent policies and control mechanisms and the complexity of bureaucratic procedures make it difficult to implement innovative solutions (Long et al, 2016; Apostolopoulos et al, 2021; Makris et al, 2024). The role of the new Common Agricultural Policy (CAP) is to support the agri-food sector towards environmental sustainability, climate change mitigation, and increased digitalisation. By incorporating practices that reduce greenhouse gas emissions and increase resource efficiency, the CAP aims to create a more sustainable and resilient agri-food sector (European Commission, 2021; European Commission, 2023). However, a shift from traditional to contemporary techniques necessitates not just financial resources for procuring new equipment but also the provision of adequate education and training in its application. The traditional culture and established habits of many farmers have acted as a barrier to the adoption of new practices, as they are unfamiliar to them (Apostolopoulos et al, 2023; Gemtou et al, 2024).

By examining the perspectives and experiences of 15 policymakers in the agri-food sector, we add knowledge and strengthen the academic literature on the challenges faced by agri-food enterprises in adopting green and digital practices in Greece. Although the global interest in this topic is huge, there is a lack of research in the literature considering the policymakers' side. The question that this research aims to answer is the following:

- What are the challenges faced by agri-food enterprises in their green and digital transition efforts?

The framework of our survey is the following. The introduction of the environmental and digital framework in the agri-food sector follows the literature review based on the scientific papers on green and digital practices of agri-food enterprises. Then, we outline our methodological approach. Next, we analyse and discuss our findings, and finally, we present the conclusion, the limitations, and future research.

2. Literature Review

The existing literature has identified research conducted on policy measures designed to support agri-food enterprises in a green and digital transition in line with the Sustainable Development Goals and the European Green Deal (Apostolopoulos et al, 2018; Stein & Santini, 2022). However, further research is required to enhance support to the agri-food sector in this twin challenging transition. The present research examines the perspectives of various stakeholders, including state, regional, and local actors, on the challenges faced by agri-food enterprises in Greece in adopting digital technologies for environmental sustainability.

Enabling the introduction of digital technologies is one of the promising ways to ensure sustainable development (Bohnsack et al, 2022; Deirmentzoglou & Deirmentzoglou, 2022). The utilisation of digital technologies in the agri-food sector has the potential to significantly reduce environmental impacts. This can be achieved by decreasing the consumption of natural resources, lowering pollutant levels, and cutting CO2 emissions. This shift in approach fosters long-term sustainability of the agri-food enterprises in line with environmental and social advantages. Research emphasizes the positive contribution of digital technologies in achieving more sustainable production and consumption processes (Mäkitie et al, 2023). The successful adoption of these technologies depends on the socioeconomic context and the presence of policy support measures (Barrett et al, 2020; Carayannis et al, 2020; FAO, 2022).

The EU has incorporated digital measures into its agricultural policies in response to concerns about environmental impact (Venghaus & Hake, 2018). The recent CAP reform has allocated 40% of the budget for the promotion of climate- and environmentally-friendly agricultural practices for the period 2023-2027 (European Commission, 2023). Despite these efforts, EU agriculture continues to have negative impacts on the environment. Doukas et al. (2023) found that "green" payments incentivize agri-food enterprises to adopt new technologies like renewable energy sources (RES) and smart agriculture. However, Slätmo (2019) noted that more stringent environmental sustainability policies may hinder the economic development of rural agri-food enterprises. Meeting EU criteria for environmental, social, and governance (ESG) requirements can be stressful for agri-food small-medium enterprises, as highlighted by Jónsdóttir and Gísladóttir (2023). Despite the prevalence of initiatives aimed at promoting positive impacts, there is currently no compelling evidence that ESG-focused portfolios outperform traditional ones. The development of a unified sustainable economic classification framework remains a challenge (Zairis et al, 2024).

The Greek agri-food sector is currently unable to undergo the long-awaited transformation. This impediment can be described as the 'triangle of stagnation'. The three sides of the triangle correspond to three key factors: the low level of education that characterises the workforce, the low level of investment in the agri-food sector, and the slow transition to digitalisation compared to most European countries (Paris et al, 2023). In particular, the majority of Greek farmers and producers (approximately 97%) have gained their experience in the field, while a minority (approximately 3%) have received basic training from accredited organisations (Doukas et al, 2022). Only a small number have received full agricultural vocational training after successfully completing integrated training programmes of at least two years' duration. Furthermore, the transition towards digitalisation and innovative production processes is slow and cautious. For example, the European Knowledge and Innovation System (AKIS) has identified the Greek system as being characterised by a lack of coherence and fragmentation (O'Flynn et al, 2018). Another research by Tsilika et al (2020) has shown how Greek SMEs are using improvisation and creativity to innovate in a challenging environment.

3. Methodology

The main purpose of this study was to explore the perspectives and experiences of executives responsible for developing and implementing policies that support the viability and sustainability of the agri-food sector. The interaction between the researcher and the research participant plays a pivotal role in interpreting the participant's experience (Ponterotto, 2005). In light of the research objective, the phenomenological approach, which entails the detection of the perspectives of policymakers in the agri-food sector and the selection of an interpretative contour, namely an in-depth comprehension and interpretation of their personal perceptions, beliefs and experiences, serves to inform the choice of qualitative research (Fossey et al, 2002). Qualitative research enables an understanding of the entrepreneurial phenomenon within its specific context (Van Burg et al, 2020) while also elucidating and explaining the complexity of entrepreneurial actions (Drakopoulou-Dodd et al, 2014).

The purposive sampling technique was used to approach specific stakeholders relevant to the subject (Kenny & Duckett, 2003). The sample size was carefully chosen to ensure it accurately represented individual characteristics, based on the principles of relevance and adequacy (Polit & Hungler, 1999). We conducted semi-structured interviews to gather qualitative data from fifteen executives representing state, regional, and local authorities in 2023. The interviews, conducted in Greek, the native language of the participants. Both telephone and online interviews were used, as research indicates that data collected via these methods are as reliable as face-to-face interviews (Apostolopoulos et al, 2021). Before the interviews, the interviewees were fully informed about the research objectives and assured of their anonymity.

We used content analysis to examine the research data (Bengtsson, 2016). After reading the transcripts, we identified sub-themes and we produced a report for sub-theme interpretations. Saturation was reached when no new concepts were extracted (Guest et al, 2006). We identified three sub-themes related to a specific theme:

- Institutional framework
- EU & national support
- Educational background

4. Data Analysis

In accordance with the interpretative framework, our research question was formulated for the policymakers of the agri-food sector. The data analysis was conducted in the native language of the survey participants to avoid ambiguity (Temple & Young, 2004). The emerging sub-themes regarding the research question were recorded and captured in Table 1. Then, the creation of categories was specified in detail. Combining the interview results with previous literature added value, and validity to the research findings (Flick et al, 2004).

Table 1: Emerged sub-themes regarding the main theme

Theme	Sub-themes	Summary
Green and digital transition of agri-food sector	Institutional framework	Bureaucracy Environmental regulation
	EU & national support	Financial instruments
	Educational background	Re-skilling, up-skilling Lifelong learning

5. Findings

The findings were structured based on the three emerging sub-themes: i) institutional framework, ii) EU & national support and iii) educational background.

- Institutional framework

The institutional framework is often challenging, characterised by complex procedures and significant bureaucracy that discourage investment. Nevertheless, recent efforts to digitise public sector services are promising steps towards simplification. Although perfect environmental practices are still a work in progress, it is essential to implement and monitor the institutional framework through robust control mechanisms.

> *'… The necessity for a novel institutional framework, the streamlining and digitisation of procedures, the implementation of additional measures accompanied by financial instruments and incentives, and the prioritisation of environmental protection are all evident…' (R7)*

> *'I believe that the European Union has established a regulatory framework for the environmental framework, and that the directives adopted by national legislation are sufficient. Of course, it is not enough to have the institutional framework, but it must be implemented and there must be control mechanisms to confirm it…' (R9)*

- EU & national support

In light of the ongoing climate crisis and the European Green Deal's objective of achieving climate neutrality by 2050, it is of paramount importance that agri-food enterprises align themselves with this goal. The parallel increase in the world population calls for the agri-food sector to increase its production in the coming years in order to ensure food security. It is of the utmost importance that the increase in production is achieved through environmentally friendly practices, such as the prudent and sustainable management of resources and the reduction of energy and water consumption. This will ensure the sufficiency and quality of the product and protect the environment. The adoption of new technologies is key to achieving these objectives. The green and digital transition of the agri-food sector requires cooperation between the EU and the state to provide appropriate financial support.

> *'... The Common Agricultural Policy (CAP) represents the primary European policy initiative for the agri-food sector. In order to advance sustainability and environmental protection, the CAP should provide subsidies and funding for practices that promote these objectives…. The CAP and Rural Development Programmes place great emphasis on the role of investment in new technologies and agricultural innovations in facilitating the transition to a more digitised agricultural sector..' (R1)*

It is evident that each state must adapt European policies to its own needs and develop national action plans.

> *'… Careful planning and strategy are needed at national level, in line with the new CAP and green growth. So we will slowly move forward with careful steps towards innovative products, new technologies, innovation, and intelligent agriculture.' (R8)*

> *'… Two major regions of Greece (Macedonia and Peloponnese) are going to face significant challenges due to the closure of all lignite plants by 2030. In this direction, the Just Transition Programme has been created to support these regions through very high aid rates for green, digital, and just transition-oriented investments.' (R5)*

All global crises to date have had a significant impact on societies. The pandemic crisis, in particular, has compelled countries across the globe to accelerate the green and digital transformation of enterprises, with the aim of ensuring their long-term sustainability and competitiveness.

> *'... In the midst of a pandemic, the Recovery and Resilience Fund (RRF) was established a a pivotal financial instrument.... for the implementation of investments in the agri-food sector with a focus on green and digital transformation...' (R4)*

However, many times the financing environment for a prospective investor or entrepreneur of an agri-food enterprise is not friendly.

> *'It is recommended that the Greek state facilitate entrepreneurship by providing subsidies and loans for the implementation of sustainable practices and the development of digital infrastructure. It is unfortunate that many entrepreneurs encounter difficulties in accessing bank loans due to the high interest rates or the requirement of excessive collateral. This highlights the challenging financing environment that entrepreneurs face... There are a lot of delays in payments...' (R13)*

- Educational background

The fact that we are at the beginning of a very large and rapid transition means that it is important to implement a continuous programme of education and retraining for farmers-entrepreneurs so that they are able to meet the challenges of this transition and remain competitive at the international level.

> *'...it is essential to link research with application in the production process. University curricula need to be updated and vocational training programmes for farmers and retraining increased'. (R1)*

> *'...strengthen the Young Farmers Programme so that more young people can join it, be trained in new farming practices and technologies and be able to participate in networks sharing knowledge and experience that promote the sustainable and digital development of the agri-food sector'. (R6)*

It is essential to ensure that this knowledge is kept up to date, which is a key aspect of lifelong learning.

'It is my opinion that farmers should engage in lifelong education and training in order to remain informed about new farming practices and modern production processes. This is essential for the sustainability of both production and the enterprise...' (R9). The integration of precision farming, for example, into the daily operations of agri-food entrepreneurs represents a significant challenge, given the constant emergence of new technological developments.

> *'... Modern production demands specialized knowledge and a highly skilled workforce. The transition to a new technological era necessitates up-skilling, re-skilling, and continuous education of human resources, with a focus on enhancing digital and green skills. Implementing effective human resource policies is crucial to ensure the creation of quality jobs in agri-food enterprises...' (R8)*

> *'....producers should seek education and specialisation, which presents a challenge for us as well as for ourselves, who prepare the background they need to know. There are fast-track specialised seminars, public schools, in cooperation with institutions such as the Regions, which cover a significant number of the current issues and challenges of the future...' (R2)*

6. Discussion

This research examines the challenges faced by agri-food enterprises in Greece in adopting green and digital practices in a constrained framework characterized by ongoing crises and climate change. Despite significant obstacles, the green and digital transition of the agri-food sector is necessary and, with the coherent European and national policies, will be possible. To facilitate this transition, governments, regional and local authorities must work together to develop a favourable institutional framework that support this twin transition. The current system suffers from dysfunctionality and excessive bureaucracy, hindering agri-food enterprises from pursuing innovative and further environmentally friendly development paths. This is in line with other previous research, like Liargovas et al (2017), Slätmo (2019), Apostolopoulos et al (2021), and Makris et al (2024). We emphasize the need to revise the institutional framework to better align environmental policies with the needs of the agricultural community. This is crucial with the upcoming European performance certification procedures for agri-food enterprises, requiring adherence to ESG criteria (Jónsdóttir & Gísladóttir, 2023). Additionally, our research indicates that it is essential to implement and monitor the institutional framework

through robust control mechanisms, to ensure compliance with the extra environmental standards (Saviolidis et al, 2020).

Concurrently, the implementation of financial incentives and the provision of financial instruments can facilitate the alleviation of economic constraints (Patsoulis et al, 2022). Our study highlights financial instruments in support of digital practices in agri-food enterprises. Despite available funding for environmental initiatives, they have not led to significant changes. De Schutter et al. (2020) suggested that the EU can provide financial support through the CAP, but support strategies are not comprehensive. Large producers receive priority, leading to issues in sustainable land management. Very small to medium-sized agri-food enterprises face difficulties in accessing subsidies due to the strict eligibility criteria in place. Overcoming technological barriers requires investment in education and training for farmers, as well as infrastructure development to support the adoption of new technologies. Research conducted by Ellis and Moarif (2015) indicated that enhancing education and up-skilling of entrepreneurs is of paramount importance for the cultivation of sustainable knowledge for green entrepreneurship in agriculture. Furthermore, it is vital to cultivate a green culture among citizens through information events, with the aim of increasing awareness of the polluting emissions associated with food production.

7. Conclusion

Our research contribution adds important insights to the literature on the emerging topic of the green and digital transition of the agri-food sector which is not only a technological or economic challenge but also a social challenge that requires the cooperation of all stakeholders. Incentives for this twin transition include policy measures to simplify procedures and reduce bureaucracy; financial support like subsidies, loans, tax exemptions; educational opportunities such us training, up-skilling and lifelong learning; and technological support for R&D and access to new technologies. The recent energy crisis has exploded the energy costs of agri-food enterprises prompting the search for alternative energy sources. The introduction of digital tools, automated systems and RES can increase the efficiency of crop and food production and reduce operating costs. In addition, social incentives to promote the circular economy and protect natural resources, are crucial. The coherent implementation of support policies can facilitate the twin transition, resulting in significant benefits for agri-food enterprises and contributing to their sustainability and environmental protection.

8. Limitations and Future Research

This research focused on the views of the policymakers regarding agri-food enterprises in Greece. Future research should involve cross-verifying data from agri-food entrepreneurs to ensure validity and take a holistic approach. It is important to understand how the sustainable practices will lead to a long-term viability and a resilient plan for the agri-food enterprises. Also, further research should include cross-country analysis taking into account the diverse cultural, socio-economic, and regulatory contexts.

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Private Enterprises and Innovative Interventions in Long-Term Care for Older People: Insights Into Residual Stereotypes of Greek Rural Areas

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Abstract: In many areas of rural Greece there exist remnants of traditional stereotypes that were socially constructed in closed societies where the institution of the patriarchal family previously reigned and are regenerated by the dominant culture. These stereotypes have shaped over time the perception that long-term care for older adults should be provided within the family structure and exclusively by family members. Notably, it was previously considered a disgrace in Greek rural society if children moved their parents to a residential or nursing home. Public or other care facilities for older people emerged just two decades ago, except a few led by the church. However, these attitudes have been softened in recent years. European and National funded programmes have shaped different notions towards long-term care in these areas. This was facilitated by the structural changes that occurred in the Greek countryside in combination with the existing low birth rate in these areas and the presence of concrete migratory flows. The present study explores the business environment that is being formed and its potential to unleash the productive forces that have pinned down the relevant residual stereotypes. It also examines the socio-economic impact of the above enterprises on rural areas. Qualitative interviews were conducted with eight entrepreneurs who have invested in rural long-term care settings for older persons and eight elected chairpersons of local councils. Our findings indicate that regardless of financial support towards private care entities for older people, in order for the services offered to take a more prominent social role, the development of local consensus and innovative interventions is required in tandem. If achieved, such care providers can contribute to the socio-economic development of rural areas. This study provides international literature with further evidence on the crucial role of such enterprises on supportiveness towards inhabitants' quality of life improvement while results can be useful for Greek and European decision-making centers as well as potential rural entrepreneurs.

Keywords: Entrepreneurship, Long-term care, Older people, Rural areas, Stereotypes

1. Introduction

One of the most crucial issues globally at the moment from various point of views is the ageing of the population. It is also the main reason for the problematic demography of many developed societies (Rudnicka et al, 2020). European populations are ageing rapidly compared to other regions worldwide (Grundy et al, 2017), a situation most pronounced in Greece (Camarero et al, 2019). The percentage of the Greek population aged 65 or over is expected to increase during the next decades (Kollia et al, 2018). The result of this, in the context of rural depopulationis leading to failures in the provision of certain services (Anastasiou et al, 2021). Considering that the biggest share of older adults is settled in countryside villages, most living alone (Kouvatsou et al, 2020), the need for care services is only going to increase (Jakovljevic et al, 2021). In this regard, the large percentage of population ageing in the non-metropolitan areas is related with significant social inequalities and exclusion, high number of single-person households and increasing health and care needs, with consequences for the rural residents' welfare and quality of life (Babatsikou et al, 2017). This situation exacerbates health inequalities between older residents of rural areas and their urban counterparts (Apostolopoulos et al, 2020). Meanwhile, changes in the average Greek family structure attributed to increasingly complex family attributes and new living standards (Anastasiou and Duquenne, 2020), are significantly increasing the demand for care services, moreso than other EU countries (Jakovljevic et al, 2021; Karagiannaki, 2005). The major trends in the above context significantly impact the rural long-term care sector, largely due to the fact that most care providers for older people operate near to urban centres (Prouskas et al, 2021). Despite the existing challenges of rural environment, all demographic statistical rates reveal that long-term care facilities will inevitably need to be developed more in the future. Across Europe, long-term care services are mostly offered to older populations through a combination of public and private entities and certain non-profit organizations (European Commission, 2021). The major differences between Northern and Southern EU countries as far as formal and informal care for older persons in terms of family and friends catalytic role and its contribution to the coverage

of the needs for care related to older adults (Lyberaki and Tinios, 2018). Concurrently, rural regions of Greece are characterized by fewer entrepreneurial opportunities (Thomakis et al, 2022), inadequate healthcare access (Anastasiou, 2020), low quality of public healthcare provision (Apostolopoulos et al, 2022), limited access to high-skilled workforce (Vlachou et al, 2021), problematic rural economy (Papadopoulos et al, 2019) and barriers to many others dimensions of rural development. The latter are mostly related to the high level of sovereign debt, consequences of the financial crisis 2009 and austerity policies imposed by the government (Apostolopoulos et al, 2019). In this respect, healthcare and entrepreneurship have been found to enhance rural development (Khalid et al, 2021) and strengthening rural community resilience (Farmer and Kilpatrick, 2009). Finally, as a result of the Covid-19 pandemic, more challenges have emerged for Greek non-metropolitan areas in this crucial sector, with one of the lowest resident-to-bed ratios with regard to long-term care in the EU (European Commission 2021).

This study examines the extent to which the existing long-term healthcare provision in rural Greece are ready to meet the ever-increasing demand for care services towards older adults. In doing so, it will consider the role of stereotypes, the impact of European funds and the potential value of relevant private care providers in supporting rural socio-economic development. In addition to the above goals, it seeks to explore the innovative practices implemented by enterprises in this sector.

2. The Greek Rural Long-Term Care Field

In Greece, the demand for long-term care services for older people exceeds the supply (European Commission, 2018). The institutionalized system of long-term care for the older adults is fragmented and responsibilities are distributed among many institutions including the Ministry of Health, social welfare, insurance organizations and local self-administrative authorities. Most of the existing rural long-term healthcare facilities for older people are the result of European financial programs. Over previous decades there has been a transformation of rural Greece through modernizing the past reliance on anagricultural economy (Kizos, 2018). However, they continue to be characterized by a small and ageing population due to youth outmigration to urban areasexacerbated by the low quality of living conditions in rural settlements (Kotsamanis, 1990). However, based on recent resettlement of economic migrants, the characteristics of Greek rural territories are changing, thus solving the problem of human resources faced by many established rural businesses (Anastasiou et al, 2021). These changes have created a new environment with business opportunities that are not only oriented to the primary or secondary sector but also to the tertiary sector (Lambrinidis, 2004). In addition, the above-mentioned process has been greatly helped by the transport networks, telecommunications and internet networks as well as by the digital transition systems that have expanded in rural areas and created business opportunities (Townsend et al, 2013). Certain greek rural health providers such as rehabilitation & recovery centers as well as medical diagnostic centers utilised the technological dynamics in the field towards open innovation practices (Apostolopoulos, Makris, and Stavroyiannis, 2023)

The case of older adults is indicative of the extended changes taking place in rural areas. Families in rural Greece retain patriarchal characteristics, including the obligation of children to take care of their older parents themselves, in their own homes. It was considered a disgrace in Greek rural society as well as in other societies of Southern Europe (Jakovljevic et al, 2021) if children removed their parents to a nursing home. Moreover, only the church provided such care in rural areas.

3. Methodological Approach

3.1 Methods and Materials

Semi-structured qualitative interviews were conducted (Paunović et al, 2024) with eight business owners/COOs of relevant enterprises active in the field and eight elected chairpersons of local councils. Interview topic guides focused ontheir views and experiences as regards the current status of long-term care in rural Greece, its evolution in relation to the addressing of stereotypes, the respective impact of those enterprises in socio-economic development, and the influence of EU funding. The research team adopted a combination of convenience and purposive sampling in order to recruit relevant participants (Gregory and Austin, 2020). Respondents were based throughout Greece, with a focus on rural locations.

Table 1 : Description of the study sample

R	Status	Characteristics
R1	Entrepreneur	Private nursing home
R2	Entrepreneur	Private residential care home
R3	Entrepreneur	Care services for older persons
R4	Entrepreneur	Private nursing home
R5	Entrepreneur	Private residential care home
R6	Entrepreneur	Private residential care home
R7	Entrepreneur	Private nursing home
R8	Entrepreneur	Care services for older persons
R9	Elected chairperson of local councils.	Mountain community of the Peloponnese Region
R10	Elected chairperson of local councils.	Mountain community of the Region of Western Greece
R11	Elected chairperson of local councils.	Mountain community of the Region of Epirus
R12	Elected chairperson of local councils.	Mountain community of the Region of Thessaly
R13	Elected chairperson of local councils.	Mountain community of the Region of Western Macedonia
R14	Elected chairperson of local councils.	Mountain community of the Region of Macedonia
R15	Elected chairperson of local councils.	Mountain community of the Region of Sterea Ellada
R16	Elected chairperson of local councils.	Mountain community of the Region of Eastern Macedonia and Thraki

3.2 Data Analysis

At first, the semi-structured interviews were analysed separately, followed byan inductive approach using a comparison strategy (Yin,1994). Subsequently, emerging themes and sub-themes were identified, respectively (Gioia et al, 2013). The coding and category creation (Table 2) were captured in detail (Krippendorff, 2018). In order to facilitate comparisons between sections (Strauss and Corbin, 1990) there was a percentage weighting by the coding group of agreement or disagreement (Hayes & Krippendorff, 2007).

Table 2 : Emergent themes and sub-themes.

Theme	Sub-theme	Highlights
Predominant rural perceptions of long-term care entrepreneurship	Residual stereotypes Migrant informal caregivers Care for older people provided by church institutions Care for older people provided by public facilities Care for older people provided by private companies	Past stereotypes have been mitigated without being eliminated Informal migrant caregivers of older people largely meet existing needs in rural areas There exist several church-based care settings for older people Public and municipal bodies provide care at home for older people Private rural care enterprises for older people have found a fertile ground for growth
Private entrepreneurship in long-term care & rural civil society	Information and communication channels Social consensus The role of local elected officials	Lack of information Social consensus is crucial for the development of long-term care entrepreneurship The role of local elected chairpersons is vital.
The impact of long-term care enterprises in rural areas	Socio-economic challenges Unleashing productive forces Quality of life of older adults	Socio-economic development Reducing the impact of stigma Improving older people's living conditions Participation of family members involved in eldercare within the operational process

Theme	Sub-theme	Highlights
Innovative interventions by long-term care providers	Innovative services in home care for older people Innovative interventions in the facilities of long-term care enterprises	Serving the older adults Quality of life Improving user experiences

4. Findings

The findings were grouped on the four themes identified in Table 2: Predominant rural perceptions of long-term care entrepreneurship, Private entrepreneurship in long-term care and rural civil society, The impact of long-term care enterprises in rural areas and Innovative interventions by long-term care providers.

- Predominant rural perceptions of long-term care entrepreneurship

Respondents perceived that the stereotypes that the older adults should be cared for exclusively in the home by a family member have been significantly eroded. As a phenomenon it continues to exist to a limited extent.

> *"A lot have changed in the villages. The rationale logic that a family member, usually the woman, would devote part of her life to caring for older individuals in the family has to some extent been overcome. The search for alternatives is a real issue".R4*

For some years, women migrants largely solved the problem of caring for older people in the countryside, for a fee, while also contributing to the mitigation of stereotypes. However, the number of migrant women caring for older persons was seen to bedecreasing and as a result, searching for alternatives leads people to the private care providers.

> *"Migrant women have largely solved the problem of care for older adults. But in recent years the number of women migrants in villages has been decreasing and this is where the difficulties begin." R10*

The church operates care facilities, but usually for poor people without family. Such facilities, however, cover a limited part of the overall needs.

> *“There are church facilities where older people without family usually go. Some of those structures however, require high fees for the hospitality.” R15*

Local government has developed specialized services to support older people in the countryside. However, they are rather limited and cannot address the whole problem.

> *“There are programs such as Care at Home which are important for older people and offer services free of charge. However, they cover limited needs and as a result, they do not solve the problem.” R13*

More and more care enterprises are operated in the countryside to meet existing needs. However, these are usually located close to urban centres.

> *"In recent years many such private facilities are being established in rural areas close to urban centers. Some the children of some older people from our village have taken their parents there." R9*

- Private long-term care entrepreneurship and rural civil society

Local rural society lacks information about the services offered by long-term care enterprises.

> *"As local council chairs we do not have any information from long-term care businesses, nor do we know much about the services they offer." R16*

Long-term care businesses for older people, do not have the appropriate channels of communication and information with local communities, creating barriers towards a wider social consensus.

> *"We don't interfere with families on how to care for their older adults. We only support the public facilities offered. I would not recommend that someone take their older person to a private long-term care facility because I know little about them." R12*

Informing local communities through elected local councils present a major gap that long-term care businesses need to fill.

"The role of local chairs is crucial but to date we have not developed a channel of communication and information with them." R1

- The impact of long-term care businesses in rural areas

Long-term care businesses for older people were perceived to contribute to the socio-economic development of rural areas. They create jobs and income.

"Long-term care enterprises, apart from the better quality of life they provide to older people, they also contribute to the economic development of the region, adding value to the local community and creating jobs." R7

Their operation was perceived to alleviate the stereotype that care of the older persons should be carried out exclusively within the home by a family member and frees up family productive resources.

"More and more families are turning to us to meet their needs for the care of their older family members." R3

Long-term care businesses create quality of life for older rural residents.

"Older people need quality care services. We provide them with that, through our structures and the scientific support we provide." R1

- Innovative interventions by long-term care enterprises

For long-term care businesses to provide reliable services to older people either in their homes or in their own facilities, they have developed and provide specialized, innovative services.

"As we are talking about seniors that their families trust them to us, this requires innovative interventions in both quality service and communication. It certainly enhances user experiences" R5

The quality of life of older people by private long-term care organisations is reported to be achieved by the development of innovative services (based mostly on the establishment of cutting-edge technology)

''We established smart devices per room that help older adults towards managing lights, adjusting curtains etc." R6

"We have invested in innovation. Innovative services lead to a better quality of life for older people. People have demands. They don't easily compromise if we don't offer them innovative services. We have invested in modern equipment such as smart beds and ward layouts as well as in digital intercom systems and sophisticated means of transport." R8

5. Discussion

Our findings indicate that the stereotypes in rural areas of Greece, whereby the care of older people was supposed to be carried out exclusively by family members at home, have been significantly mitigated, but not eliminated. This is mainly due to the migration of young people from the countryside to urban centres, leaving the rural areas predominantly inhabited by older people. This evolution has led to carefor older people being undertaken largely by migrant women for a fee. However, when there was a shortage of migrants, alternatives were sought, involving private care providers. On top of that, public facilities and church institutions in rural areas are very limited, while the latter often appeared to be a substitute for public sector services (Pöyhönen and Seppänen, 2016). Despite taking advantage of European resources, the long-term care services owned by local government, are unable to tackle the problem in its entirety. Searching for relevant findings in the international literature, the existence of stereotypes towards rural care of the older adults was identified in many other countries as well (Jakovljevic et al, 2021; Okoye and Obikeze, 2005). Stereotypes characterise the perceptions among specific social groups within different types of settlements (Frydrychová et al, 2017; Palacios et al, 2009). The inability of public organisations to cover the care of the rural older population is also observed in other countries (Knapik, 2020). Hence, the provision of rural care for older people by immigrants is not a Greek phenomenon (Zechner, 2008). What the present research has demonstrated as regards the distinguishing feature of greek rural long-term care (for older people) from other countries is the increasing tendency to create private care homes in rural areas, close to urban centres, when in many countries the deinstitutionalisation of care for older people is constantly being strengthened (Herron et al, 2021; Anttonen and Karsio, 2016).

Additionally, the present study indicates the increased need for long-term care of older people in the Greek countryside and the lack of information on the range of services offered by private care providers. This

information deficit creates an obstacle to the formation of a broader social consensus. Specifically, it was highlighted that the availability of private care establishments for the older adults in rural areas is not sufficient, and can be constrained by local culture. Similar findings in the international literature reveal that care providers for older people need to comprehend the various aspects of stereotypes (Nemmers, 2005). They also need to understand local contexts and address stereotypes of rurality through social consensus (Manthorpe et al, 2005).

Finally, the research indicates that private long-term care enterprises for older people in rural Greece contribute to the socio-economic development of areas, create jobs, reduce stereotypes and promote older people's quality of life. Similar findings were detected in the international literature. Research by Hjaltadóttir and Gústafsdóttir (2007) showed that older individuals who receive long-term care feel safe and experience quality in their lives and this crucial factor adds value to a threadbare world that retains its humanity. It is evident that private long term care enterprises create jobs (Torpey, 2011) and enhance socio-economic development (Brown Wilson, 2009). Subsequently, our study highlights that private rural long-term care providers for older people offer reliable and innovative services either at home or within care home services. The improved quality of life of older people is due to the innovative services delivered by private rural long-term care enterprises, and specifically their innovative living settings. They have also placed emphasis on improving their organisational environment by leveraging advanced technologies. We identified similar findings in the international literature. Research by André et al (2014) showed that improving the organizational environment creates quality characteristics in the field. Innovative interventions in improving the social context and providing human-centred care (Loria et al, 2024) for older adults play a significant role in quality of life (Fleming et al, 2014), with the same applying to innovative living arrangements (Adams et al, 2017). Lastly, it was observed that some care providers have developed collaborations with medical doctors in the field of home telehealth services (Frishammar et al, 2023).

6. Conclusions

This study has shown that the rural Greek culture of a family member caring for older people in the home has been mitigated, but not eliminated. The outmigration of young people from the Greek countryside, as well as the arrival of foreign migrants and funded programmes have suppored the long-term care of older people. In parallel, it was revealed that the increased needs for long-term care of the older adults in rural Greece have created a trend towards the establishment of many relevant facilities offering care home services, while in many other countries the deinstitutionalization of this care is constantly being strengthened. This study also indicates that national or European financial support for private enterprises operating in the field is not sufficient, and further social consensus and innovative interventions are needed in order to be appreciated by local communities who seek to overcome the stereotypes in rural Greece.

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Perception of Gen Y and Z on Bank's Financial Performance: Exploring Managerial Capabilities and Digital Innovation

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Abstract: The inception of digitalization has transformed many organizations. Presently, personal and professional lives are difficult to fathom without the utilisation of digital technologies. For organisations, digital innovation has brought up several opportunities. While most of the previous research considers how digital innovation affected worker productivity, and business performance and emphasised the massive deployment of digital technologies, little research assesses the factors influencing digital innovation. To fill this gap, this study aims to explore the impact of managerial social capital and managerial human capital on digital innovation, and the intervening impact of digital innovation on the connection between firm performance and managerial social capital as well as managerial human capital. To achieve this, 728 bankers in Ghana were conveniently sampled and the structural equation modelling in the PLS approach was utilized to analyse the data. The results showed that managerial social capital and managerial human capital have a substantial impact on digital innovation. Most significantly, digital innovation emerged as a favourable mediator on the managerial social capital and perceived performance affiliation, and the managerial social capital and expected performance connection. The findings urge managers and policymakers to combine the efforts of managerial social capital and digital innovation to increase the performance of banks as digital innovation has become a necessity in today's dynamic and digital era.

Keywords: Digital innovation, Bank performance, Managerial social capital, Managerial human capital, Gen Y and Z

1. Introduction

Due to the intense competition of today, shifts in consumer preferences and satisfaction, and profound advancements in digital technologies, businesses are engaging in initiatives that will strengthen their competitive advantage, support their expansion, and ensure their survival. This means that in this dynamic, organisations must be inventive, efficient, and productive. Organisations' efforts to achieve this led to the development of digital innovation (DI). According to many, DI is the strategy shift that elevates an organisation and improves performance (Wang, Guo and Zhang, 2023; Le and Ikram, 2022; Migdadi, 2022). From the perspective of Nambisan et al (2017), it refers to the degree of integration of digital technology in various advancements. Nambisan et al (2017) and Nylén and Holmström (2015) suggest DI can improve the design, control, and improvement of products, services, and processes. Performance is ultimately the result of process, service, and product design, control, and improvement. Hence, organisations trying to innovate digitally need to develop new managerial competencies. According to earlier research, one important predictor of a strategic shift is dynamic managerial capabilities (Matarazzo et al, 2021; Adner and Helfat, 2003). There is, however, a dearth of literature on how dynamic managerial capabilities affect DI, particularly in the banking sector where digital technology has been widely used over the years. Digital banking, as a strategic shift, is too important to ignore given its significant influence on the non-financial and financial performance of banks (Diener and Špaček, 2021; Lim et al, 2019).

The dynamic capability approach (Teece, Pisano and Shuen, 1997; Teece, 2007) emerged from the resource-based view and focuses on how companies sustain and expand their competitive advantage. That is the ability of businesses to develop, bring together, and rearrange both external and internal competencies in reaction to a rapidly changing environment (Teece et al, 1997). Being able to manage dynamically is vital since it keeps organisations running smoothly. Managers have a critical role in business performance and strategic change; creating and identifying new opportunities (Huy and Zott, 2018; Helfat and Martin, 2015). Dynamic managerial capabilities originate from the fundamental managerial resources of managerial cognition (MC), managerial social capital (MSC), and managerial human capital (MHC) (Adner and Helfat, 2003). These resources serve as the foundation for the patterned components of managerial intentionality, contemplation, decision-making, and action (Martin, 2011). As a result, the study concentrates on MSC and MHC, highlighting the elements of the

extensive literature on these managerial resources as well as the dynamic qualities that enable managers to implement strategic change.

Organisational performance, according to Otley (1999), is the analysis of an organization's performance concerning its goals and objectives. In other words, an organization's performance serves as a barometer for its growth and development as it shows how well a business is accomplishing its goals. Based on previous research, some of the well-established measures of organisational performance in the literature are financial, learning and growth, safety, quality, information technology, communities of practice innovation and work-life quality and employee and customer satisfaction (see Paliszkiewicz, Gołuchowski and Koohang, 2015). The expected and perceived financial performance is the main emphasis of this investigation. The rationale is that earlier research has focused on how social capital, entrepreneurship, and leadership in general affect business performance (Schmid and Sender, 2019; Tata and Prasad, 2015; Zehir et al, 2011). Nevertheless, we are not aware of any research that examines the impact of dynamic managerial capacity variables on company performance. Furthermore, there exists numerous of research on business performance. However, breaking down performance into more focused metrics helps managers and organisations understand which factors to consider when utilising dynamic managerial capabilities. Thus, the purpose of this study is to investigate how MSC and MHC affect both expected (PPE) and perceived financial performance (PPP). Consequently, the mediation role of digital innovation on the affiliations are examined.

2. Literature Review

2.1 Managerial Human Capital, Managerial Social Capital, and Digital Innovation

Digital technology's wide-ranging effects have led to a fundamental restructuring of entire industries, as it becomes more and more required to satisfy commercial objectives. Furthermore, recent studies have demonstrated the enormous and unpredictable potential that digital technologies present for the creation of unique products and services (Nylén, and Holmström, 2015). This has increased the bar for technological advancements in all economic areas. Due to customers' changing views on satisfaction, traditional company practices have experienced an unprecedented transformation to meet the new requirements of customer experience. Managers' interest in mastering digital innovation is growing, as the COVID-19 pandemic also revealed the shortcomings of traditional methods for creating novel goods and services. To sustain and enhance the company's competitive edge and overall performance, managers have a fundamental responsibility to revitalise and enhance the company's resource base. Managers must begin their businesses, develop their leadership skills, and widen their social networks to do this.

The educational backgrounds, work experiences, and interpersonal interactions of managers comprise managerial human capital in terms of skills and knowledge (Kor and Mesko, 2013). According to Helfat and Martin (2015), managers can benefit from this kind of capital by using it to reorganise the resource base and recognise and take advantage of opportunities and hazards. The diversity and level of growth of managers' skill sets vary (Adner and Helfat, 2003). Nonetheless, managers have access to resources and information because of the goodwill that arises from their formal and informal interactions with others (Ambrosini and Altintas, 2019; Helfat and Martin, 2015). We call this managerial social capital. Adner and Helfat (2003) assert that managers can gain insights from both formal and informal work connections that may enable them to identify new opportunities. Because the banking industry is so interwoven with all other economic sectors, it stands to gain from having a wider social network, helping them gain access to information and resources (Adler and Kwon, 2002). This can help with environmental scanning and subsequent opportunity discovery.

One kind of strategic change that gains from managerial human and social capital is digital innovation. For example, research indicates that when senior managers have more external relationships, organisations purchase more strategy transformation items (Helfat and Martin, 2015). In a similar line, Maritan (2001) found that to carry out the strategic transformation, strong leadership was required to supervise the beginning of investments in new competencies and resources and to be in touch with business unit managers. According to earlier studies, social capital fosters the growth of creative and competitive capacities by making up for the lack of resources required to establish organisational routines (Hughes et al., 2014; Agarwal and Selen, 2013). Based on the inference above, the following hypotheses were formulated:

$H1_a$: MHC positively impacts DI.

$H1_b$: MSC positively impacts DI.

2.2 Managerial Human Capital, Managerial Social Capital, and Financial Performance

Prior literature hypothesized that there is no direct influence of MHC and MSC on firm performance and the results validate those entrepreneurial skills, the second dimension of MHC directly do not influence firm performance (Heubeck, 2023). Nonetheless, the foundation of managerial capabilities lies in managers' capacities to grow, diversify, and modify their companies' revenue streams. This ability sheds light on the relationship between organisational performance, strategic change, and the calibre of managerial decisions (Adner and Helfat, 2003). In summary, the concept distinctly links fluctuations in company performance during periods of transition to fluctuations in management aptitude (Helfat and Martin, 2015). Bertrand and Schoar (2003) found that manager fixed effects were major predictors of business performance as well as corporate investment programmes, diversification, and acquisitions—factors that were conducive to strategic change. Martin (2011a) found evidence of dynamic managerial capabilities: financial performance, new product launches, business unit creation, and resource reconfiguration were all impacted by multi-business teams, which were composed of senior executive leaders of business units.

From a wider angle, research on entrepreneurship has shown a direct correlation between MHC and MSC and the survival and performance of businesses. Additionally, it is discovered that two MHC characteristics that affect business success are leadership and entrepreneurial talents. For example, a study by Zehir et al (2011) shows a strong and positive correlation between company operational success and leadership. The study's conclusions showed how entrepreneurial leadership abilities affect business performance. Moreover, research to date supports a strong and positive correlation between social capital and business performance (Schmid and Sender, 2019; Tata and Prasad, 2015). Based on the above inference, the following hypotheses were formulated:

$H2_a$: MHC impacts expected performance (PPE) positively.

$H2_b$: MHC impacts perceived performance (PPP) positively.

$H2_c$: MHS impacts PPE positively.

$H2_d$: MHS impacts PPP positively.

2.3 The Intervening Role of Digital Innovation

According to preliminary studies, DI boosts some performance indicators for a business, including net profit margin, customer happiness, sales growth, profitability, and overall performance (Wang et al, 2023; Le and Ikram, 2022; Hanelt et al, 2021). Numerous literary has also recognised the impact of DI on society at large. One of its main effects, especially in the financial sector, is its ability to encourage a cashless economy (Mohd Thas Thaker et al, 2023). However, it has improved client services, engagement, accessibility, and experience. Most academics concur that DI is crucial. Furthermore, the study of Guo et al (2022) demonstrated the mediating role that value creation and value capture innovation play in the beneficial relationship between value proposition innovation and digital start-up performance. Also, Migdadi (2022) sampled manufacturing companies to present a unified framework that integrates knowledge management processes (KMP), innovation capability (IC), and organisational performance (OP). Additionally, the study tested the effects of KMP on IC, IC's effect on OP, and KMP's impact on OP via IC as the mediator. The findings show that KMP affects an organization's ability to innovate in the areas of marketing, processes, products, and operations. IC also affect the financial, operational, and product quality aspects of an OP. Lastly, IC acts as a mediator in KMP and has an impact on OP. This research corroborates the notion that digital innovation affects organisational effectiveness.

Currently, DI is a strategic instrument that helps businesses survive and become more competitive. The managers who are driving forces through their MSC and MHC will decide whether to accept and adopt it. Previous research, considering the issue under investigation indicates that the association between entrepreneurial skills and company performance is mediated by digital business model transition. Nevertheless, no research has examined the mediating role that digital innovation plays, particularly in the banking environment, between the two variables of dynamic managerial capabilities and company performance. Accordingly, the research indicates that DI has a higher probability of mediating the link between MSC and company performance as well as the relationship between MHC and firm performance. Therefore, the following hypotheses emerged:

$H3_a$: DI favourably impacts PPE.

$H3_b$: DI favourably impacts PPP.

$H3_c$: The impact of MHC on PPE is mediated by DI.

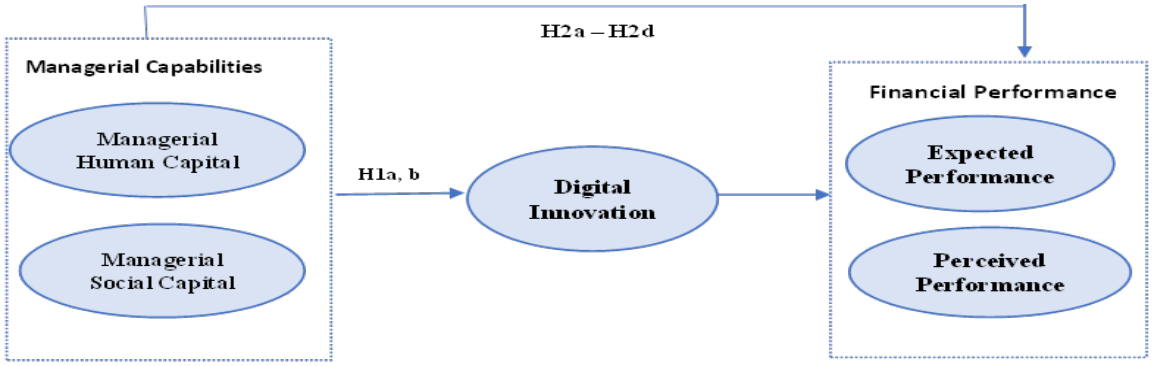
$H3_d$: The impact of MHC on PPP is mediated by DI.

$H3_e$: The impact of MSC on PPE is mediated by DI.

$H3_f$: The impact of MSC on PPP is mediated by DI.

2.4 Conceptual Framework Development

While the direct relationship between DI and firm performance is well-established in prior studies, the direct effects of MHC and MSC on firm performance have only received partial attention. Consequently, this study implies that digital innovation has a mediating effect on the subsequent affiliation, as illustrated in Figure 1 below. Stated differently, DI serves as a conduit for the beneficial outcomes of MSC and MHC, which in turn improves business performance.



Source: Authors' research.

Figure 1: Conceptual framework

3. Research Methodology

3.1 Measurement, Sampling, and Data Collection

Applying the quantitative technique, emphasizing data gathered from bankers in Ghana, allowed the research to achieve its goal. The researchers used the inverse square root approach and statistical power analysis to estimate an adequate sample size because the overall number of the targeted population was unknown. The research employed purposive sampling and convenience sample approaches to facilitate the identification of qualified participants for the investigation. To gather the data for the study, A questionnaire with a range of 1-5 was created. Every question on the questionnaire was adapted from earlier studies. While MHC and MSC were measured using 10 and 12 items adapted from Heubeck and Meckl (2022), DI measured with nine items developed by Sanders Jones and Linderman (2014). Further, firm performance was evaluated utilizing ten items adapted from Cazacu et al (2023). 728 respondents between the ages of 18 and 44 made up the analysis. The first step was analysing the respondents' demographic data using percentages and frequencies. Men made up 441 of the total participants, with women making up the remaining. More than half of the participants were between the age of 20–29. Over half of the participants had a bachelor's degree. While 309 respondents had master's degrees, 61 respondents, representing 8.38 per cent had PhD. Also, while about 88 per cent of the respondents have 5-10 years of working experience, 68 respondents have worked between 11-19 years and the rest had 16^+ years of working experience.

3.2 Data Analysis

According to Hair et al (2017), partial least squares structural equation modelling (PLS-SEM) valuation is a highly adaptable technique based on the iteration of PLS regressions. As a result, we examined the assumptions using partial least square structural equation modelling (PLS-SEM). A multitude of papers attest to the PLS-SEM's acceptance in management research and its appropriateness for sophisticated and simple models. Furthermore, PLS-SEM offers several ways to assess the reliability and validity of a scale (Hair et al, 2017). The measurement and the structural model were investigated using the SmartPLS software. To determine whether each item was acceptable, tests for discriminant and convergent validity as well as reliability were performed. Finally, we used the PLS bootstrapping approach to verify the validity of our suggested assumptions. The study used a 95 per cent confidence interval to determine the significance level for the significant paths. This meant that a relationship was considered negligible if the T-statistic was less than 1.98 or the P-value was greater than 0.05.

4. Results and Discussion

4.1 Reliability, Convergent and Discriminant Validity Analysis

Before proceeding with the structural model analysis, it is imperative to assess the measurement model, encompassing validity and reliability. Table 1 shows that all average variance extracted (AVE) and composite reliability (CR) values above the predetermined thresholds of 0.50 and 0.709, respectively, indicate the achievement of convergent validity and reliability (Hair et al, 2017; Fornell & Larcker, 1981). The Fornell-Larcker criterion was utilised to assess discriminant validity, it is commonly recognised by empirical research. Table 3 shows the square root of the AVE for each variable. These values imply adequate discriminant validity because they are higher than the variables' highest correlation with other variables.

Table 1: Measurement of convergent validity and reliability

Variables	Proxy	CR	AVE
Digital Innovation	DI	0.923	0.668
MHEntreprenuer	MHE	0.917	0.737
MHLeadership	MHL	0.970	0.866
MSCognitive	MSCa	0.824	0.611
MSRelational	MSR	0.777	0.636
MSStructural	MSS	0.789	0.556
Pexpected	PPE	0.989	0.946
Pperceived	PPP	0.976	0.891

Source: Authors' analysis.

4.2 Evaluation of Quality Criteria

The study evaluated the predicted accuracy of its model using the R square and Q square. Table 3 displays the coefficient of determination (R2) for DI, PPE, and PPP, which are 0.530, 0.283, and 0.261 respectively. Because all R square statistics are above Cohen's (1988) recommended values for a significant level of 0.26, they demonstrate that the constructs have appropriate explanations. In addition, based on Hair et al (2017) thumb rule, the Q2 values of 0340, 0.262, and 0.227 for DI, PPE, and PPP, respectively, show that the predictive relevance of the model is good.

Table 2: Fornell-Larcker

	DI	*MHE*	*MHL*	*MSCa*	*MSR*	*MSS*	*MHC*	*MSC*	*PPE*	*PPP*
DI	0.817									
MHE	0.390	0.858								
MHL	0.489	0.807	0.930							
MSCa	0.723	0.429	0.496	0.782						
MSR	0.436	0.249	0.306	0.434	0.797					
MSS	0.460	0.388	0.367	0.505	0.379	0.746				
PPE	0.489	0.273	0.330	0.547	0.256	0.267	0.324	0.492	0.973	
PPP	0.475	0.253	0.292	0.506	0.251	0.278	0.291	0.471	0.904	0.944

Source: Authors' analysis.

4.3 Discussion

According to Generation Y and Z, the current study offers preliminary evidence that MSC and MHC greatly boost managers' capacity to engage in DI. Previous research has focused on the larger perspectives of social capital, entrepreneurial abilities, and leadership skills (Helfat and Martin, 2015; Hughes et al, 2014; Agarwal and Selen, 2013).

Table 3: Assessment of quality criteria

	R square	*Q square*
Digital innovation	0.530	0.340
Expected performance	0.283	0.262
Perceived performance	0.261	0.227

Source: Authors' analysis.

We suggested that MSC and MHC have a major impact on PPP and PPE concerning H2a–H2d. The outcome showed that MHC does not directly improve PPP (β=0.024; p<0.580) and PPE (β=0.055; p<0.198). This result aligns with the findings of Heubeck's (2023) study, which showed that MHC—leadership and entrepreneurial skills—does not directly correlate with organizational performance. Conversely, there is a positive correlation between MSC and PPE (β = 0.271; p<0.000), as well as a well-directed relationship with PPP (β = 0.259; p<0.000). From a broader viewpoint, social capital derived from social ties plays a significant role in the success of firms (Schmid and Sender, 2019; Tata and Prasad, 2015). This study assessed social capital from the perspective of dynamic capacities, and the findings are in line with Martin's (2011) study, which found that manager social relationships affected financial performance.

The relationship between DI and PPP (H3a) also turned out to be positive, with a coefficient value of 0.269 and a t-value of 4.906. The p-value of 0.000 indicates that there is a strong association between DI and PPE. Additionally, with an estimate of 0.277, the path from PPP to DI (H3b) shows a favourable and significant direct influence. A p-value of 0.000 validates the statistical significance, while the t-statistic of 5.190 indicates good dependability. Thus, there is substantial evidence to support the conclusion that DI positively and significantly influences Generation Y and Z's expectations and perceptions of banks' financial performance. Previous research, such as Wang et al (2023), Le and Ikram (2022), and Hanelt et al (2021) which found that DI significantly affects organisations' overall performance, supports these findings.

Table 4: Direct Effect

Hyp.	Path	Beta	Std. Dev.	T - Statistic	P-value	Decision
$H1_a$	MHC->DI	0.139	0.033	4.186	0.000	Accepted
$H1_b$	MSC->DI	0.646	0.029	22.473	0.000	Accepted
$H2_a$	MHC->PPE	0.055	0.043	1.289	0.198	Rejected
$H2_b$	MHC->PPP	0.024	0.043	0.554	0.580	Rejected
$H2_c$	MSC->PPE	0.271	0.057	4.746	0.000	Accepted
$H2_d$	MSC->PPP	0.259	0.057	4.585	0.000	Accepted
$H3_a$	DI->PPE	0.269	0.055	4.906	0.000	Accepted
$H3_b$	DI->PPP	0.277	0.053	5.190	0.000	Accepted

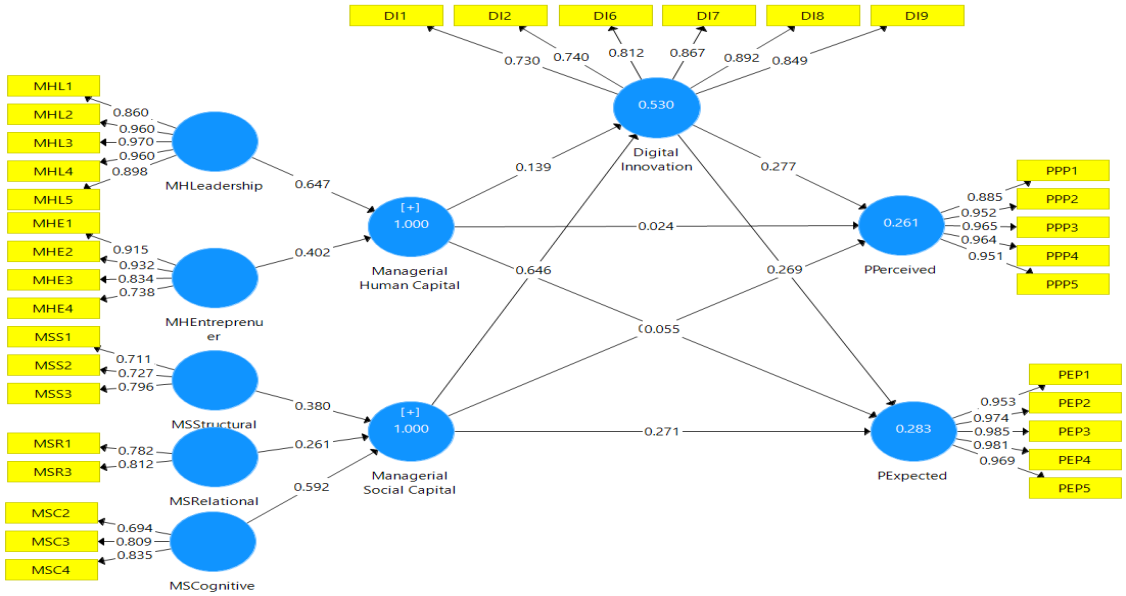
Source: Authors' analysis.

Finally, as indicated by Table 5 and Figure 2, an examination was carried out concerning the mediating role of DI with MHC, PPE (H3c), PPP (H3d), and the correlation between MSC and PPE (H3e) and MSC and PPP (H3f). The findings showed that there is a mediating effect of DI on the variables. As a mediating effect of DI, the results support the hypothesis that MHC has an indirect and substantial link with PPP (β=0.039; p<0.000) and PPE (β=0.037; p<0.002). This finding is noteworthy both conceptually and practically since it shows that MHC is only necessary to boost a bank's financial performance in the presence of digital innovation. These results support Heubeck's (2023) findings, which indicate an indirect relationship between MHC and business performance. According to Adner and Helfat (2003) and Helfat and Martin (2015), MHC improves performance through organisational strategy variables. This finding augment that claims. Likewise, with a t-value of 4.724 and a p-value of 0.000, the analysis validated a DI mediating association between MSC and PPE. Additionally supported (β=0.179; p<0.000) was the mediation relationship between MSC and PPP. As a result, DI becomes a significant mediating factor between managers' interpersonal relationships and business performance. The findings of this study indicate that the banking sector should continuously prioritise the adoption of digital technologies to enhance and innovate its processes, services, and goods to promote customer experience as well as organisational competitiveness, growth, and survival.

Table 5: Specific indirect effect

Path	Beta	Std. Dev.	T - Statistic	P-value	Decision
MHC->DI->PPE	0.037	0.012	3.047	0.002	Accepted
MHC->DI->PPP	0.039	0.012	3.140	0.002	Accepted
MSC->DI->PPE	0.173	0.037	4.724	0.000	Accepted
MSC->DI->PPP	0.179	0.036	4.959	0.000	Accepted

Source: Authors' analysis.



Source: Smart PLS bootstrapping output.

Figure 2: Structural model: direct and indirect paths

5. Conclusion

This study aimed to investigate the relationship between MSC, MHC, PPE, and PPP through the mediating role of DI. The survey comprised banking personnel from Ghana, a developing country. 728 people in total responded to the distributed survey. Choosing the respondents involved considering their generation cohort, they are the active members of the working population. Using the SmartPLS 3, it was feasible to develop the hypothesis. The results showed that MHC positively impacted DI. MSC demonstrated a good relationship with PPP and PPE as well as DI. The DI had a strong direct correlation with PPE and PPP. It was successful in assigning DI as a mediating variable on the link between MSC and MHC and financial performance indicators. From the standpoint of Generation Y and Z, the study's findings have provided relevant insight into MHC, MSC, DI, and financial performance in Ghana's and other developing countries' banking sectors.

5.1 Managerial Policy

The few previous research on the relationships between MSC, MHC, DI, and financial performance left gaps that this study fills. The empirical results of the study validated that MHC and MSC present financial institutions with multiple opportunities to improve their DI processes, ultimately leading to better financial performance. According to the findings, businesses that want to improve their financial performance should use digital technology to help with process, service, and product creation, control, and improvement. Additionally, the study demonstrates that MHC and MSC share almost 50 per cent of the variances in variables that affect DI. When hiring, selecting, and developing training programmes for future managers, firms and managers should consider the foundational variables of these constructs (relational dimension, cognitive dimension, structural dimension, entrepreneurship skills, and leadership skills). The study's findings also provide managers and businesses with the motivation to use digital technology more frequently to improve productivity. The reason is that, before the advent of DI, the relationship between MHC and financial performance was weak.

5.2 Limitations and Further Research

This study has some gaps that allow for additional research. In this case, longitudinal data is better than cross-sectional data because the latter may hinder a thorough analysis of the data to identify the factors antecedents required for both financial performance and DI. Secondly, collecting data from a specific country (Ghana) and analysing the data based on the opinions of workers (Gen Z and Y) reduces generalizability and increases bias risk. Research with a broad range of respondents from other departments within the organisation and in other countries can be conducted in the future. Moreover, studies should consider which attributes of MHC and MSC impact banks' performance to aid personnel selection and training, with a focus on managers' perspectives.

Acknowledgement

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The NEXUS Story and its Stakeholder Analysis: Digitalising Multimodal Logistics and the Associated Value Chain Worldwide

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Abstract: The NEXUS project involves innovation and entrepreneurship. The first task of the project team, which is eclectic and includes several different profiles (research assistants, researchers, managers, engineers, designers and marketing specialists) was to do a stakeholder analysis, which involved doing some field work – six unstructured interviews – as well as some secondary data analysis (scientific articles on the Scopus database; Google searches; among others). The main concerns were to: unlock value through stakeholder engagement; move from concept to collaboration – for sustainable port development; and to connect ports worldwide which will involve international stakeholder collaboration and synergies for sustainable innovation. A Stakeholder analysis is a process consisting of identifying the individuals or groups that have a specific interest in a project, which can affect them, or be affected by them, including large groups such as customers and suppliers; employees; shareholders and investors. It is necessary to sort them according to their impact and consequences regarding the project. It is essential to manage stakeholder expectations when making decisions, especially in a project with thirty-five partners and with a global reach. The initial funding is around 92 million euros (approved by the Recovery and Resilience Plan (RRP)), to ensure the ambitious implementation of the new NEXUS platform and other related products. To minimize backlash, early as well as ongoing stakeholder involvement is a prerequisite. Strategy formulation should not occur in an "ivory tower" and involvement is key. For effective and efficient decision-making, to minimize risks, which need to be identified as well as all the connections and relationships to be created and nurtured. The research question at the outset was: How may we successfully implement a multi-partner project which involves considerable investment, and which aims to digitalize maritime ports worldwide? The theme is, currently, without precedent as the impact intended is for there to be a positive impact on all stakeholders involved – a win-win situation all around. The project will finish in 31-12-2025 and will produce 28 innovative solutions for commercialization. NEXUS is a green and digital project which is up to date as regards the latest sustainability norms and regarding overall operational efficiency in multimodal logistics. Work Package 10 is a specific exploitation, internationalization, promotion, and dissemination package.

Keywords: Maritime ports, Global strategy, Financed Project, Interviews, Decision making, Innovation

1. Introduction

The Recovery and Resilience Plan (RRP or PRR in Portuguese notation) is part of the European Council's economic and social impact mitigation instrument, Next Generation EU. This instrument aims to support the dual climate and digital transition. The RRP, as a national action programme, covers an extended period until 2026, with the aim of supporting and implementing reforms and investments for sustainable economic growth after the pandemic. The RRP benefits from a total funding of 16.643 billion euros, a total of 13.944 billion euros in grants and 2.699 billion euros in loans, targeting investment in three fundamental areas: resilience, climate transition and digital transition.

The present article focuses on NEXUS Agenda, one of the selected Mobilising Agendas for Business Innovation of the Recovery and Resilience Plan (PRR). NEXUS Agenda is a consortium headed by the Port of Sines and comprises 35 partners sharing the main objective to digitalise and decarbonise the logistics chain associated with the Port of Sines corridor. The consortium represents the whole value chain, covering port authorities, maritime, terminal and railway operators, carriers, dry ports, logistic operators, technology suppliers, importers, and exporters, and is supported by universities and research institutes. The initial funding is around 92 million euros (approved by PRR), to ensure the ambitious implementation of the innovative project. NEXUS Agenda aims to create an ecosystem comprising 28 products and services for the Sustainable and Digital Transition of Sines Corridor. This includes three main categories: open data collaboration platform, federated applications and services, and hardware assets, distributed across ten work packages.

The research question at the outset was: How may we successfully implement a multi-partner project which involves considerable investment, and which aims to digitalize maritime ports worldwide?

Agenda NEXUS is the first project of this kind in Portugal. Like other international projects such as MAGPIE and PIONEERS, this entrepreneurial project has ambitious innovative goals, in line with current sustainability and

digitalisation needs (the need to minimize the carbon footprint while minimizing costs at the same time - simplifying and streamlining processes).

2. Bibliometric Analysis

A bibliometric analysis was performed, to show trends in the research (large dataset, broad scope) pertaining to our "stakeholder analysis" AND strategy topic. A search in the Scopus database on 09-03-2024 with the terms "stakeholder analysis" AND strategy revealed 633 documents. Exporting the CSV files to VOS viewer (co-occurrence of author keywords; minimum number of occurrence of keywords = 2) revealed figure 1.

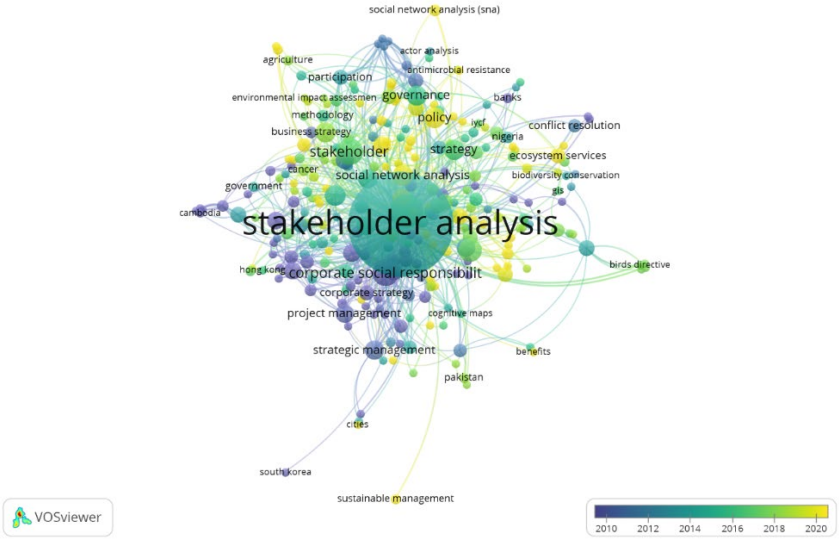


Figure 1: VOS viewer (co-occurrence of author keywords)

Table 1 shows the 22 main keywords in the VOSviewer analysis. Note that China appears above the United States of America in the analysis (with 12 versus 5 occurrences on Scopus for this topic) as China is apparently being more discussed in the literature for this topic. Stakeholder Analysis appears most linked to the term Corporate Social Responsibility (CSR); as well as to the term governance (table 1). Indeed, within the NEXUS project the Stakeholder Analysis was decided to be done by the governance stakeholder and the rationale behind the Stakeholder Analysis is that all stakeholder impacts and consequences (and needs and expectations) of the NEXUS project must be predicted and planned for in advance. NEXUS is about CSR, innovation, community development, corporate strategy, participation, sustainable development, decision making, project management, among others, so the VOSviewer depictions (figure 1 and table 1) show we are on the right track and aligned with the literature.

Other author keywords visible in figure 1 though not in the top 22, in table 1, are: benefits, conflict resolution, stakeholder engagement, public participation, participatory approach, and participatory planning, which are all essential concepts, at this earlier as well as at later stages, of the NEXUS project.

Table 1: The 22 main keywords in the VOSviewer analysis

Selected	Keyword	Occurrences	Total link strength
☑	stakeholder analysis	286	485
☑	corporate social responsibility	19	52
☑	stakeholders	29	50
☑	stakeholder	19	48
☑	governance	11	38
☑	china	12	28
☑	participation	6	27
☑	strategy	11	27
☑	decision making	10	26
☑	community	6	25
☑	environmental management	8	24
☑	stakeholders analysis	14	24
☑	corporate communications	8	23
☑	policy	12	23
☑	social network analysis	12	23
☑	community development	3	22
☑	corporate strategy	6	22
☑	innovation	8	21
☑	public participation	7	21
☑	sustainable development	9	20
☑	united states of america	5	20
☑	project management	9	19

3. Methodology

The approach adopted in this article is a case study (the analysis of a contemporary phenomenon using various methodological approaches) outlining, in particular, the stakeholder analysis which was performed. The case study herein involves a qualitative analysis of the NEXUS Agenda innovation project (literature reviews plus six unstructured interviews). The case study research method was selected as it allows for a specific analysis of the project's scope in a real context. Of note is that in the literature review, which was performed, a comparison was made with similar projects (Eisenhardt, 1989; Ghauri, 2004). The case study allows for a more profound analysis (Piekkari et al., 2009), provides a detailed analysis, combining information from various sources, ensuring the validity of data (Ghauri, 2004). The research question is linked to the management of an innovation project - enabling the study of the processes conducted in the stakeholder analysis conducted as part of the NEXUS Agenda.

The literature review was conducted through a search in the Scopus database (a main database in the social sciences area). Search terms were established according to the research topic and organised into a search sequence, allowing for greater interaction and reorganisation in the process (Pittaway et al., 2004). The search terms, applied to the title, abstract and keywords, resulted in the following search string: search 1 - "stakeholder analysis"; search 2 - "ports" AND "stakeholder*" AND "innovation"; search 3 - "sustainability strategies"; search 4 - "port management"; search 5 - "port" AND "entrepreneur". The searches were conducted on March 28th, 2024.

A qualitative methodology was used to collect data through interviews (Duncan & Holtslander, 2012; Easwaramoorthy & Zarinpoush, 2006). Six unstructured and exploratory interviews (Saunders et al., 2019), regarding the stakeholder analysis, were conducted during the months of January, February, and April 2024 (as the need arose): with a freight forwarder, a cargo owner, a specialist in Ports, two technology firms / suppliers and a Portuguese taxpayer. The interviewees were chosen because they had the necessary knowledge to help answer the research question (a purposive sample). The interviews lasted approximately 10 minutes each and were conducted by telephone. Handwritten notes were taken of the interviews. Previous knowledge of the company was used (following a desk research effort to that end) to tailor the interview script used to the specific context of the company.

With the data from the interviews and other sources, it was possible to develop a study of the stakeholder analysis process that was close to reality.

4. Literature Review

4.1 The Port's Role in Supply Chain Management and its Sustainable and Digital Transition

Ports serve as pivotal elements within the supply chain, enabling local production and consumption sectors to engage on a global scale. In recent years, the advent of globalization has significantly modified the paradigm of supply chain management, leading to increasingly demand-driven markets. Factors external to ports, including technological advancements, governmental policies, competitive forces, and a growing emphasis on sustainability in its comprehensive context, have earned increased focus (Notteboom, 2022).

Ports are facing a tremendous challenge, due to the sustainable and digital transition under the label 'Industry 4.0' and 'Logistics 4.0'. The challenge is to ensure that port clusters remain economically profitable by developing and introducing sustainable innovations in the process, providing value to society (Mendes Constante et al., 2023a).

An increasing need to introduce sustainable practices has been emphasised in the industry, fostering a holistic implementation of sustainability in port management (Notteboom, 2022). The benefits include, among others, increased security and resilience of the infrastructure, reduced emissions, creation of job opportunities and convergence with the local community (Mendes Constante et al., 2023a).

Business management over different time horizons is highly strategic. Considering that the environment in which the business operates is constantly changing means understanding that the management strategy must focus on the present and the future (Aalders, 2023).

A sustainable approach to supply chain management comprises three pillars of sustainable business models, mentioned in the literature: environmental, economic, and social (Daly & Cobb, 1999). Accordingly, ports address different reliance on stakeholders for economic, environmental, and social issues thus engaging stakeholders, whose progress is regularly disclosed through reports (Herremans et al., 2016). Ports operate as

an economic engine, contributing significantly to a country's economic growth (Vinod & Prakash, 2023). As powerful economic business networks, ports can support multi-layered sustainability (Lavissière et al., 2020).

4.2 Innovation and Entrepreneurship

In the port and intermodal context, considering the current paradigm shift, the implementation of innovative technologies is imminent (Musso et al., 2022). Consequently, ports face exceptional challenges arising from emerging trends: the energy transition, the digital transition, the focus on the circular economy, urbanisation, etc. (Mendes Constante et al., 2023). Developing a business model is a complex activity that implies close collaboration between those involved, by concentrating diversity as much as possible (Osterwalder & Pigneur, 2011).

Musso (2022) argues that 5G networks are the backbone of data collection and sharing infrastructures to be combined with technologies such as cloud computing and storage, Blockchain and Artificial Intelligence, among others (Musso et al., 2022).

Innovation in ports is remarkably complex because of two main factors, both arising from the interconnected nature of port activities, which require coordination and collaboration between several companies. Innovation does not occur in environments with isolated efforts, but through a joint effort of interconnected actors, as the concept itself implies this interconnection (Gilbert & Rasche, 2008). The result of innovation, however, is constrained by institutional nuances, such as a risk-taking culture, regulation, and an attitude in favour of cooperation (Mendes Constante et al., 2023). Port clusters involve a variety of activities along the supply chain, involving challenges for building an effective innovation ecosystem. International activities in ports are controlled by subsidiaries of multinational corporations, representing most companies present in port clusters (de Langen & Haezendonck, 2012).

The innovation system approach aims to describe, understand, and clarify the structure, processes, and dynamics of innovation. Systems of innovation may be supranational, national and/or regional (Mendes Constante et al., 2023). The literature suggests that there are advantages to the spatial concentration of initiatives and the promotion of innovation, even if they are restricted to a particular region. It is in this environment that innovation ecosystems are born - although the concept is subject to various interpretations in academia - based on the complex relationships established between the parties involved in technological and innovative development (Mendes Constante et al., 2023).

Mendes Constante (2023) proposes a framework with port-specific characteristics, identifying the components of a port innovation ecosystem, mentioning that the great distinctive characteristic of this ecosystem is its absorptive capacity (Mendes Constante et al., 2023). Nicotra (2014) says that this capacity "determines its ability to recognize and assess the potential value of external knowledge and then to assimilate and integrate it into innovation activities" (Nicotra et al., 2014, pp. 90). The framework comprises 'Human capital (formation), Demand for innovative products and services, support structures for cooperative innovation projects, research cooperation, incubation services (including venture capital)', with the base of an 'innovation-oriented culture, and pro-innovation government (regulation)' (Mendes Constante et al., 2023).

4.3 Stakeholder Analysis

In the literature there is no unanimity regarding stakeholder theory, and it is possible to analyse a set of different narratives that outline the various perspectives, considering the subject matter, such as strategic management (Miles, 2017; Gilbert & Rasche, 2008).

The term "stakeholder" does not find a consensual definition in the literature, considering the various interpretations of the authors, which are invariably different based on the scope of use of the term. This inevitably leads to challenges and constraints in the development of theory and empirical tests (Harrison et al., 2015; Miles, 2017).

Thus, Miles (2017) suggests a system for classifying this construct, which makes it possible to list, filter and order the definitions presented, drawn from both stakeholder and managerial perspectives. This multi-dimensional model comprises four sections, aiming to provide clarity in identifying and analysing stakeholders (Miles, 2017). Each section focuses on distinct aspects of stakeholder identification, featuring: Managerial Perceived Determinants; Managerial Perceived Relationship Attributes; Stakeholder Perceived Determinants; and Stakeholder Perceived Relationship Attributes. This framework leads to the configuration of 4 quadrants, relating to 4 classes of stakeholder, class 1 influencer, class 2 claimant, class 3 recipient, and class 4 collaborator (Miles, 2017).

Kennon et al. (2009) proposed a stakeholder analysis tool. It is presented as a 16-square matrix with two axes centred on the stakeholders, which are *influential* - stakeholders who have power and influence on the organisation or project management (x-axis), and *important* - stakeholders who have power over the execution of the project or the outcomes (y-axis) (Kennon et al., 2009). This helps to have a holistic view of the stakeholders.

4.4 Stakeholder Governance

Governance is intricately linked to stakeholder theory and has acquired particular importance due to the emerging challenges and complexities that new businesses present. The literature emphasises that globalization, technological innovation, and a broader impact of corporate actions require a reassessment of traditional governance models, highlighting the importance of considering a wide range of stakeholders in governance processes. The fundamental role of executive governance in orchestrating interactions between stakeholders to optimise the creation and dissemination of value is also highlighted, advocating a governance framework that comprehensively integrates the perspectives of a diverse set of stakeholders. Businesses should identify and prioritise stakeholders based on their ability to affect or be affected by the actions of the business. This involves effective governance, which implies strategic engagement with various stakeholders (Parmar, et al., 2010; Yuan & Wang, 2024).

4.5 Stakeholder Management and Engagement in Port Operations

To achieve a competitive advantage and remain important players in the market, interaction with the port's stakeholders is a strategic move (Ascencio et al., 2014).

Proper contact with stakeholders must be ensured via proper interactions that allow valuable feedback regarding future improvements. A first step is to identify and analyse these groups, conducting a Stakeholder Analysis, enabling mutual needs and expectations to be identified in the short, medium, and long term (Aalders, 2023).

Port stakeholders can be identified as all those involved directly or indirectly in the international trade processes, such as the importers and exporters, the Port Authority, the terminal operators, customs, customs agents, transport companies (ground and maritime), freight forwarders, empty container parks, surrounding society, etc. (Ascencio et al., 2014). Stakeholders have been categorized into three groups: business-related stakeholders; societal groups and local communities and institutional stakeholders (Notteboom, 2022).

The literature has distinguished three stakeholder engagement strategies, also based on different relationships, the transactional, which aims to inform, the transitional, that responds, and the transformational, whose purpose is to involve (Herremans et al., 2016).

5. Case Study Presentation

5.1 NEXUS Agenda

The Recovery and Resilience Plan (RRP) is a key component of the European Council's Next Generation EU initiative, aimed at mitigating economic and social impacts. This instrument is designed to support the dual transitions of climate and digitalization.

This article specifically highlights NEXUS Agenda, one of the selected Mobilising Agendas for Business Innovation under the RRP. Led by the Port of Sines, the Nexus Agenda consortium includes 35 partners who share the common goal of digitizing and decarbonizing the logistics chain associated with the Port of Sines corridor. Many of these members are companies currently exploring products in innovative areas, such as Physical Internet Supply Chain Orchestration and Collaboration, Last Generation Port and Logistics Community Systems, Innovative Gate Operational Systems and Access Control Solutions, Highly Specialised Terminal Operating Systems and Gate Control Solutions, Cloud and Data Solutions for Transport Operations, Transport Management Systems and eCMR solutions, Carrier Operations optimisation), among many others.

The primary objective of NEXUS Agenda is to establish an ecosystem comprising 28 products and services for the Sustainable and Digital Transition of the Sines Corridor.

The work within the NEXUS Agenda is divided into a distinguished structure, through 11 work packages. The agenda is divided into four primary areas of work packages:

1. Work packages 1 to 8 are core to the project, relating to R&D&I activities that will lead to the NEXUS ecosystem of products and services for the digital and ecological transition.

2. Work package 9 addresses advanced training and HR qualification needs for the port, multimodal and logistics sector.
3. Work package 10 has to do with all matters relating to the exploitation, dissemination, and internationalisation of the agenda (including the Stakeholder Analysis).
4. Work package 11 is responsible for project management.

5.1.1 Similar projects

At the European level, there are other similar projects.

The Horizon 2020 project, "Pioneers," represents a strategic initiative aimed at transforming European ports into models of sustainability, aligning with the European Green Deal's vision for a climate-neutral continent by 2050. This project, involving a consortium of 46 partners from 11 countries, seeks to create a replicable green port master plan by 2026.

The Magpie project, led by Project Manager Reyer Will, embodies a transformative approach towards creating smart, green ports across Europe. This ambitious initiative involves a consortium of 45 diverse partners, including four major European ports, knowledge institutions, industry associations, and private enterprises, all focused on enhancing logistical efficiencies from the port to the hinterland through innovative, sustainable technologies.

These projects, as well as NEXUS Agenda, are united by the Green Deal initiative and European ideas of creating green and digital corridors, aligning with the Global Gateway Strategy to create sustainable and trustworthy connections for the benefit of people and the planet.

The main difference concerns the leadership of the project, as NEXUS Agenda is led by the Port of Sines Authority, while in the other projects the ports participate as partners. The funding itself also differs, both PIONEERS and MAGPIE being funded by the European Union's Horizon 2020.

5.2 Mission, Vision, and Values

NEXUS Agenda's mission is "to create an innovation ecosystem that promotes the green and digital transition of the transport and logistics sector, with a special focus on the multimodal corridors of Sines". This aligns with the NEXUS Agenda's vision of positioning the Port of Sines as a catalyst for an international reference ecosystem in the field of the green and digital transition.

5.3 Products and Services Ecosystem

NEXUS Agenda aims to develop an ecosystem of 28 products and services for the Digital and Sustainable Transition in the transport and multi-modality sector.

The 28 innovative products and services across three key categories:

- Nexus Open Data Collaboration Platform.
- Nexus Federated Applications and Services.
- Nexus Hardware Assets.

The NEXUS Open Data Collaboration Platform aims to gather, organize, standardize, and analyse a vast quantity of quality multimodal network data, which will then be accessible through an open data collaboration marketplace. Establishing a comprehensive environment for sharing data and collaborating which will encourage innovation and the application of artificial intelligence.

NEXUS Federated Applications and Services covers 25 applications and services to be included in the Open Data Collaboration Platform's Apps and API portfolio. These will significantly leverage the wealth of accessible high-quality logistic data and synergies with other products in the ecosystem. Each of these digital products and services will have its own Unique Selling Proposition (USP) and *Go to Market Strategy*. They will be prepared for commercialisation both through NEXUS and as stand-alone solutions.

NEXUS Hardware Assets include innovative hardware-based products that offer significant synergies with the open data collaboration platform and all its applications and services.

6. Stakeholder Analysis Process

The NEXUS Agenda has emerged on the national scene as an entrepreneurial and innovative project. The unprecedented scope of the agenda gives the project the potential to strategically position the activities associated with the Sines corridor at an international level.

As clarified in the literature, the Stakeholder Analysis process consists of identifying individuals or groups that show some specific interest in the organization, either impacting it or being impacted by it, for example in the decision-making processes. The success of a project, especially an innovation project, can be determined by those who are involved (Kennon et al., 2009). In this sense, a stakeholder analysis was conducted as a way of trying to deeply understand the impact of stakeholder clusters.

In NEXUS Agenda's case, the target segments were identified. The process involved allocating stakeholders from the NEXUS ecosystem to quadrants in the matrix. The interviews with a freight forwarder, a cargo owner, a specialist in Ports, two technology firms / suppliers and a Portuguese taxpayer were a valuable contribution to identifying the stakeholders' needs regarding the NEXUS Agenda. This first process resulted in the definition of six main clusters: project partners, potential customers, professional experts, academic public, governmental institutions, and Portuguese and international population.

An adaptation of the 16-square matrix proposed by Kennon et al. (2009) was used, distributing the clusters into four quadrants. The matrix crosses the levels of influence, on the X axis, and the level of importance, on the Y axis (Kennon et al., 2009).

Figure 2 shows the Stakeholder matrix for the NEXUS project.

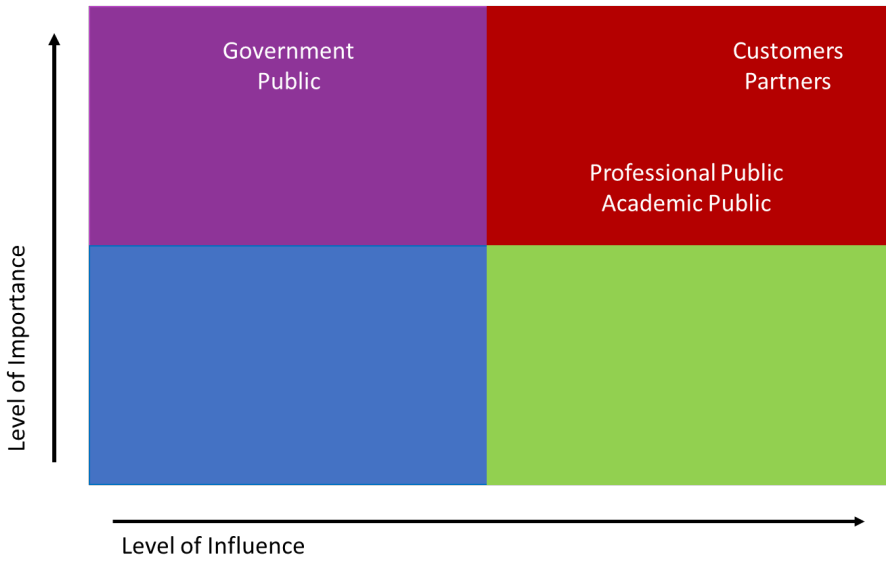


Figure 2: Stakeholder matrix – NEXUS Project

In figure 2 we can see that both the government and the [general] public are important but have a low level of influence in the outcome of the NEXUS project. The professional (specialists) and academic publics (higher education institutions) have a greater influence on the outcomes but are less important. Finally, customers (including potential customers) and [project] partners are both important and influential.

7. Discussion and Conclusion

> *Love change and hence implement the right strategy for all - and not just a strategy to maintain the status quo*
>
> *(The Authors)*

Transformation efforts "have gone under many banners: total quality management, reengineering, right sizing, restructuring, cultural change, and turnaround. But, in almost every case, the basic goal has been the same: to

make fundamental changes in how business is conducted to help cope with a new, more challenging market environment." (Kotter, 1995).

The NEXUS project falls under Portuguese cultural norms, which mean high uncertainty avoidance (99/100) and low motivation towards achievement and success (31/100) (rather favouring quality of life) (Hofstede Insights, 2024). This may mean a subconscious attempt at maintaining essential processes and systems in place - rather than changing the fundamentals which need to be changed – as "innovation may be resisted" (Hofstede Insights, 2024). Change requires hard work. Change requires an embracing of the unknown. Will the senior leadership of NEXUS be up to the task – beyond incremental innovation and more in the direction of radical [technological] innovation?

Future NEXUS project difficulties may involve the following, as enumerated by Kotter (1995):

Error #1: Not Establishing a Great Enough Sense of Urgency

Error #2: Not Creating a Powerful Enough Guiding Coalition

Error #3: Lacking a Vision

Error #4: Undercommunicating the Vision by a Factor of Ten

Error #5: Not Removing Obstacles to the New Vision

Error #6: Not Systematically Planning For and Creating Short-Term Wins

Error #7: Declaring Victory Too Soon

Error #8: Not Anchoring Changes in the Corporation's Culture

The above-mentioned errors correspond to phases which need to be traversed over a long period of time. These phases cannot be disregarded or jumped over as this will lead to failure. Haste is the enemy of a solid implementation - that sticks in the long term. All of the above eight errors may have tragic consequences for a project. Having said this, it is normal that even the best managers and leaders commit at least one big error during transformation efforts (Kotter, 1995).

The Kotter (1995) change model has gained a good reputation for addressing the main issues involved – including communication (or a lack of it). As regards error 4 - communication between partners is a constant, and frequent visits to the Sines Port have occurred during the NEXUS project.

As the project has not yet finished certain business implementation errors may still appear – to date, the project is on track. Project team members have been chosen on a voluntary rather than mandatory basis – all the better for the necessary intrinsic motivation (Amabile, 1998) to be present. Job satisfaction, passion, curiosity, and a personal challenge are all present at key points of the project – making for creativity to be nurtured and not killed (Amabile, 1998) – a prerequisite for success.

To sum up we would like to include a quote from an interview with a member of the Portuguese population – a Portuguese taxpayer. The interview was done on 17-04-2024 - by telephone and for around 10 minutes:

> *"From my point of view the NEXUS project makes sense, to the taxpayer, as if the general objective is to make ports more efficient, in Portugal, including Sines, then the money is well spent. To lower costs is essential, as is to contribute to a better functioning of ports, and to make them more profitable. Being a project aiming at mainly public entities it should be noted that private entities that use the ports will also benefit, from the better and improved services. Obviously, an online platform should not just be glossy and nice but provide real time information which is of use. Do not just provide the weather forecast, which we can get anywhere nowadays, from many other sources and sites... A better interaction with ports, which leads to added business, for a public good, is a good objective to have. As a taxpayer I am interested in that. More efficient public services. If the project does contribute to more traffic to our ports, stating when cargo will arrive and leave... without having to make telephone calls... that is advantageous. Anything that optimizes work is good and if that brings business to a Portuguese port instead of to Vigo, in Spain, or others, then all the better. Invest to gain something... to stimulate real time information, to make things more fluid, help logistics, that is good. Ports are a point of entry for wealth in the country and so as a taxpayer I am happy that money is being well spent. It is important to be efficient, have less people involved in the process, to make management processes quicker, this is all desirable." (a Portuguese taxpayer).*

This research has some limitations. Considering that the project is still ongoing, there might be a lack of comprehensive data available for analysis, which could limit the depth of the findings. Stakeholder dynamics can change over time, and an ongoing project may encounter new stakeholders or shifts in existing stakeholders' interests, which may not be fully captured in the analysis.

Future research should include interviews with stakeholders after the project has finished. Have the objectives been achieved and the expectations fulfilled? Only then will we really be able to answer the research question: How may we successfully implement a multi-partner project which involves considerable investment, and which aims to digitalize maritime ports worldwide?

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Dynamics of Organisational Change: Resistance, Readiness, and the Road Ahead

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Abstract: In today's rapidly changing and competitive business landscape, organizations are constantly forced to innovate to maintain success within their industries (Bagrationi, 2022). Resistance to change is often seen as a conscious and active choice of employees against proposed changes based on various prerequisites and motives (Oreg & Vakola and Armenakis, 2011). The purpose of this research is to explore approaches to resistance to change and readiness for change in terms of their differences. The following research questions were raised during the study: 1) What areas of research exist in the scientific discourse regarding attitudes towards change? and 2) What distinguishes understanding resistance from understanding non-readiness for change in these studies? To answer these questions, a bibliometric analysis was conducted of all English-language articles published in the journals of the first quartile (Q1) in the period from 1948 to 2022 in the category «Management, Business and Accounting», with an emphasis on attitudes to organizational change. The co-citation analysis was incorporated to narrow the sample from 21,162 articles to the most significant 258 articles. With the help of thematic analysis four main areas of research related to resistance to change and readiness for change were identified: 1) the «individual psychological» stream, 2) the «group» stream, 3) the «institutional and strategic» stream and 4) the «agency» stream. Our findings indicate that the bases for resistance to change and readiness for change are fundamentally distinct. This research underscores the variance in strategies for addressing resistance to change versus a lack of readiness for change. Tackling resistance to change is a reactive process that necessitates dynamic engagement by leadership, involving transformational actions, support for staff, and conflict resolution. This stands in contrast to the proactive fostering of change readiness, which primarily involves educating and informing employees.

Keywords: Attitude towards changes, Readiness for changes, Resistance to changes, Organizational psychology, Leadership

1. Introduction

Innovations emerge from various sources such as technological advances or changes in market demand (Vermeulen & Barkema, 2002; McGrath & Rotchford, 1983): new ideas, products and processes, or organizational structures, the implementation of which can significantly improve organizational performance (Ven van de & Poole, 2005). Regardless of their origin, innovations inevitably require organizations to implement accompanying changes (Tsoukas & Haridimos and Chia, 2002).

The existing literature identifies several constructs reflecting different aspects of attitudes toward change. Thus, «employee cynicism» towards change is considered to be a specific type of social attitude when employees doubt the sincerity or truthfulness of management's intentions (Andersson, 1996). «Commitment to change» reflects the degree to which an employee is willing to support and participate in the change process (Herscovitch & Meyer, 2002). «Openness to change» indicates an individual's willingness to accept and support innovation (Miller & Johnson and Grau, 1994). «Acceptance of change» is related to actively recognizing the need for change (Jones & Jimmieson and Griffiths, 2005), while coping with change focuses on an individual's ability to adapt to new conditions (Folkman & Lazarus, 1985).

«Resistance to change» considered a conscious and active choice of employees against proposed changes based on various backgrounds and motivations (Oreg & Vakola and Armenakis, 2011). This may be due to threats to status, personal power, disagreement with the goals of the change or problems in the relationship with management (Eisenbach et al., 1999). On the other hand, «readiness for change» is usually related to positive perceptions and openness to upcoming changes, recognizing their necessity and usefulness (Armenakis & Bedeian, 1999). This paper focuses on these two constructs: although attitudes towards change are a complex and versatile phenomenon, resistance and readiness are the most fundamental and most popular among in the existing academic discourse.

The article by Stroh, 2021 identifies a pivotal shift in change management practices, stating a moving focus from primarily addressing employee resistance to actively cultivating their psychological readiness for change (Stroh, 2021). In this regard, the question arises: how relevant is it to study exactly resistance to change? Can the entire spectrum of employees' attitudes towards change be described in terms of one or another degree of readiness?

Through the systematic review analysis, the authors of the article discuss the possibility that employees may simultaneously exhibit both readiness for change and resistance to change and conclude that it is important to

distinguish between the concepts of «readiness for change» and «resistance to change» as each of these concepts has its own characteristics and mechanisms of influence on the success of change (Repovš et al., 2019).

2. Methodology

The first stage of the methodology for this systematic review was conducted in alignment with the Preferred Reporting Items for Systematic Reviews and Meta-analyses (PRISMA) guidelines to ensure the robustness of the findings (Moher et al., 2009). The review process comprised several key phases: (1) formulating research questions, (2) identifying relevant databases and keywords, (3) selecting sources and analysing them, and (4) discussing the results.

Phase 1. The following research questions were formulated:

- RQ1. What directions of research on attitudes toward change exist in academic discourse?
- RQ2. What is the difference between understanding resistance and understanding readiness for change in these works?

Phase 2. To answer the formulated research questions, a bibliometric analysis of all English-language articles published in Q1 journals between 1948 and 2022 in the Management, Business & Accounting category (Small, 1973) was conducted. This resulted in a sample of 21162 articles.

Phase 3. Authors used co-citation method of analysis (CCA-R) via VOS viewer software identify most relevant articles from the initial sample (Van Eck & Waltman, 2017). This resulted in 326 articles that formed 6 clusters. Then, articles were excluded if their title or abstract did not align with the theme of employee attitudes toward change. This reduced the sample to 285 research papers. Their full-text versions were then processed using Natural language processing (NLP) algorithms in Python. As a result, a tag cloud was obtained, visualizing the significant preconditions for the emergence of a particular attitude towards wards change. Thematic analysis was conducted using Latent Dirichlet placement (LDA) algorithm to build a machine learning model based on a hierarchical Bayesian network.

Phase 4. The of LDA results were then interpreted to identify key factors, primary clusters, and research themes within the domain of employee attitudes towards change.

3. Findings

As a result of the CCA-R, six clusters were identified, each covering a specific area of study of attitudes to change. (Figure 1)

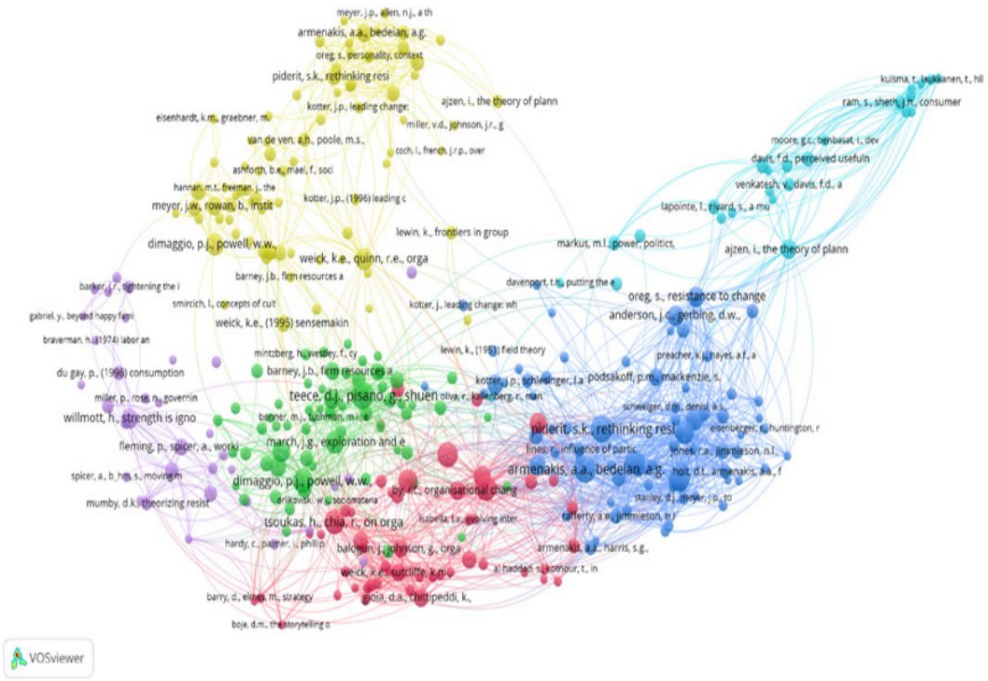


Figure 1: CCA-R

The red cluster summarizes strategic aspects of change, focusing researchers' attention on the role of top management (e.g. Kotter, 1995; Tsoukas & Haridimos, 2002). This cluster includes C. Lewin's seminal work, "Frontiers in Group Dynamics: concept, method and reality in the social sciences; social equilibrium and social change", where the "planned change" approach was first introduced, laying the foundation for subsequent studies of organizational change as a strategic process (Lewin, 1947). The green cluster emphasizes the dynamism of the change process and the adaptability of the organization during the period of change implementation (e.g. Eisenhardt & Martin, 2000). Studies of this cluster can be classified as institutional: they examine the role of culture, power relations, and change policies (e.g. Orlikowski, 1996; Oliver, 1991), as well as the dynamic capabilities of the organization (Eisenhardt & Martin, 2000). The purpose of several works categorized in this cluster was to develop tools to assess the readiness for change and the level of resistance of an individual employee (Oreg, 2003) and to explain how resistance can be managed (e.g. Armenakis & Harris, 2002). Th light-blue cluster centered around behavioral aspects, primarily the theory of planned behavior (Ajzen, 1991), which establishes a direct link between attitudes, norms, perceived behavioral control, behavioral intention, and behavior itself. The purple cluster highlights control and power dynamics. Articles provide meaningful contributions to the understanding of control and power in the context of organizational change: a dialectical approach focuses on the relationship between control and employee resistance (Mumby, 2005), other works consider identity regulation as a form of organizational control and explore its implications for employee behavior in organizational change (Alvesson & Willmott, 2002), and analyze cultural management in organizations and its relationship to control and power (Willmott, 1993). The yellow cluster, functioning as a «mirror», duplicates key works from the other clusters, identifying basic principles and approaches to the study of attitudes toward organizational change.

Thus, through co-citation analysis, we have uncovered key research areas in the field of attitudes to change. However, more detailed study is needed to uncover the interactions among theories and concepts. Thematic analysis, exposing important themes and relationships that might have been missed or under-reported in co-citation analysis, can pinpoint where theories intersect and guide more detailed research into readiness for change or resistance (Table 1). This allowed us to proceed to the description of the main results of the thematic analysis.

Table 1: The results of the thematic analysis

Group 1	Group 2	Group 3	Group 4
personality	discussion	structure	contract
psychological	act	divisional	main
contribute	readiness	requirement	agreement
failure	team	direction	life
employee	interpersonal	culture	relevant aspect
internal world	affect	emergent	department
desire	force	reason	goal
age	allow	gradual	necessity
career	common vector	openness	adaptivity
support	take action	unofficial	community
skill	organize	failure	balance
benefit	provoke	incremental	basis

4. Discussion

Group 1. (48%) «Individual-psychological» direction

The works included in this group focus on causes related to individual psychological characteristics such as personality traits and attitudes (e.g. Herold et al., 2007; Oreg, 2006). The publications included in the first group indicate that, overwhelmingly, employees seek comfort - an understandable and familiar situation, and the thought of impending change inspires anxiety and causes fear and alienation, subsequently becoming a complete barrier to attempts to overcome resistance to change by management (Rosenberg, Mosca, 2011). Researchers identify personality assumptions (self-esteem, self-efficacy, and others) and attitudes that directly influence resistance to change (Oreg, 2006). Other individual factors that influence attitudes toward change include demographic characteristics such as age, gender, skills and education, threat of personal power,

attitudes (trust) toward management, attitudes toward the difficulty of learning new technologies, and divergence of individual and organizational interests (Mumby, 2005; Venkatesh et al., 2003)

Thus, the first group is particularly significant and occupies almost half of the total volume of the thematic model. In a large number of works of this group the central role in the framework of employees' reaction to changes is given to individual-psychological characteristics, attention is focused on internal barriers and motives that can both contribute to resistance to changes and create conditions for readiness for them. According to this approach, resistance is predominantly caused by personal characteristics that directly influence the perception of change and reaction to it, such as self-esteem and self-efficacy, and the causes of resistance are associated with anxiety due to the need to leave the comfort zone, with the avoidance of uncertainty (Oreg, 2006). Thus, in the works of the first group resistance to change is associated with personal preconditions and predisposition to a certain reaction to change, readiness for change is more associated with the perception of change by each individual employee and the degree of his/her awareness of these changes (Kotter & Schlesinger, 1979).

Group 2. (22.5%) «Group» orientation

The second group rightly emphasizes the importance of group dynamics, team and interpersonal relationships in shaping and changing attitudes toward change (Armenakis & Harris, 2002). Interactions within the group directly affect participants' awareness of the upcoming change, which can contribute to the formation of readiness, and group dynamics is one of the main factors affecting the success of organizational change (Armenakis & Harris, 2002). One reason for resistance may be the establishment of close ties within groups, which may lead to acting in the group's interests for fear of losing interaction with colleagues (Rafferty & Jimmieson and Armenakis 2013). In top-down directive change implementation, there is an increasing role for the authority of individuals and resistance to change may be based on the opinion of an authoritative participant (Eisenbach et al., 1999).

The second group focuses on the relationship between group dynamics and interpersonal relationships in the context of organizational change. Resistance to change in this group is primarily manifested through group dynamics: close ties within groups can lead to actions against organizational change for fear of losing those ties (Rafferty & Jimmieson and Armenakis 2013). Resistance can also arise from authoritative actors in a group when these actors resist change (Eisenbach et al., 1999). Norms and values play a key role in shaping readiness for change at the group level (Armenakis, Harris, 2002; Bordia et al., 2004). The degree of compliance of changes with the values and norms of the organization can serve either as an incentive or a barrier to their implementation, affecting the attitude towards wards change at the individual level (Rafferty & Jimmieson and Armenakis 2013). According to the works of the second group, to increase the level of readiness for change, it is necessary not only to provide clear information to employees about the upcoming changes, but also to take measures that promote the strengthening of interpersonal trust of employees in general and their trust in management in particular (Kotter, 1995).

Group 3. (16.8%) «Institutional and strategic» direction

The third group focuses on the attitude towards changes at the organizational level: the importance of aligning organizational changes with the company's development strategy is emphasized (Burns, 2004). When employees only learn about planned organizational changes retrospectively, the negative side of informal communication (rumors that create anxiety and fear of change) is manifested (Rosenberg & Mosca, 2011). Moreover, negative past experiences of change implementation can have a negative impact on the implementation of current changes: failed or incomplete changes cause employees to become cynical about management actions in the present and future changes in general (Tsoukas et al., 2002). In contrast, a policy of «small steps», continuous incremental change that allows the organization to continually adapt, can increase readiness for change through pairing long-term system plan-strategies with «quick wins» (Burnes & Jackson, 2011). On the other hand, the third group shifts the focus of attention to the external environment as well: it is in the third group that much work on institutional theory and resistance as a form of response to institutional pressures is concentrated (Greenwood & Hinings, 1996). The context and reason for change can also influence the adoption or non-adoption of a particular innovation (Rosenberg & Mosca, 2011).

The third group's focus on the organizational level is also expressed in the way it illustrates the importance of organizational structure as a factor in a company's ability to change: structural characteristics (centralization or decentralization, hierarchy, size) directly affect the performance of the change implementation process and the level of resistance (Orlikowski, 1996). Other important ideas of the third group are the importance of the presence of a responsible person (Gioia & Chittipeddi, 1991) controlling the process of change implementation

(whose presence contributes to increasing the level of readiness for change and promptly identifying problems with the current policy of change implementation), as well as the significant role of organizational culture, namely the conformity of change to the values and norms of the organization (Huber et al., 1993). In the works of the third group, resistance to change is generally viewed as an intentional action on the part of employees - it is to some extent an active expression of disagreement with proposed changes, often based on past experiences or rumors (e.g. Orlikowski, 1996; Rosenberg & Mosca, 2011; Tsoukas et al., 2002).

Group 4. (12.7%) «Agent-based» orientation

The last group examines the role of individual agents - active stakeholders - in shaping employees' attitudes towards change and relates the roles of individual actors to their capabilities in reducing resistance or in shaping readiness for change. Key here are the concepts of 'narrative' and 'meaning making' in the company: how exactly agents narrate change, how exactly meanings are translated (Isabella, 1990). It has been noted that the success of change is mediated by the achievement of consensus (agreement) rather than a directive approach (Gioia & Chittipeddi, 1991). Individual conditions of success of change agents are considered, such as high social status of the actor (as a necessary condition for its effectiveness in the role of a change agent, providing employees with necessary resources and the opportunity to acquire the necessary skills, providing support from immediate and top management, which will contribute to the perception of changes as fair (Eisenbach et al., 1999; Rosenberg & Mosca, 2011).

Thus, the works included in the fourth group emphasize how the role of individual agents in the process of change implementation is critical for generating positive employee attitudes towards the change: the narratives through which agents communicate information about change can both generate willingness and provoke employee resistance (Weick & Sutcliffe & Obstfeld, 2005; Isabella, 1990). When change agents with high social status competently communicate with employees and support them on their mastery journey, their readiness for change increases (Higgs & Rowland 2005). In the absence of such work, especially if change is perceived as imposed or unfair, readiness levels may decline. At the same time, resistance is often a conscious choice; lack of readiness is more often related to a lack of understanding of how to adapt to a new situation. Effective change agents know how to distinguish between these two phenomena and adapt their strategies accordingly. Resistance to change in this context may be due to the actions of specific actors, e.g., employees with high social status who deliberately obstruct change for fear of losing their status or authority/privilege. The success of change may depend on the ability of agents, through transformational behavior, to form a suitable narrative by which change is perceived in a less negative way by company employees (Huy, 2002). Readiness for change, within the agency approach, can be enhanced by the actions of individual actors providing employees with the necessary support to acquire new skills. Research focusing on change readiness involves the development of approaches to foster positive attitudes towards change among employees and the organization (Teece et al., 1997; Ajzen, 1991).

5. Conclusion

Organizational change has traditionally been the focus of attention of researchers and practitioners in management and organizational psychology, with a special place in the discourse given to issues related to how to prepare employees for the upcoming changes and overcome their resistance (Burnes & Jackson, 2011; Kotter, 1995; Lewin, 1947; Coch, French, 1948). Since the late 20th century, «resistance» and «readiness for change» have become key concepts in academic and practical management discourse, epitomizing different attitudes towards the change process. The purpose of this study was to attempt to delineate the boundaries of these constructs.

Thus, resistance is most often associated with several social-psychological factors such as fear of the unknown, bias based on experience or the influence of the social environment and is expressed as active opposition to proposed changes (DiFonzo & Bordia and Rosnow, 1994). Readiness, on the other hand, acts as an indicator of understanding of the meaning of change, support and participation by management and their agents in the change process that organizations seek to implement (Teece et al., 1997). From these perspectives, unpreparedness is rather related to the lack or absence of knowledge and conditions for successful adaptation to new circumstances (Kotter, 1995; Burnes & Jackson, 2011). Therefore, resistance to change and readiness for change have different backgrounds and motivations, which require different approaches to studying and overcoming them (Oreg, 2006; Eisenbach et al., 1999; Armenakis & Harris, 2002; Kotter, 1995).

Since the mid-twentieth century, staff resistance, which is often seen as a conscious choice of employees, has been assigned the role of a major obstacle to the successful implementation of organizational change (Lewin,

1947), and methods aimed at overcoming it are often based on a reactive approach, suggesting a predominantly reactive response to pre-existing circumstances. The goal of such interventions is to address concerns that may serve as sources of resistance - including those related to previous experiences, existing stereotypes, social pressures, and so on (Markus, 1983). To overcome resistance to change, management should, on the one hand, take into account both perceived threats to employees' status and social capital (including employee «blat», see: Bagrationi & Volkov, 2022), which cause disagreement with the goals of change, actively manage the change process by implementing a change-oriented style, such as transformational behavior (Eisenbach et al., 1999).

In contrast to methods within a reactive approach to overcoming resistance, building readiness for change requires methods implemented in a proactive approach. Such methods may also include persuasive tactics, for example: providing additional information about the benefits of change or showing successful adaptation examples of other organizations (Ajzen, 1991; Armenakis & Bedeian, 1999). However, change readiness techniques are not aimed at transforming the already established attitudes of individual resisters, but at creating conditions for the involvement of a wide range of employees in the change process by providing them with the necessary support, by teaching them new skills and competencies (Weick & Sutcliffe and Obstfeld, 2005; Isabella, 1990). They may also include creating a positive narrative about the upcoming changes, utilizing feedback mechanisms to capture employee opinions, and actively engaging leaders at various levels to promote change (Huy, 2002). Thus, the key difference between the two approaches is that while methods for overcoming resistance involve responding to problems that already exist, methods for creating readiness involve creating favorable conditions for the successful implementation of change.

Management often perceives their subordinates as a single social group with common goals, whereas the presence of different subgroups requires a much more nuanced approach to change management (Collins, 1998). Programs need to be shaped to both overcome resistance and build readiness. It is necessary to form programs aimed at both overcoming resistance and building readiness. The specificity of strategies designed to mitigate or neutralize resistance implies, for example, the inclusion in such programs of active leadership of change agents who are able to form an attractive vision of the company's future for employees after the implementation of changes (Bagrationi & Thurner, 2020): they need to actively communicate with employees, clarify their concerns and fears, and provide them with information about the reasons, goals and benefits of the proposed changes. To achieve this goal, change agents not only need to demonstrate their commitment to change and try to become a role model (Higgs & Rowland, 2005), but also use an individualized approach to employees who show a high level of resistance to consider their concerns, motives and needs in the communication work (Eisenbach et al., 1999).

Strategies to build readiness for change include emphasizing transparent and clear communication, employee training and development, and management support at all stages of the change process (Teece et al., 1997). Such strategies may involve a variety of training courses, master classes and workshops aimed at increasing employee awareness of change and its benefits to the organization (Armenakis & Bedeian, 1999; Bamford & Forrester, 2003). The combination of these strategies is aimed at forming a synergetic effect that facilitates the process of change implementation and minimizes potential risks associated with resistance and unpreparedness of employees.

Based on this analysis, the directions for future research can be suggested. Since the vast majority of research has focused on a static understanding of the constructs under study, future research may shift the focus of researchers and practitioners to how resistance and readiness for change evolve over time in different contexts. Moreover, both best and unsuccessful change management practices should continue to be analyzed to identify key success factors.

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Entrepreneurship Education Around the World: A Study on Member Universities of the Association to Advance Collegiate Schools of Business

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Abstract: It has long been debated whether people are born entrepreneurs or if it is a combination of skills and knowledge that can be acquired through education and training. While there are passionate scholars on both sides of the debate, the increasing number of studies and programs focusing on training people on how to become entrepreneurs perhaps shows that the balance is shifting in favour of the latter side. The purpose of this study is to examine how universities are performing the task of teaching entrepreneurship by focusing on member institutions of the Association to Advance Collegiate Schools of Business (AACSB). A total of 461 out of 1794 institutions that are members of the AACSB member directory were examined for the study. First, descriptive statistics were used to determine the number of bachelor's and master's degree programs that focus directly on entrepreneurship education along with lower-level programs such as minors and certificates. This was supplemented by examining additional entrepreneurship-related best practices employed by these institutions, such as entrepreneurship centres or certificate programs. All analyses were bifurcated by examining results based on criteria such as educational level, geographical location, and AACSB accreditation. The results show that although almost all business schools have included some form of entrepreneurship courses in their curricula, the number of programs or degrees directly dedicated to entrepreneurship remains a minority. In addition to classroom teachings, some of these institutions offer innovative practices related to entrepreneurship, such as entrepreneurship scorecards, entrepreneurship competitions, and certificate programs. All data collected and analysed were used to develop an overview of undergraduate and graduate level entrepreneurship education to encourage institutions and individuals to develop entrepreneurship programs that cover all theoretical and applied aspects of entrepreneurship education to support aspiring entrepreneurs along their journey.

Keywords: Entrepreneurship education, Association to Advance Collegiate Schools of Business, Case study

1. Introduction

Entrepreneurship education, which can be defined as any activities undertaken by institutions to teach individuals how to become entrepreneurs, is one of the key items of the Entrepreneurial Framework Conditions stipulated by Global Entrepreneurship Monitor (GEM) which lays down the conditions that support or hinder new business creation (GEM, 2024). However, it is reported in the GEM 2023/2024 report that entrepreneurial education is the weakest assessed of all items, which indicates there are some issues to be fixed in this area. The debate of whether entrepreneurship can be taught or is an inherent quality that people are born with lays the foundation of the quality and the quantity of entrepreneurship-oriented education. This debate also shapes the methods of teaching entrepreneurship and the mindset of entrepreneurship scholars. As many fields of higher education, entrepreneurship education is also changing to keep up with the trends which raises the question of how the universities and colleges of today undertake the task of teaching entrepreneurship.

1.1 Purpose

The purpose of this study is to examine how entrepreneurship is being taught by higher education institutions and provide an overview that encompasses the best practices. For this purpose, the institutions included in the member directory of the Association to Advance Collegiate Schools of Business (AACSB) were studied regarding the entrepreneurship-oriented education they provide as well as the extra-curricular activities they undertake such as holding entrepreneurship competitions, offering certificate programs, and establishing entrepreneurship centres. The findings were used to provide an overview of entrepreneurship education to provide insights to higher education institutions aspiring to provide extensive entrepreneurship training.

1.2 Limitations

As any research, this study also has certain limitations. First and foremost, the study is limited to the sample of AACSB member institutions. Although AASCB is one of the highly regarded accreditation institutions for business schools, as evident by 88% of the highest ranked management schools according to QS Top Universities Ranking being AACBS members (AACSB, 2024; QS World University Rankings, 2024), the geographical distribution of the members may raise concerns. The majority of the members in the sample are

from the United States of America (57%) and even though this may simply be a reflection of the global distribution of higher education institutions, it may also lead to the results of this study to be interpreted as representing the "American view" on entrepreneurial education.

Another limitation is the fact that not all institutions listed by AACSB has shared all necessary information. Considering the fact that there is a significant number of institutions with no data about their programs and courses whatsoever may lead to questions about the completeness of the study. Therefore, it is possible that the institutions that have not disclosed data about their entrepreneurship-oriented courses and activities might indeed have valuable contributions that may have been overlooked due to this shortfall.

2. Literature on Entrepreneurship Education

The term entrepreneurship, as coined by Richard Cantillon in 1755 and later expanded by François Quesnay in 1888 and Jean-Baptiste Say in 1845, is often attributed to Joseph Schumpeter who defined it as the act of "reforming or revolutionizing the pattern of production by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing and old one in a new way by opening up a new source of supply of materials or a new outlet for products by reorganizing and industry and so on" (Schumpeter, 1942; Śledzik, 2013). Following the definition of Schumpeter, entrepreneurial activities often include various methods of introducing ideas and transforming those ideas into marketable products and services for the purpose of earning profit.

Early theories on entrepreneurship are exceedingly diverse which include economic theories such as the theories of Schumpeter (1989), Kirzner (1997) and Marshall (1948) with a focus on the role of entrepreneurs in the market and their relationship to profits; psychological theories including but not limited to the studies of McClelland (1961), Hagen (1962) and Kunkel (1997) that emphasize the personality of individuals and their psychological motives; and sociological theories such as Weber (1904), Young (1971), Hoselitz (1963) and Cochran (1971) that underline the impact of the society on the emergence of entrepreneurship.

In addition to diverse disciplines studying entrepreneurship, another compelling question asked by scholars is whether entrepreneurship is an inherent quality people are born with or something that can be taught. Notwithstanding the view on whether people are born entrepreneurs or they have to be taught how to become one, the role of entrepreneurs in economies as engines for growth has long been accepted (Adekiya and Ibrahim, 2016). However, the view on this debate is epochal since it affects how educational institutions approach entrepreneurship education. Literature is divided on theories that argue certain personality traits are required to become entrepreneurs and thereby entrepreneurship education is useless and those that claim knowledge and skills to be acquired through education is what turns individuals into entrepreneurs.

2.1 Arguments for Entrepreneurship Education

Entrepreneurship education comprises all kinds of educational activities that aim to support the entrepreneurial journey of individuals. This education may be offered as a course, a concentration area (which is a subsection of a degree where the student focuses on entrepreneurship by choosing elective courses in that field), an undergraduate degree, or a graduate degree by a higher education institution or may be in the form of trainings delivered by other public and private institutions. The common goal of these activities is to provide individuals with theoretical and practical knowledge on how to establish their own businesses.

Early research on the relationship between entrepreneurship education and entrepreneurial intent demonstrates that exposure to entrepreneurship education during early ages encourages and supports the entrepreneurial intent (Gibb and Ritchie, 1982; Lee-Gosselin and Grise, 1990; Dyer, W, 1994). In other empirical research, Zhao et al (2005) uncovered a strong positive relationship between entrepreneurial education and entrepreneurial intent, which was later supported by Adekiya and Ibrahim (2016) in their research investigating the relationship between entrepreneurship training programs and the tendency of students to engage in entrepreneurial activities as well as Hutasuhut, Aditia and Thamrin (2024) who found a significant relationship between entrepreneurship training and entrepreneurial orientation and intent. Davidsson and Honig (2003) had a different approach which included not only the entrepreneurial intent but also the success of entrepreneurial activities which led to the conclusion that formal entrepreneurship education had a significant role in predicting entrepreneurial intent but no significant relationship was discovered between education and entrepreneurial success.

From a theoretical perspective, the foundation of entrepreneurship education is laid down by theoretical frameworks such as Theory of Planned Behaviour and Self-Efficacy Theory. Theory of planned behaviour

developed by Ajzen (1991) is relevant in the sense that entrepreneurship is a planned behaviour for which the intention would depend on personal attractiveness, social norms and feasibility. It is claimed that intentions models predict entrepreneurial behaviours better than individual (personality traits) and situational factors (external variables) (Krueger, Reilly and Carsrud, 2000). On the other hand, the Self-Efficacy Theory developed by Bandura (1978) emphasizes perceived behavioural control and observational learning in shaping intentions and behaviours which in this case is reflected in entrepreneurial intent and behaviour.

2.2 Arguments Against Entrepreneurship Education

Looking from the other end of the spectrum, not all scholars are in agreement that entrepreneurship education is the right path to follow when the goal is to increase the number of nascent entrepreneurs. Shane and Venkataraman (2000) and Kuratko (2005) are among the first scholars who challenged the idea of legitimizing entrepreneurship education as a solution that will lead to an increase in new business creation. The question of whether entrepreneurship can be taught, as coined by "teachability dilemma" by Haase and Lautenschlager (2011), is often answered by the scholars on this side of the debate by accentuating the importance of experience over classroom education.

One of the dominant arguments of those against entrepreneurship education is that it is a skillset that can only be obtained through real life experience and this experience supersedes classroom teachings. As claimed by Kent (1990), one of the early scholars studying the topic of entrepreneurship education: "Entrepreneurship education must be entrepreneurial". This approach emphasizes the notion that entrepreneurship should be taught in a more "learning-by-doing" standpoint where students engage in more hands-on activities to acquire real life experience (Cope and Watt, 2000; Rasmussen and Sørheim, 2006).

Neck and Greene (2011) posit that there are three approaches to entrepreneurship education which are named as 1) Entrepreneur World; where the entrepreneur is the focal point of the education, 2) Process World; where the entrepreneurship process is taught from idea creation to business establishment, and 3) Cognition World; where the knowledge structures and thinking patterns of entrepreneurs is the main attraction. However the scholars believe that these traditional approaches no longer function in the new world and propose a new approach where entrepreneurship should be taught as a method (Neck and Greene, 2011). This approach requires the entrepreneurship education to be taught as an experience and action-based set of courses which involve simulations, real enterprise creation and design-based learning.

3. Methodological Framework

The approach to entrepreneurship education is varied among institutions based on their view on whether it should be a separate field or just a track of the business administration curriculum. To further understand this disparity, this study aims to provide an overview of how entrepreneurship education is delivered by leading higher education institutions around the world by conducting an analysis of secondary data. This section provides information on the research methodology including sampling methods, analyses and findings.

3.1 Research Methodology

The methodology employed in this study includes statistical analysis of secondary data complemented by case examples. First step of the analysis was to calculate the descriptive statistics of schools and programs by countries, institution type, size, educational level and the accreditation status of institutions. Second step of the analysis was to examine each school and the entrepreneurship-oriented programs they offered. And final step was to investigate the best practices of the schools in the sample. Case examples were selected based on subjective criteria such as their uniqueness and contribution to the entrepreneurship education. All the findings and analysis results were then compiled to provide an overlook of how entrepreneurship education is undertaken in different institutions around the world.

3.2 Sampling and Data Collection

The sample used in this study is selected from the higher education institutions which are members of the Association to Advance Collegiate Schools of Business (AACSB). AACSB is a highly regarded global nonprofit association established in 1916 which aims to help business schools worldwide achieve educational excellence (AACSB, 2024). The institution undertakes accreditation activities for colleges and universities focused on business education as well as creating a network among its members to elevate the standards of business education. The justification for selecting this sample is the vast amount of higher education institutions (1794 institutions as of July 2024) included in the database provided by AACSB and its coverage of highest-ranked

colleges and universities. This is believed to help this research achieve a view on best practices in the business education ecosystem.

Data used in this study is obtained from AACSB Analytics Hub which provides varied data on all the institutions included in the member directory. The term "institution" used here refers to all colleges, universities and other educational entities added to this list. The search engine provided by the Hub delivers 1794 institutions in total that are included in the member directory. When schools and programs related to entrepreneurship are searched, the results show that 461 out of 1794 institutions have some type of an entrepreneurship program which is calculated as 1908 programs in total.

3.3 Analysis and Findings

First step of the analysis was to lay down the descriptive statistics of the data obtained from AACSB Analytics Hub. This database is a paid service offered by AACSB to its member institutions which offers information about the universities and colleges and gives the opportunity to compare these institutions on various dimensions. Table 1 exhibits the distribution of institutions that offer entrepreneurship programs based on geographical location, institution type and size.

Table 1: AACSB Member Institutions with Entrepreneurship Programs

		N	**%**
Status	Institutions with Entrepreneurship Programs	461	26
	Institutions without Entrepreneurship Programs	1333	74
	Total	1794	100
		N	**%**
Countries	United States of America	261	57
	United Kingdom	39	8
	France	19	4
	Australia	17	4
	Canada	16	3
	Germany	10	2
	Taiwan	7	2
	Ireland	5	1
	Others (<1%)	87	19
	Total	461	100
		N	**%**
Institution Type	Public (owned by state)	319	69
	Private (owned by private entities)	142	31
	Total	461	100
		N	**%**
Size	Small (Up to 35 Full-time Faculty Members)	78	17
	Medium (36-75 Full-time Faculty Members)	139	30
	Large (More than 75 Full-time Faculty Members)	201	44
	Not Declared	43	9
	Total	461	100

Table 1 demonstrates that the distribution of entrepreneurship-oriented programs in AACSB member institutions leans towards not having programs purely dedicated to the field. An investigation into the curricula of AACSB member institutions shows that business schools tend to integrate entrepreneurship as a course or a track to their studies rather than dedicating a separate program or degree to this discipline.

Regarding the geographical distribution, a significant percentage of all institutions appear to be located in the United States of America which can be explained by the fact that a high percentage of all higher education

institutions worldwide are located in that region. This may also be caused by AACSB being perceived more important in American institutions since being originally founded as "American Assembly of Collegiate Schools of Business" despite its current positioning as a global nonprofit association (AACSB, 2024).

Although not directly related to the study, the distribution of the members by institution type and size is also provided in Table 2 which provides insight into the characteristics of the research sample. Data indicates that majority of the member institutions are public institutions, and the number of large institutions is higher than the others which means they have more than 75 full-time faculty members. These two factors might be correlated since public universities are often larger than private universities and such institutions have more government support and funding which may have led to having more entrepreneurship-oriented programs.

After a general overview of the data, the institutions that offer entrepreneurship were analysed based on the educational level of the programs, accreditation status of the institutions and the names of the programs offered.

3.3.1 Level of education

Another important dimension of how entrepreneurship programs are distributed is the level of education. Results demonstrate that entrepreneurship programs are widespread among both undergraduate and graduate level studies. Table 2 summarizes the results of the analysis.

Table 2: Distribution of Entrepreneurship Programs by Level of Education

Level of Education	**N**	**%**
Undergraduate	810	42.5
Masters-Specialist	451	23.6
Masters-Generalist (MBA)	282	14.8
Graduate Level Certificate	98	5.1
Doctoral	74	3.9
Masters-Generalist (non-MBA)	71	3.7
Undergraduate Certificate	65	3.4
Masters-Generalist (EMBA)	38	2.0
Masters-Generalist (MBA/Dual Degree)	11	0.6
Integrated Undergrad-Masters	7	0.4
Executive Education	1	0.1
Total	**1908**	**100**

As exhibited in Table 2, the percentages of undergraduate and graduate level entrepreneurship programs are very close despite the latter being slightly higher. In fact, the sum of all master's and doctorate level programs (48.6%) exceeds the number of bachelor's level programs (42.5%) which may be interpreted as entrepreneurship education being considered more appropriate for more mature and educated individuals. This supports the notion that older and more experienced entrepreneurs are often more successful in their endeavours compared to newly graduates (Azoulay *et al.*, 2018). This may also be because entrepreneurship education requires the individual to have a basic understanding and knowledge in business functions which may be provided by a bachelor's degree.

Additional investigation into the other levels of entrepreneurship education reveals that some of the institutions prefer to have entrepreneurship as a concentration, minor program or track to their business administration programs. Certificate programs are also quite common but none of these lower-level programs are as widespread as entrepreneurship majors provided at undergraduate and graduate level. This illustrates that entrepreneurship education has been accepted as a legitimate university degree.

3.3.2 Accreditation status

AACSB accreditation is a profoundly prestigious achievement for any institution related to business education which means that they have gone through a long and intricate process of being scrutinized by AACSB. Table 3 shows the distribution of the institutions analysed, by their accreditation status.

Table 3: Distribution of Institutions by Accreditation Status

Accreditation Type	N	%
Business Accreditation	311	67
Business & Accounting Accreditation	112	24
Not Accredited	38	8
Total	**461**	**100**

As the table demonstrates, majority of the institutions that offer entrepreneurship programs are accredited by AACSB. This indicates that the decision to dedicate a program to entrepreneurship is a decision that is more commonly adopted by highly prestigious colleges and universities worldwide.

3.3.3 Terminology use in naming of programs

Findings of the research also demonstrate that a significant number of undergraduate and graduate level entrepreneurship-oriented programs offered by the institutions have one thing in common: The term "innovation". Innovation, which can be broadly defined as the act of introducing something new, is a concept that goes hand-in-hand with entrepreneurship. Following the ideas of Schumpeter (1942), being innovative is often considered as a pre-requisite of being an entrepreneur.

This is evident in the names of the programs offered by the institutions in this study. After the choice of simply naming the programs as "Entrepreneurship" (which makes up 30% of all programs), the most common choice is to combine the term with innovation. A pattern can easily be drawn by looking at the programs named "Innovation and Entrepreneurship" or "Entrepreneurship and Innovation" on both undergraduate and graduate level, which is approximately 16% of all programs.

Looking at the names of the programs, there also exist some unique examples that attempt to combine entrepreneurship with innovation and creativity. BINUS Business School from Indonesia (BINUS, 2024) having a program called "Creativepreneurship" under its business school and the Chulalongkorn University from Thailand (Chulalongkorn University, 2024) offering a program called "Technology Management and Innopreneurship" is just two examples of these attempts to merge these concepts which are already being used interchangeably.

3.4 Case Examples from Selected Institutions

Following an overall analysis of all entrepreneurship programs offered by AACSB member institutions, this section provides case examples from selected institutions to provide an overview of the entrepreneurship programs.

3.4.1 Entrepreneurship centres

Entrepreneurship centres are entities established within universities which aim to encourage and support entrepreneurial activities at these institutions. These entities are sometimes referred to as "entrepreneurial institute" or "entrepreneurship academy" as in the case of California State University/DH (California State University, 2024) in the USA and ESMT in Germany (ESMT, 2024). Entrepreneurship centres often work as bridges between the entrepreneurship education and real-life practice. As previously mentioned to be one of the shortcomings of theoretical entrepreneurship education, entrepreneurship centres help the whole process become more integrated with the real business world.

For instance, Bettany Centre for Entrepreneurship established under Cranfield School of Management in England (Cranfield School of Management, 2024) describes its role as facilitation of entrepreneurial growth to unlock the entrepreneurial potential of students, faculty and staff by closely linking research, education and practice. They provide consulting, events for networking, entrepreneurship competitions and scholarships to aspiring entrepreneurs. A similar case can be observed in Ozyegin University in Turkiye (Ozyegin University, 2024) which offers incubation and acceleration centres for students named as "Startup Factory" and "OpenFab". Babson College in the USA (Babson College, 2024) is another unique example which provides three distinct entrepreneurship centres for entrepreneurship (Arthur M. Blank Centre), women's entrepreneurial leadership (Frank & Eileen Centre) and family entrepreneurship (Bertarelli Institute).

3.4.2 Entrepreneurship competitions and scholarships

Since competition and rivalry is at the heart of entrepreneurship, it is also one of the most common type of activities undertaken by institutions that focus on entrepreneurship. Frequently referred to as "pitching day", "elevator pitch competition" or similar names, these competitions provide a platform for students to experience the real-life scenario where they go on stage in front of real investors and pitch their idea to receive investment. Such competitions usually offer rewards to the highest-ranking projects but more importantly they provide the aspiring entrepreneurs with the opportunity to meet the investors and create networks.

Examples include DePaul University's "University Pitch Madness" in the USA, University of Bath's "Dragons' Den Pitching Competition" in England, Jönköping University's "Entrepreneurship Challenge" in Sweden, LaTrobe University's "PitchFest" in France, Chongqing University's "Internet+ Innovation and Entrepreneurship Competition" in China and many more. Since pitching, which is delivering a very short speech to convince investors to make an investment in the project, is considered one of the key competencies of any entrepreneur, these competitions provide the opportunity to their students to experience this "rite of passage" in a controlled environment. One unique example in this field is the pitching tools provided by the University of Edinburgh which includes resources for students that teach how to create a successful pitch as well as a website (pitch.com) to help them achieve success in this crucial step. In addition to the competitions, certain institutions such as Indiana University in the USA prefer to provide entrepreneurship scholarships to students to support them in their entrepreneurial journeys (Indiana University, 2024).

3.4.3 Entrepreneurship certificates

Universities and colleges with a distinct focus on entrepreneurship also offer programs that provide their students with certificates to document the entrepreneurial activities they have undertaken. These documents are used by their graduates in their professional lives as a proof of their commitment to becoming entrepreneurs.

One of the examples of these certificate programs is the "Entrepreneurship Scorecard" offered by OSTIM Technical University in Turkiye (OSTIM Technical University, 2024). As a university that positions itself as an "entrepreneurial university", this certificate contains all the entrepreneurial activities undertaken by their students throughout their studies. Each activity is scored by pre-determined criteria whether it is an entrepreneurship training or participating in entrepreneurship projects and each student is given the scorecard along with their diploma and transcript to demonstrate what they have done as potential entrepreneurs.

3.5 Overview of Entrepreneurial Education Around the World

In the scope of this research, 461 higher education institutions were investigated to determine how they deliver entrepreneurship education. Quantitative and qualitative analysis results were combined to create an overview of entrepreneurship education around the world. Figure 1 demonstrates the overview.

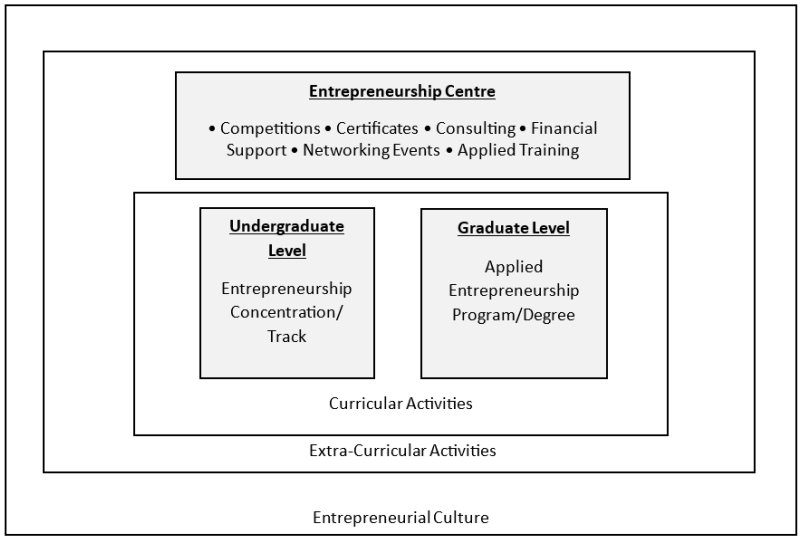


Figure 1: Overview of Entrepreneurship Education Around the World

The overview of entrepreneurship education around the world provides three dimensions: Curricular Activities, Extra-Curricular Activities and the Entrepreneurial Culture. Curricular activities encompass all undergraduate and graduate level education whereas extra-curricular activities are organized under an entrepreneurship centre that will focus on supporting entrepreneurial activities of student and staff and all these activities are encircled by an entrepreneurial culture that lays the foundation of the overview.

As depicted in the overview, descriptive statistics and best practices of the business schools in the AACSB member directory suggest that entrepreneurship should not be a separate program or a degree at undergraduate level. Therefore, having entrepreneurship as a concentration area or a track to be added to the business degree would provide the undergraduate students with the necessary entrepreneurial mindset without focusing the whole degree on this topic. A separate program or a degree dedicated to entrepreneurship may be considered at graduate level provided that it is an applied program that requires students to participate in real-life entrepreneurial activities such as establishing a company, seeking investment or developing and implementing a business plan.

Considering the importance of real-life experience, perhaps the most crucial component of the overview is the entrepreneurship centre. A separate entity to be established under the university or college should be responsible for supporting and encouraging entrepreneurial activities by organizing competitions and networking events, providing certificates and trainings and offering consultancy services and financial support. These extra-curricular activities will help incubate and accelerate business ideas for which the foundation is laid down by undergraduate and graduate level programs.

Finally, the whole structure should be supported by an entrepreneurial culture to be created and sustained at the institution. Without such a culture that underlines the importance of having an entrepreneurial mindset, none of the other activities would bring any success.

4. Conclusion and Discussion

Entrepreneurship education has long been debated by scholars who passionately believe in its effectiveness as well as those who think that it is nonsense. However, the increase in programs focusing on entrepreneurship education in recent years demonstrate that higher education institutions recognize the importance of entrepreneurship and are willing to take necessary measures to integrate it into their programs.

The aim of this research was to investigate how universities and colleges around the world undertake the task of teaching entrepreneurship by conducting research on members of Association to Advance Collegiate Schools of Business (AACSB), which is one of the most prestigious associations that conducts accreditation processes for business schools. Data obtained from AACSB Analytics Hub was used to achieve an overview of entrepreneurship education programs offered by these institutions as well as investigating some of their best practices in the field of entrepreneurship. Results of the quantitative and qualitative analyses were used to provide an overview of entrepreneurship education around the world. This overview is proposed as a suggestion for higher education institutions to advance their entrepreneurial endeavours and adopt a holistic view on entrepreneurship education.

4.1 Suggestions for Further Research

This research was conducted to develop a provide an overview of entrepreneurship education around the world based on the preferences and best practices of some of the most prestigious business schools around the world. However, considering the fact that majority of AACSB member institutions are from the United States of America may raise certain concerns that could be relieved by conducting a similar research based on other directories or rankings that have a more balanced geographical distribution. Another suggestion for further research may be to have a deeper investigation into the dimensions identified in the overview such as the activities of entrepreneurship centres or how to create and maintain an entrepreneurial culture at higher education institutions.

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COIL Method in Economic Higher Education: The Stakeholders' Perspective

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Abstract: COIL (Collaborative Online International Learning) is an innovative teaching method that allows students to experience international cooperation and develop intercultural skills using digital technologies. This online teaching method became popular recently based on the experience gained by higher education institutions during the COVID-19 pandemic. COIL is an effective and convenient teaching method that provides students with the experience of „internationalisation at home." The COIL engages students, teachers, and business partners. As those groups have different educational needs and expectations, the question arises as to what extent this teaching method can address those needs. Therefore, the main objective of this paper is to identify the main benefits and limitations of the COIL method in economic higher education based on the empirical survey results. The survey was conducted after the successful COIL implementation in 2023/2024 in several courses at the University of Economics in Katowice, Poland. The COIL method was applied in the form of three different models and was organised in cooperation with partners from several European universities. In particular, the COIL method was applied within a course devoted to Digitalisation and Sustainability, aiming at developing projects on business plans for start-ups using innovative technologies to enhance sustainable development. The paper presents the COIL concept, course objectives, and learning outcomes, as well as an assessment of the COIL method from the perspectives of students, teachers, and business experts. The main findings suggest that all students appreciate the advantages of COIL: the possibility to gain international experience, improve communication and intercultural skills, and learn the basics of project management. They also signalled some challenges related to international teamwork. However, teachers, in general, are satisfied with the quality of outcomes of students' cooperation, although applying the COIL method requires lots of administrative work and developing new skills. Similarly, business partners highly assessed the benefits of the COIL method for students in terms of their future professional careers.

Keywords: COIL methodology, Innovative teaching methods, Project-oriented education, Economic studies

1. Introduction

The technological advancements observed during the last decades have changed all aspects of human life, including teaching methods. The new generations' needs in graduate programs have required universities to seek new ways of acquiring knowledge and skills to face the new digital age. As a result, during the last two decades, innovative teaching methods aimed at engaging students have been broadly discussed, and this interest has been boosted after the COVID-19 pandemic. Those methods include flipped learning, case studies, problem-based learning, storytelling, gamification, collaborative learning, experiential learning, just-in-time learning, social media, and self-learning.

COIL (Collaborative Online International Learning) is an innovative teaching method offering students the possibility to experience international cooperation and develop intercultural skills by using digital technologies. This online teaching method became popular recently, based on the experience gained by higher education institutions during the COVID-19 pandemic. COIL is an effective and convenient teaching method used to provide students with the experience of „internationalisation at home".

The COIL engages students, teachers, and business partners with different educational needs and expectations. Thus, the question arises as to what extent this teaching method can address those needs. Therefore, the main objective of this paper is to identify the main benefits and limitations of the COIL method in economic higher education based on the empirical survey results.

The survey was conducted after the successful COIL implementation in 2023/2024 in several courses at the University of Economics in Katowice, Poland. The COIL method was applied in the form of three different models and was organised in cooperation with partners from several European universities. In particular, the COIL method was applied within a course devoted to Digitalisation and Sustainability, aiming at developing projects on business plans for start-ups using innovative technologies to enhance sustainable development.

The paper is structured as follows: the second section presents the COIL concept and assumptions for its implementation; the third section focuses on research methodology; and the next section presents the stakeholders' assessment of the COIL method. The paper ends with concluding remarks.

2. COIL Method in Economic Higher Education- the Concept and Implementation

2.1 The Characteristic of the COIL Method in Economic Higher Education– Theoretical Framework

The evolution of the COIL method commenced at the beginning of the 21st century. The growing interest in implementing this method results from constraints on physical mobility and the development of virtual exchanges and networks (Rubin, 2017; Rubin and Guth, 2022; Hacket et al., 2023). COIL represents a relatively new method with ongoing literature and research development. Most of the existing literature addresses rather the broad concept of "virtual exchange" or "international virtual exchange", often through case studies offering descriptive analyses of implementing and leading exchange. The literature review reveals that international virtual exchange has primarily served language learning, peacebuilding, and developing international cultural competencies. Most exchanges involve a one-to-one relationship between two institutions rather than leveraging a network of partners (Woodman and Kastler, 2020). The studies directly focusing on the COIL method present its model, emphasise that the method creates the space for shared course design and implementation, enhances learning outcomes and promotes cultural awareness through interactions with international counterparts (Vahed and Rodriquez, 2020). They also stress the role of administrative support in enhancing the sustainability of the COIL programs (Guth and Rubin, 2015; Rubin, 2016).

Several characteristics make COIL unique compared to other initiatives. Firstly, it fosters peer-to-peer experimental learning focusing on teamwork skills and facilitates developing digital skills by learning how to work remotely and manage digital tools professionally. The term "COIL" itself is transparent and explicit in describing the practice and benefits of collaborative learning for both educators and students (Rubin, 2017). In practical terms, it involves two or more educators from different geographic locations collaborating online to design a shared syllabus for their students. This syllabus includes joint online group assignments with co-created learning outcomes. The method focuses on subject-specific knowledge and intercultural competence development, making it adaptable to various disciplines.

Typically, a COIL course involves the creation of multicultural student teams comprising individuals from each participating institution. During this process, educators intentionally design assignments with intercultural learning in mind and facilitate and promote this collaborative learning throughout the COIL course. The primary goal of this collaboration is to broaden students' understanding of course content and to help them develop intercultural competencies. In doing so, COIL offers students an authentic international learning experience at their home institution rather than at an institution abroad (Woodmann and Kastler, 2020).

It is important to emphasise that the COIL implementation is not a goal. COIL should be treated as a tool for achieving learning outcomes and providing students with the necessary knowledge, skills, and mindset. As a complex academic endeavour, it requires careful consideration and planning before implementation. Using a COIL format changes teaching methods and requires technological integration (Alvarez and Steiner, 2019).

Only a few studies have examined implementing the COIL method in economic higher education. For instance, Marilú Marcillo-Gómez and Desilus (2016) examined students in International Business Courses at two universities: in the United States and Mexico City. The topics referred to intercultural communication, culture structure, cultural values, guidelines for behaviour, and cultural influences on communication contexts. Mestre-Segarra and Ruiz-Garrido (2022) explored students' reflections and the experience of 23 learners from different nationalities enrolled in a business-related master's degree. Similarly to previous research, they analysed the application of language and content, along with cross-disciplinary skills and cultural awareness. Kjølseth and Siddiq (2023) investigated how students perceive and describe group work in an online course in international business. O'Dowd (2019) explored different virtual team models, referring to business-focused competencies needed in professional settings, albeit with a focus on foreign language skills. Additionally, other studies analysed how the COIL method may be used for teaching entrepreneurship (Katre, 2020; Romero-Rodriques et al., 2022; Elenurm, 2022). To the best of the authors' knowledge, no research has referred to digitalisation and sustainability so far.

2.2 The COIL Implementation in the "Digital Transformation and Sustainability" Project

The main objective of the COIL project was to present and discuss the convergence of digitalisation and sustainability, focusing on the main opportunities and challenges. The course introduced the problematics of digitalisation and its impact on business and individuals' daily lives. The main course objectives refer to the following questions:

- How do emerging technologies transform industries and business models?

- How can digitalisation support the socio-ecological transformation of the economy?
- How might new business models built on digital technologies positively impact sustainability?
- How do these questions relate to regional and international business environments?

As presented in Table 1, the international teams were diversified, including first-year undergraduate students in bachelor programs in International Management, Economics, and Ethics (UCO Angers) and bachelor and master students in Finance and Accounting programmes (UE Katowice). The total number of fixed meetings was 8, but the students were also collaborating in subgroups between meetings.

Table 1: The COIL project metrics

The metric	**Description**
Title	Digital Transformation and Sustainability
Institutions	Universite Catholique De L'Quest, Angers, France (UCO Angers) University of Economics in Katowice, Poland (UEKAT)
Number of students	40, including: • 29 UCO Angers students • 11 UEKAT students
Model of realisation	additional elective course created for COIL purposes
Language	English
Type of module	fully online
Duration	6 weeks (from March 10 to April 21, 2023)
Number of general meetings/ duration	4 meetings/ 15 hours
Number of students' interim meetings/ duration	at least 4 meetings/ according to the students' needs

Source: Own elaboration

The COIL implementations included three stages: a preparatory phase, a course launch, and course facilitation, each involving specific activities as outlined in Figure 1.

During the preparatory phase, the COIL expert conducted COIL Design Workshops for university teachers. Based on the knowledge shared during those workshops, the teachers collaborated on course design and curriculum.

The project was launched in the summer semester of the academic year 2022/2023. The COIL method was applied in the form of three different models and was organised in cooperation with partners from several European universities. Specifically, the COIL method was applied within a course focused on Digitalisation and Sustainability. From March 10 to April 21, 2023, the course included four general meetings for participants. The first meeting (4 hours) introduced the project and was focused on team building. The second meeting (3 hours) facilitated monitoring of students' progress and included a mid-evaluation. Students presented their projects and shared their experiences during the last two meetings (2 meetings, 4 hours each). Additionally, four interim meetings for individual groups were scheduled to facilitate project work and consultations with teachers. Each group could choose the most suitable time and software solution to organise their project work. They also had the opportunity to ask for advice and discuss their outcomes with Polish and French teachers. The students were required to submit brief reports on their interim meetings as part of their assessment. The last stage, comprising COIL facilitation, is described in the next section.

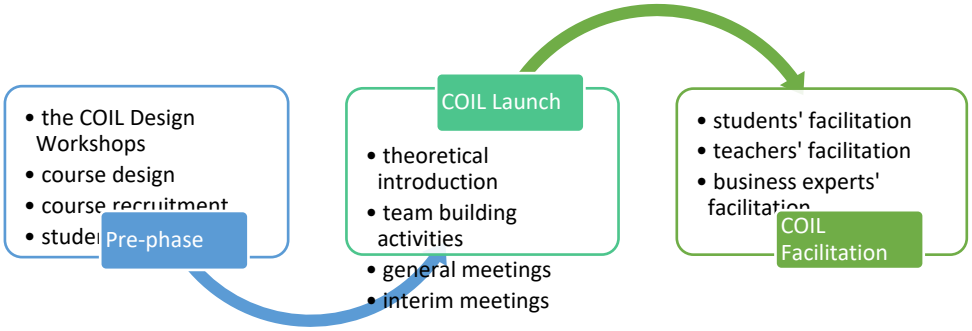


Figure 1: The stages of the COIL project. Source: Own elaboration

3. COIL Assessment - Research Methodology

As part of the teaching quality assessment and improvement process, the COIL project's stakeholders - students, teachers, and business experts - were asked about their opinions on the various aspects of the COIL project (Figure 2).

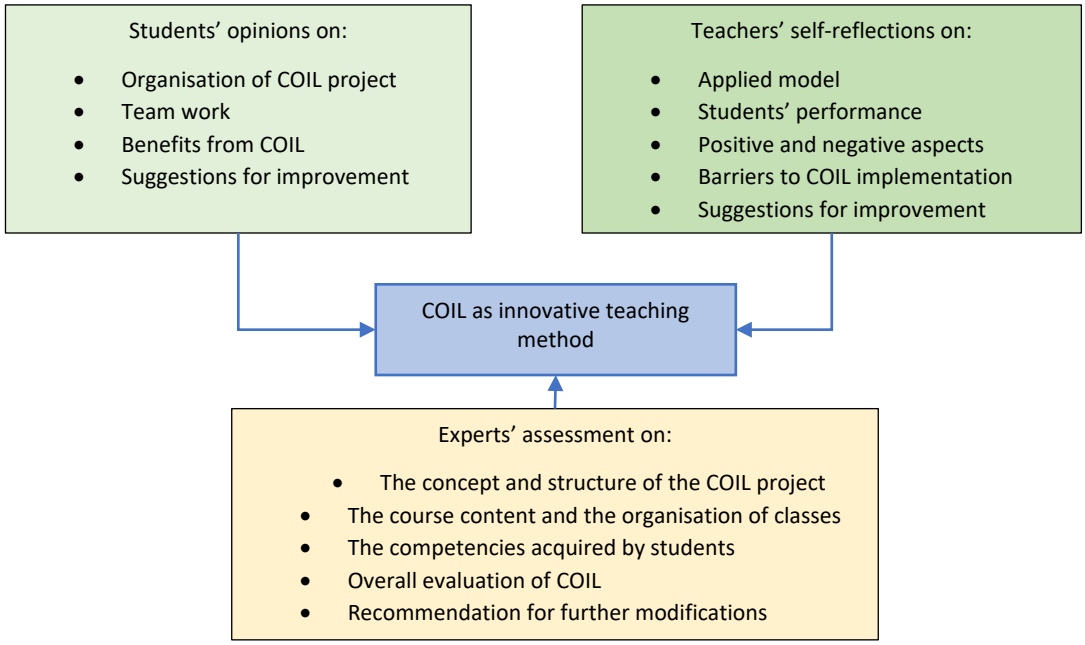


Figure 2: The scope of COIL project's evaluation. Source: Own elaboration

The students' opinions on the COIL project were collected through a closed and open-ended survey questionnaire. For closed questions, students were asked to select their answers using a 5-point Likert scale, where 1 means "definitely not" and 5 means "definitely yes". Additionally, the open-ended questions allowed students to provide their comments and suggestions. The survey was distributed to all 40 students participating in the COIL project, and 24 students (both from UEKAT and UCO Angers) responded, resulting in a response rate of 60%. Similarly, teachers shared their opinions through the questionnaire, while the business expert prepared reports using an assessment form. Three opinions from teachers and three expert assessments were collected in this manner.

4. The stakeholders' assessment of COIL implementation – the research results

4.1 Students' Evaluation

The first part of a survey questionnaire addressed to students consisted of 11 closed questions related to the organisation of the COIL project. Table 2 presents the mean results for these answers.

Table 2: The students' opinions on the organisation of the COIL project

No	The organisation of the COIL project	Mean
A1	Were the goals of COIL clearly explained?	3,88
A2	Do you find the team-building activities successful?	3,29
A3	Do you find icebreaking activities successful?	3,42
A4	Are you satisfied with the digital platform used during the virtual meetings?	4,21
A5	Do you find the theoretical introduction sufficient to run the project tasks?	3,25
A6	Do you find the information about the project task sufficient?	3,92
A7	Do you find the information on evaluation criteria sufficient?	3,83
A8	Was the number of virtual meetings sufficient?	4,00
A9	Do you feel the workload on the project was adequate for the reward?	3,52

No	The organisation of the COIL project	Mean
A10	Do you find the project task complicated?	3,33
A11	Do you find the project task time-consuming?	3,58
	Overall assessment	**3,65**

Source: Own elaboration

Students assessed positively all aspects of the organisation of the COIL project with a final score of 3,65. Particularly, the digital platform used during virtual meetings received the highest score of 4,21 (A4). While students generally found the number of virtual meetings sufficient, some suggested having more frequent but shorter joint meetings to better monitor progress on the final presentation. However, the theoretical introduction and team-building activities received lower scores, ranging from 3,25 to 3,29 (see Figure 3 for details).

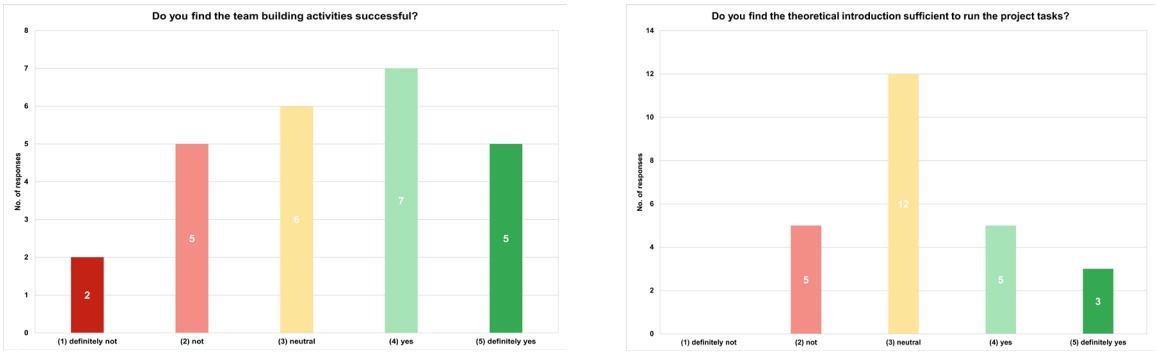


Figure 3: Answers to questions A2 (panel B) and A5 (panel B). Source: Own elaboration

The second aspect of the students' assessment was related to teamwork, which was evaluated through four closed questions. The mean results for the answers to these questions are presented in Table 3.

Table 3: The students' opinions on the teamwork

No	The teamwork in the COIL project	Mean
B1	Did you have any problems in organising meetings with team members?	3,29
B2	Did you find the workload of the project team members balanced?	3,08
B3	Did you have any communication problems with your team?	2,83
B4	Did you enjoy the collaboration with your team?	3,75
	Overall assessment	**3,23**

Source: Own elaboration

Students also positively assessed the teamwork-related aspects of the COIL project. Overall, students enjoyed the collaboration (3,75) and felt that the workload was balanced within their teams (3,08). However, some students mentioned difficulties in organising meetings with team members. Altogether, 13 out of 24 students selected answers 4- "yes" and 5 – "definitely yes" for this question (B1). However, they indicated lower importance of communication problems with their teams: only 9 students selected answers 4 "yes" and 5 "definitely yes" for this question (B3, see figure 4 for details).

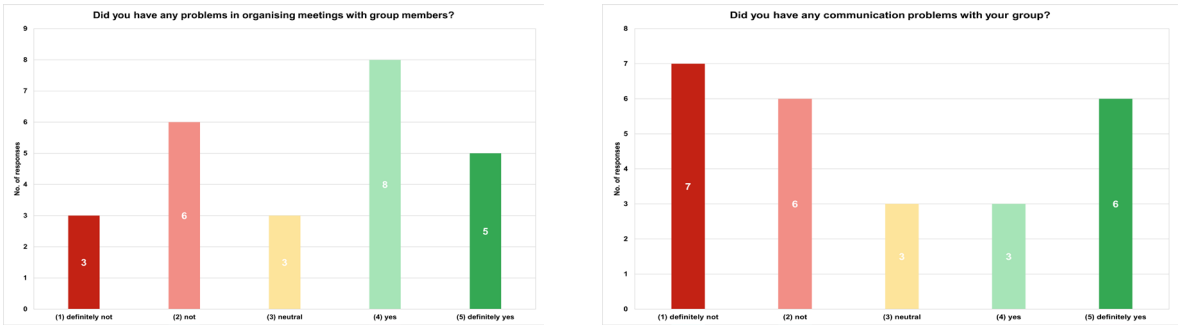


Figure 4: Answers to questions B1 (panel B) and B3 (panel B). Source: Own elaboration

The third part of the survey questionnaire focused on the educational and internationalization benefits of the COIL project. The answers to the 9 closed questions included in this part are presented in Table 4.

Table 4: The students' opinions on the benefits of the COIL project

No	The benefits of the COIL project	Mean
C1	Do you find COIL as valuable teaching method?	3,79
C2	Did COIL help you develop your competencies in international teamwork?	3,62
C3	Did COIL help you to improve language skills?	3,75
C4	After the COIL experience, do you feel better prepared for online project work?	3,75
C5	Would you be interested in taking part in the COIL project once again?	3,08
C6	Overall, do you find project important for developing international skills?	3,92
C7	Overall, do you enjoy taking part in the COIL project?	3,46
C8	Have you been interested in being an exchange student and studying a semester abroad (before COIL experience)?	4,00
C9	Are you interested in being an exchange student and studying a semester abroad (after COIL experience)?	3,96
	Overall assessment	**3,70**

Source: Own elaboration

The assessment of the benefits of the COIL project received the highest score of 3,70, indicating that students generally valued their participation in the project. However, question (C5) concerning future participation in the COIL project received the lowest score of 3,08, with only 9 students selecting answers indicating a willingness to participate again (see Figure 5 for details). Nevertheless, students appreciated the COIL method as a way to develop international skills (3,92), improve language skills (3,75), be prepared for online project work (3,75) and gain competencies in international teamwork (3,63). Additionally, the majority of students (17) agreed that COIL is a valuable teaching method. However, only 11 students stated that they enjoyed taking part in the COIL project (C7, see Figure 5 for details). Interestingly, the COIL experience slightly reduced interest in being an exchange student and studying abroad (compare results for questions C8 and C9).

In the open questions, students provided positive comments on the benefits of the COIL project, such as gaining knowledge on sustainability, developing skills related to teamwork, widening experience with international communication and group project management, discovering new ways of working and communicating, knowing better other cultures, establishing international relationships, and practising social skills. Overall, students' opinions show their satisfaction with the COIL project experience.

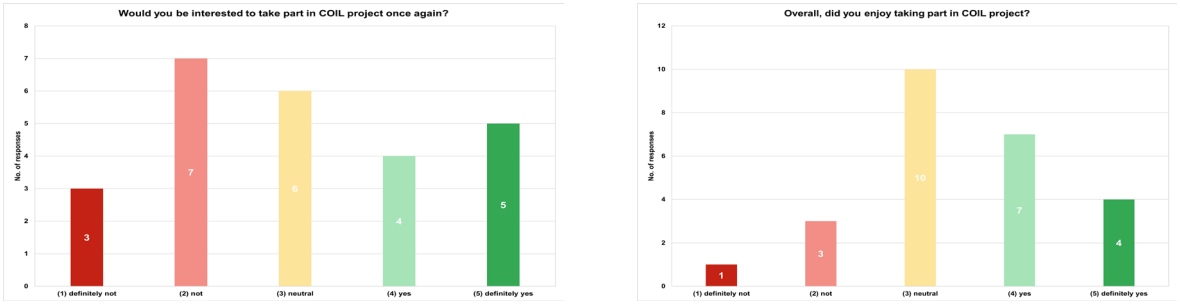


Figure 5: Answers to questions C5 (panel A) and C7 (panel B). Source: Own elaboration

4.2 Teachers' Evaluation

When asked to reflect on this innovative teaching method's positive and negative aspects, teachers evaluated the applied model, students' performance, organisation, and barriers to implementation.

The applied model was based on the additional elective course created for COIL purposes. Such a model offers flexibility in scheduling joint meetings. It can also be used for students from various study programs who may be enrolled in elective courses. However, this model requires many additional formalities for teachers, students and university authorities:

- the necessity of obtaining the rector's and dean's approval to launch an additional elective course,
- the requirement to create particular additional exam protocols for students enrolled in this course,
- the organisation of student registrations for the additional elective course (risk of low student interest in the extra elective course and underrepresentation of students from one partner university),
- upon completion of the subject, students must submit their application to the Dean for the accreditation of ECTS points received from the COIL project.

Teachers positively assessed students' performance - the high quality of their final presentations due to international cooperation and the exchange of diverse experiences and perspectives, despite encountering difficulties in organising teamwork. In teachers' opinion, the COIL project offers an invaluable opportunity for practising teamwork skills within the international environment. On the other hand, teachers recognised the importance of difficulties in teamwork organisation, notably in finding a suitable time frame for all team members. This problem was enhanced by the disproportionate representation of French students within teams, which led to the marginalisation of Polish students' scheduling preferences.

Finally, the teachers admitted that organising the COIL project requires considerable time, involving multiple coordination meetings with teachers from the partner universities, which creates an additional workload. However, this is balanced by the satisfaction derived from witnessing the positive results of students' work. Additionally, teachers confirmed that online activities serve as both disruptors and facilitators of the process. Despite occasional difficulties with managing the timetable, all teams successfully prepared for the final presentation.

According to teachers, the significant barriers to the successful implementation of the COIL projects can be classified into organisational, content-related and technical barriers (Table 5).

Table 5: Barriers to the COIL project

The barrier type	Characteristics
organisational	the limited administrative support to the organisation of international teamwork difficulties in managing communication in international teams limited possibility to find partners willing to engage in joint projects for part-time students (Sunday-Saturday teaching days) limited number of teachers willing to participate in the COIL projects due to the additional organisation workload various regulations and organisational requirements at the partner universities
content-related	lack of balance in the level of knowledge and skills among students from different universities differences in study programs and subjects at the partner universities

The barrier type	Characteristics
technical	difficulties in accessing online platforms, including indicated information sources and study materials

Source: Own elaboration

Teachers also formulated several suggestions for future COIL project organisation at the UEKAT by addressing the existing regulations and the implemented solutions. Ahead of the project launch, all students should undergo training if electronic platforms beyond those typically used within the university are employed. The quality of COIL project implementation could be improved by engaging the universities' planning department in the preparatory phase. This would entail aligning the schedule with students' existing lectures and classes, ensuring their optimal participation in the COIL project. The number of students enrolled in the COIL project could be enlarged by assigning more European Credit Transfer and Accumulation System (ECTS) points compared to other elective courses conducted in Polish. The procedure of granting ECTS points for the COIL project in the form of an elective course should be automatised.

4.3 Business Experts' Evaluation

The external business experts, who also have experience in lectures and workshops for students, were invited to assess the courses based on the COIL documentation (course description cards, study materials for students, and exemplary students' presentations). They were asked to assess the COIL projects with regard to the concept and structure of the project, its implementation, the competencies acquired by students, and the overall evaluation of COIL as an innovative teaching method. The experts were asked to answer the questions using a 5-point Likert scale where 1 means "definitely not" and 5 means "definitely yes".

Table 6 presents the mean results for the answers related to the COIL project's concept and structure.

Table 6: Experts' opinions on the concept and structure of the COIL project

No	The concept and structure of the COIL project	Mean
A1	The goals and content of COIL were properly defined	5,00
A2	The communication process was planned correctly	4,67
A3	The principles of cooperation among students were properly planned	4,67
A4	The tasks designated for students to develop were harmonised with the course objectives	5,00
A5	The assessment criteria for student projects were appropriately planned	5,00
Overall assessment		**4,87**

Source: Own elaboration

Regarding the concept and structure of the COIL project, the experts highly assessed the design of the project (A1) and the clear communication from teachers regarding tasks (A4), principles of cooperation (A3), and assessment criteria for students (A5). The overall assessment of this COIL project aspect was the highest, with a score of 4,87.

The mean results of the answers related to the COIL project implementation are presented in Table 7.

Table 7: Experts' opinions on the implementation of the COIL project

No	The implementation of the COIL project	Mean
B1	The software and other IT tools were properly selected for implementing COIL	5,00
B2	The materials for students were available online before the planned activities and tasks	4,33
B3	Online activities related to integration and building international teams were planned	5,00
B4	Students had the opportunity to choose the project topics	4,33
B5	Students had the opportunity to choose communication tools	5,00
Overall assessment		**4,73**

Source: Own elaboration

Regarding project implementation, the experts appreciated the students' ability to choose project topics (B4) and the communication tools for teamwork (B5). They acknowledged the possibility of using various teaching methods and teamwork tools. They also valued the effectiveness of the icebreaking and team-building activities during the first joint meeting (B3). They emphasised the importance of selecting proper software and other IT tools for online meetings, communication between meetings and resource platforms (B1).

Six dimensions further assessed the students' competencies gained by participating in the COIL project. The mean results are presented in Table 8.

Table 8: Experts' opinions on the students' competencies

No	The students' competencies	Mean
C1	COIL enables understanding of cultural differences and increases tolerance	5,0
C2	COIL enables the development of participants' language skills	5,0
C3	COIL facilitates the development of teamwork skills	4,75
C4	COIL enables understanding of the international context of discussed issues	4,75
C5	COIL enables the practical application of acquired knowledge and skills	4,00
C6	COIL increases students' chances of finding employment	4,33
Overall assessment		**4,64**

Source: Own elaboration

In the context of the student's competencies, the experts appreciated that COIL helps students to:

- understand cultural differences,
- increase tolerance, integrate and build relationships,
- develop their English skills and teamwork skills,
- apply critical thinking, searching for and selecting sources of information,
- develop their independence and responsibility for organising teamwork activities,
- understand the international context of discussed issues,
- gain digital skills by using IT tools for online teamwork and communication,
- apply the acquired knowledge and skills in practice,
- increase their chances of finding an attractive job.

Additionally, the experts confirmed the importance of topics covered by the COIL project as the nexus between sustainability and digital transformation is very up-to-date and focused on real-life business models and technological solutions.

They also provided recommendations for improving COIL in the future. Experts proposed planning more time during classes for students' free expression. They suggested adding a brief evaluation session during the final meeting, which may provide an opportunity for students to analyse their actions, recognise their impact on the team's work organisation, and take responsibility for the course of this work. Discussing challenges and actions taken by students to overcome them from a broader perspective could be a catalyst for interesting conclusions and the development of competencies useful in students' future professional careers. The experts also recommended additional topics that could be included in the COIL projects, such as technology transfer or sources of funds for sustainable projects.

5. Discussion and Conclusions

The main findings of our case study suggest that all students appreciate the advantages of COIL, such as the possibility to gain international experience, improve communication and intercultural skills, and learn the basics of project management. Similar to Katre's (2020) research the results show that collaborating in cross-cultural teams, supported by appropriate technologies for effective synchronous and asynchronous communications, can equip students to develop a deep understanding of their own and other people's cultures. This aligns with the results of Vahed and Rodriguez (2020), who discovered that COIL positively influenced intercultural awareness and stimulated students to be globally engaged.

However, students also signalled some challenges related to work organisation within international teams. Teachers, in general, are satisfied with the quality of students' cooperation outcomes, although the application

of the COIL method requires lots of administrative work and the development of new skills related to this innovative method. Similarly, business partners highly assessed the benefits of the COIL method for students in terms of their future professional careers and the skills required by future employers. The relatively lower scores given by students compared to the assessment by experts may stem from the different perspectives and time horizons. Experts, as external stakeholders, focused more on the COIL method as a tool for developing important skills related to international cooperation, communication and teamwork organisation (long-term perspective). In contrast, students, as internal stakeholders activiely participating in the COIL project, were more focused on the immediate process of using the COIL method for this particular course and working within this specific team (short-term perspective).

When designing future COILs, teachers should allocate more time to team-building activities and theoretical presentations on the project's topic. They should also pay closer attention to how team member meetings are planned, organized, and supervised. Alvarez and Steiner (2019) stressed the importance of structuring and preparing the course. Stronger administrative support could facilitate the teachers' increased engagement. Previous research also pointed out this postulate (Marcillo-Gomez and Defilus, 2016; Rubin, 2017).

Making attendance in the COIL courses more attractive for students requires planning them as electives for more credits than standard ones. Marcillo-Gomez and Defilus (2016) shared the same recommendation based on their research.

Our results contribute to previous studies examining the COIL method as a new pedagogical technique. Most of them give little attention to the practical components of designing and implementing COIL projects. Although the existing practitioner-based resources share tips and insights for designing projects, they do not provide empirical evidence to support program design decisions in economic higher education. Future research should focus on specific elements within the COIL framework to determine what could lead to greater student learning outcomes.

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Open Innovation Capabilities and Competences

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Abstract: Productivity can be enhanced and competitive advantages can be gained by using an open innovation approach instead of a closed innovation approach. The successful implementation of an open innovation approach requires careful examination of the existing innovation capabilities and competences of a company. This study aims to explore and give a picture of the current level of open innovation capabilities and competences of companies with particular emphasis on companies in Finland. A quantitative approach was followed and a 13-item survey was administered. The reliability of the survey used was .957 and its items included statements regarding the five-level maturity model for open innovation. Level five of the model represents the highest maturity level and level one of the model corresponds to the lowest. Claims regarding maturity level one were excluded as innovation activities do not occur at this level. The survey was administered in both 2022 and 2024 and consisted of three questions for each maturity level from level two to level four and four questions for level three. Maturity levels four and five indicate that companies understand the significance of strategic thinking and that they also include innovation strategies within their general strategy or perceive it as an integral addition to their strategy. We conclude that the effective open innovation culture forms an essential part of the overall success of a company. Therefore, an increase in innovation culture characteristics simultaneously results in an increase in the innovation maturity level.

Keywords: Innovation maturity, Open innovation, Innovation competences

1. Introduction

Open innovation has emerged as a contemporary concept for businesses that want to capture external ideas for generating value and minimizing risks. Chesbrough (2019) coined the open innovation expression and defined it as "*a paradigm that assumes that firms can and should use external ideas as well as internal ideas, and internal and external paths to market, as the firms look to advance their technology*". After a decade, Chesbrough and Bogers (2014) defined open innovation as *"a distributed innovation process based on purposefully managed knowledge flows across organizational boundaries, using pecuniary and non-pecuniary mechanisms in line with the organization's business model".* The central theme in these two definitions is that innovation is co-created in collaboration between external stakeholders.

By opening up the innovation process to employees, customers and external innovation partners, valuable insights and knowledge that will improve outcomes and benefit future activities will be gained. The internal innovation team members will work together with external networks aiming for a win-win situation for all involved stakeholders. Hence, open innovation facilitates improved employee engagement, access to talents, and creation of lucrative partnerships. The incorporation of open innovation practices in an organization signifies more than a strategic choice; it represents a paradigm shift towards collaborative, externally oriented approaches to problem-solving and value creation (Malodia et al, 2023). For example, Luan et al (2024) showed that open innovation impacts digital transformation, i.e. integration of digital technologies into all aspects of an organization. Their results offered empirical insights into the complex relationship between open innovation and technological development. They divided technological capabilities into technological maturity and technological diversity and highlighted their significance as channels through which open innovation influences digital transformation.

Siakas et al (2014) emphasized that key factors for success embrace organization specific knowledge and capacity to exploit this knowledge. Other success factors are related to collecting and building up firm specific knowledge, low levels of uncertainty regarding present and future technology developments, and understanding

of market demands and competitive threats. Hence, internal structures and processes must continuously be balanced to meet conflicting requirements regarding how to identify, capture and exploit specialized knowledge across technological fields, business functions and product divisions. Open innovation supports ideas flowing out of the organization for evaluation, sharing and exploitation and flowing back into the organization as new offerings and new business models. Moreover, ideas from other organizations may be evaluated, shared, and exploited. A core issue in open innovation is finding the right balance and mechanism between intellectual protection and openness in adopting open innovation.

The main aim of innovation is to create and sustain value (Siakas et al, 2016). The quest to innovate drives the organization to capture information and knowledge externally and transfer the obtained knowledge to the internal knowledge base for contributing to the creation and delivery of value (Lampropoulos & Siakas, 2018). This contributes to the dynamic capability of the organization which facilitates performance increase, profits, and organizational growth, reaching out to new markets. Openness promotes visible operations among dynamic capabilities through commitment of various stakeholders. Openness also facilitates understanding of opportunities and threats. Increased customer value enables companies to optimize revenue. A by-product of an open innovation approach is the identification of partners for the whole open innovation value chain.

Digital technologies of today enable collaboration across geographical distances with limited resources (Enkel et al, 2020; Kanakaris et al, 2019). They facilitate identification of suitable knowledge owners and partners for collaboration (Makkonen et al, 2019). Access and integration of large numbers of diverse and dispersed external unknown individuals can be achieved with the use of social media (Makkonen et al, 2020; Siakas et al, 2016) and crowdsourcing (SIakas and Siakas, 2020). When using crowdsourcing, organizations open up to the public, usually starting with their customer base to obtain ideas. Hence, it is an outside-in open innovation approach.

Open innovation provides new prospects for obtaining more and better resources, data and diverse means for carrying out a project. It also provides opportunities for networking and connecting with potential partners, collaborators and investors. Knowledge management systems are tailored to each organization separately. In order to identify potential organizations for collaboration in open innovation it is important to assess and understand the KM maturity of that organization (Peirera et al, 2021).

This paper examined the maturity of open innovations through the Open Innovation Maturity Model designed by Enkel et al (2011). The study aimed to investigate the open innovation maturity by using an online questionnaire that was responded to by 145 part-time students working in diverse Finnish companies. The aims were to increase awareness of the importance of maturity related to knowledge management and innovation practices for keeping up with globalization (see eg. Siakas et al, 2020) and for using smart technologies to a higher degree (see e.g. Lampropoulos et al, 2024).

2. The Open Innovation Maturity Model

Rocha et al (2019) emphasized that maturity is an indication of the measurement of organizational capability and maturity models offer simple but effective ways for measuring quality of processes. Companies can obtain an overview of their innovation capabilities by using maturity models. Maturity models can help meet challenges faced by a rapidly changing environment and also allow companies to enhance their competitive advantages. One maturity model of open innovation as applied in a previous study (Makkonen et al, 2023), which examines the maturity level of open innovation in any company (Enkel et al, 2011). The open innovation maturity model includes five maturity levels as follows:

> *"Level 1 —Creative individual attempts are dismissed. The organization focuses on day-to-day operations. Innovation output is inconsistent and unpredictable".*
>
> *"Level 2 —The need to innovate is identified; innovation is clearly defined. There is a basic understanding of the influential factors. Innovation output is inconsistent but traceable".*
>
> *"Level 3 —Appropriate practices, procedures and tools are in place, innovation is encouraged among employees. Outputs are consistent and ensure sustained market share and positioning".*
>
> *"Level 4 —Practices, procedures and tools for integrating innovation activities are used. A deep understanding of the internal innovation model and how it relates to business requirements has been established. Innovative outputs are consistent, diverse and a source of differentiation"*

> *"Level 5 —Practices, procedures and tools are institutional. Individuals are encouraged to innovate. Synergy is achieved through the alignment of business and innovation strategy and synchronization of activities. Outputs provide sustained competitive advantages in existing and new markets."*

This study aims to establish the maturity levels of companies, in particular their readiness to adopt and integrate open innovation by using the maturity model. Paulk et al (1993) highlight the importance of maturity models in achieving Improved performance through innovation efforts and Enkel et al (2020) note that companies can utilize open innovation strategically to enhance their innovation capabilities

3. Our Study

Using the maturity model as a basis for examining the innovation levels, a survey was conducted both during spring 2022 and during the spring of 2024. The aim of the questionnaire was to reveal the status of the open innovation maturity in the companies especially in Finland. The participants were given a set of claims in the open innovation context. It should be noted that claims regarding maturity level 1 were excluded as innovation activities do not occur at this level. Therefore, the questionnaire contained claims related to the maturity levels 2 to 5. Three innovation related claims were included for each of the maturity levels. The three claims were as follows:

Level 2:

1."The necessity of innovation is identified in your organization" (level 2)

2."The meaning of the word Innovation is clearly defined in your organization" (level 2)

3."There is a basic understanding of the influential innovation factors in your organization" (level 2)

Level 3:

4."Appropriate practices, procedures and tools are applied" (level 3)

5."Innovation is encouraged among employees" (level 3)

6."Innovation outputs are consistent and ensure sustained market share and positioning" (level 3)

Level 4:

7."Practices, procedures and tools for integrating innovation activities are used" (level 4)

8."Internal innovation model has been established in your organization which is deeply understood and it relates to the needs of your business" (level 4)

9."Innovative outputs are consistent, diverse and a source of differentiation" (level 4)

Level 5:

10."Innovative practices, procedures and tools are institutional" (level 5)

11."Individuals are encouraged to innovate" (level 5)

12."Collaboration is achieved through business and innovation strategy alignment as well as synchronization of activities" (level 5)

13."Innovation outputs provide sustained competitive advantage in both existing and new markets" (level 5)

The participants were given these aforementioned claims and were then able to provide their comments on open innovation activities. The focus was on elements and activities promoting open innovation as well as hindering it. The participants work in various fields including technology companies such as sawmills, ICT, steel and zinc industries, chemistry, public health care and public rescue services.

The data collection was undertaken by administering an online questionnaire uploaded on to the Webropol platform as well as the use of a paper-based one. The participants rated each item (variable) of attributes on a Likert scale of 1 to 5 where 1 meant "Not at all important" and 5 meant "Extremely important". Statistical analysis was carried out using Excel.

4. Data Analysis

The data collected was analyzed using IBM Statistical Package for the Social Sciences (SPSS) and descriptive statistics were used. Specifically, the data used derived from a total of 145 higher education students who were involved in this study. The students were enrolled in engineering, business and healthcare programs, representing both the public and private sector as well as a great variety of industries. However, the responses of 4 students were missing several answers to the questions of the questionnaire and they have been removed from the analysis. The Cronchbach's Alpha of the 13-item survey was .957 which renders its constructs and items highly reliable. As a result, the data of 141 higher education students, 70 female (56.03%) and 62 male (43.97%) students, are presented in this study. Students came from 17 different countries. However, as the study was mainly run in Finnish universities, the vast majority of the participants (78.01%) are students whose country of origin is Finland. Most students were pursuing Master degree programs (freq.: 81, perc: 57.45%) followed by students pursuing Bachelor degree program (freq.: 54, perc: 38.30%). Six students (4.26%) were pursuing different professional programs. Apart from one participant who did not specify whether they attended their program as a part time or full-time student, most students (freq.: 97, perc: 68.79%) were attending as part time students followed by full-time students (freq.: 43, perc: 30.50%). Given the background of the students examined, this outcome is justifiable as the vast majority of them were also working. Specifically, a total of 119 students (84.40%) answered that they were employed while 21 students (14.89%) were unemployed. One student did not disclose their working status. There was a similar distribution among the different types of companies regarding their entity being international (freq.: 49, perc: 34.75%), nationwide (freq.: 44, perc: 31.21%), or local (freq.: 40, perc: 28.37%). Eight students (5.67%) did not specify the entity of their current or previous company. The distribution of the companies' size is presented in Figure 1. Based on the results, employees from small, medium, and large companies participated in this study. When asked what their position level was, most students had a mid-level position (e.g., expert with responsibility) (freq.: 62, perc: 43.97%) followed by an operational level position (e.g., worker) (freq.: 36, perc: 25.53%) and an executive level position (e.g., management) (freq.: 35, perc: 24.82%). Eight students (5.67%) had a different position based on the options given. Students' working experience varied and the results are depicted in Figure 2.

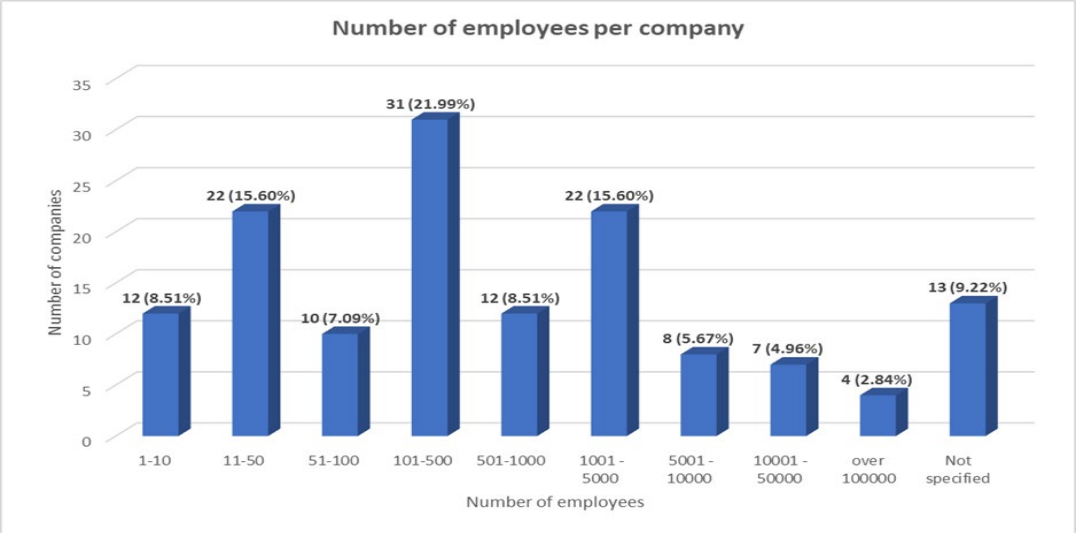


Figure 1: Distribution of company size

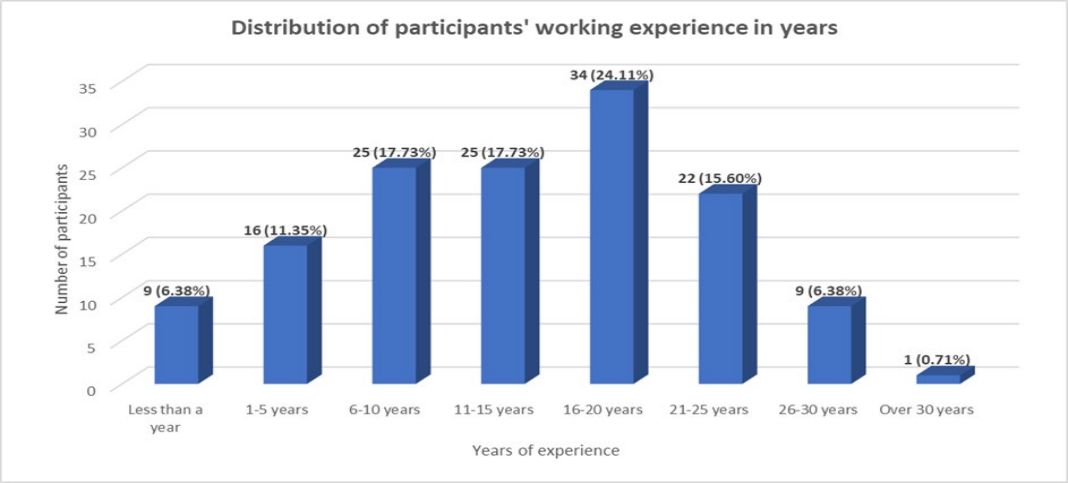


Figure 2: Distribution of participants' working experience

Furthermore, the responses to the 13-items of the questionnaire related to companies' maturity level are presented in Figure 3. Questions 1-3 refer to maturity level 2, questions 4-6 are related to maturity level 3, questions 7-9 refer to maturity level 4, and questions 10-13 are related to maturity level 5. All questions used a Likert scale from 1 to 5. Based on the results, it is obvious that mostly positive responses in terms of the importance of the practices and statements are observed. However, the neutral responses are also high. On the contrary, there are fewer responses which regard these matters to be of lesser or no importance at all.

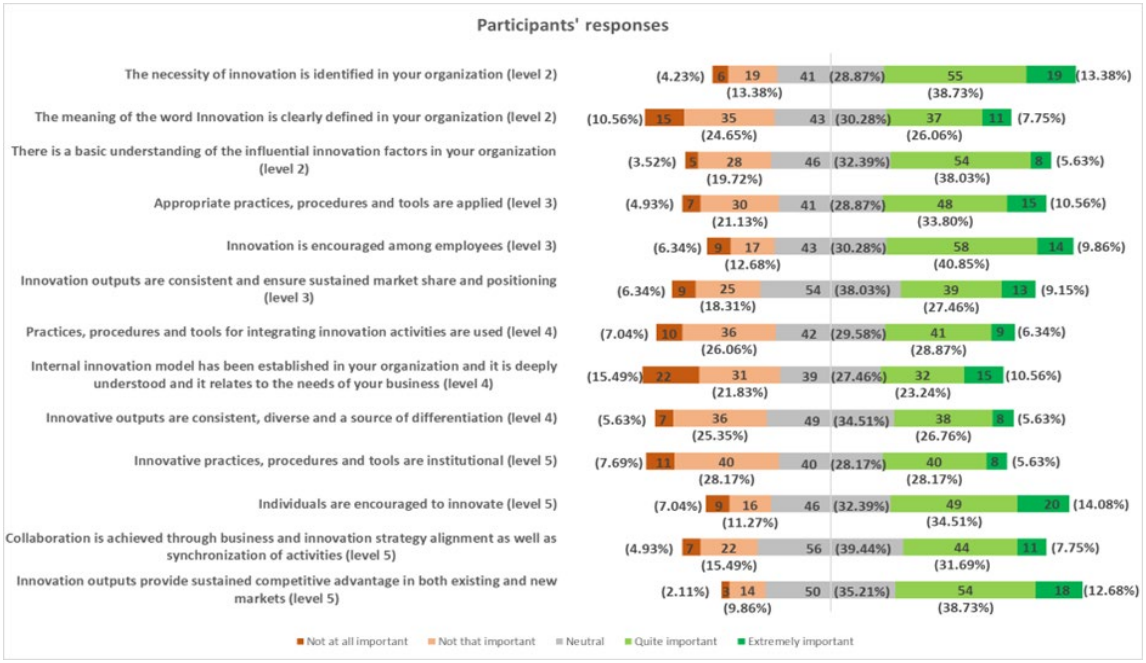


Figure 3: Distribution of participants response to each question related to company's maturity level

Moreover, Tables 1-4 present the mean value of the participants' responses to each question. Based on the outcomes, when taking the mean value of the participants' responses into account, it can be inferred that the open innovation thinking capabilities of the companies examined are mostly focused on maturity Levels 5, 3, and 2 while Level 4 has the lowest mean value. Therefore, companies should focus more on actions that would also help them improve in that regard to achieve better innovation competences and organization cultures. From Table 3 it can be observed that lowest mean value has been received to the response " our organization internal innovation model has been establish and it is deeply understood and it has relation to the needs of our business ", thus greater emphasis should be given to establishing innovation models and to understanding the correlation between business needs and innovation models.

Table 1: Maturity Level 2 statements

Statement	Average
The necessity of innovation is identified in your organization (in Finnish Tarve innovaatiotoiminnalle on identifioitu organisaatiossasi)	3.44
In your organization the meaning of the word Innovation is clearly defined (in Finnish Innovaation käsite on organisaatiossasi selkeästi määritelty)	2.96
In your organization there is a basic understanding of the influential innovation factors (in Finnish Organisaatiossasi on perusymmärtämys innovaatioihin vaikuttavista tekijöistä)	3.23
Mean of responses at Maturity Level 2	3.21

Table 2: Maturity Level 3 statements

Statement	Average
Appropriate practices, procedures and tools are applied (in Finnish: Asianmukaiset käytänteet ja toimintatavat ovat käytössä)	3.24
Innovation is encouraged among employees (in Finnish: Työntekijöiden keskuudessa innovaatioihin rohkaistaan)	3.36
Innovation outputs are consistent and ensure sustained market share and positioning (in Finnish: Innovaatiotoiminnan tulokset ovat yhdenmukaisia ne varmistaa vakaan aseman markkinoilla)	3.16
Mean of responses at Maturity Level 3	3.25

Table 3: Maturity Level 4 statements

Statement	Average
Practices, procedures and tools for integrating innovation activities are used (in Finnish: Käytänteet, toimintatavat ja työkalut on integroitu käytössä oleviin innovaatioaktiviteetteihin)	3.02
In our organization internal innovation model has been establish and it is deeply understood and it has relation to the needs of our business (in Finnish: On olemassa sisäinen innovaatiomalli meidän organisaatiossa ja se on syvällisesti ymmärretty ja sillä on yhteys liiketoiminnan tarpeisiin)	2.91
Innovative outputs are consistent, diverse and a source of differentiation (in Finnish: Innovatiiviset tuotokset ovat johdonmukaisia, monipuolisia ja erilaistamisen lähteitä)	3.03
Mean of responses at Maturity Level 4	2.99

Table 4: Maturity Level 5 statements

Statement	Average
Innovative practices, procedures and tools are institutional (in Finnish: Innovatiiviset käytänteet, toimintatavat ja työkalut ovat vakiintuneita)	2.96
Individuals are empowered to innovate (in Finnish: Yksilöt ovat oikeutettuja innovoimaan)	3.39
Collaboration is achieved through business and innovation strategy alignment as well as synchronization of activities (in Finnish: Onnistunut yhteistyö saavutetaan niveltämällä liiketoiminta- ja innovaatiostrategia sekä synkronisoimalla aktiviteetit)	3.21
Innovation outputs provide sustained competitive advantage in both existing and new markets (in Finnish: Innovaatiotuotokset antavat pysyvän kilpailuedun nykyisillä ja uusilla markkinoilla)	3.50
Mean of responses at Maturity Level 5	3.27

5. Discussion

The general findings suggest that open innovations have been accepted in the companies examined at a moderate level. This means that strategy-driven innovation work should be introduced and enhanced. Creating networks and ecosystems utilizing both internal and external capabilities should be set up to enhance the open innovation maturity levels (Chesbrough, 2019). Organizations that have more advanced innovation maturity levels also have better performance across key financial as well as innovation metrics. Their innovation speed, scale, and effectiveness is better than their competitors. They can also convert their innovations into financial outcomes more rapidly and efficiently than their peers. Mature companies are more likely to outperform their less mature peers on profitability and also achieve higher operating margins (Densik et al, 2023).

An increased effort should be made to change the organizational culture towards a more innovation driven one, allowing idea generation and other innovation activities such as brainstorming amongst their employees. Organization support in addition to open innovation activities enhance innovation (Zang et al, 2022) and should thus also be taken into consideration. The significance of corporate change management should also be taken into consideration in addition to organizational support in the innovation enhancement process of a company. Adopting an open innovation culture also requires changes in the organizational management. For a smooth innovation enhancement process, companies should consider and apply appropriate approaches and methods ensuring motivated employees and also short-term and long-term benefits, such as the one presented by Kotter (1996).

6. Conclusion

Overall, it can be concluded that companies with a high level of open innovation maturity are better positioned to take advantage of the full potential of external knowledge and resources in order to drive innovation, obtain and maintain a competitive advantage. As the main aim of innovation is creating and sustaining value, organizations should utilize their innovation capabilities to their full potential in order to enhance their performance, increase profits, and enable organizational growth as well as maintaining or gaining competitive advantages within their market position. Open innovation allows for innovation utilizing both internal and external capabilities and also allows for a better understanding of opportunities and threats. Our findings conclude that the importance of the innovation practices and statements observed, a small number of responses could be noted, which regarded these matters to be of lesser or no importance. Therefore, companies should focus more on actions that would also help them improve in that regard to achieve better innovation competences and organization cultures.

To fully utilize open innovation, agile business models and processes for managing partnerships as well as a culture of collaboration should be established (Lampropoulos & Siakas, 2018). Our study finds lowest mean values for the establishment of the organization's internal innovation model, its deep understanding and its relation to the needs of the business. Thus, greater emphasis should be put on the innovation models. The innovation levels should be continuously assessed and adapted by using performance metrics as well as market feedback to further enhance and encourage innovation activities. Activities such as idea-sharing platforms and both internal and external partner networks with an organizational culture allowing for mistakes and experimentation and thus learning are key elements of an innovative organization. Furthermore, open innovation maturity could be enhanced by expanding the awareness of diverse innovation opportunities, fostering collaboration with external partners across different dimensions of innovation, aligning innovation efforts with strategic objectives, and optimizing resource utilization. By establishing a holistic approach to innovation and also enhancing a culture of openness and continuous improvement, organizations can leverage external resources more effectively, cultivate innovation ecosystems, and remain competitive in dynamic markets. (Keely et al, 2013). It should be noted that the survey was completed by university students, thus the results of the study are limited thereto, and further studies should be completed by giving the survey directly to companies. The aim of this study was to establish the maturity levels prevailing in different companies and also to highlight the need for innovation activities, in particular open innovation. Our study provides guidelines for the implementation and the overall level of open innovation activities. Open innovation maturity should be enhanced to harness external knowledge, resources and capabilities to further foster and drive growth, innovation and competitive advantages in today's rapidly changing business environment.

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Effect of Economic Risk Sources on the Quality of the Business Environment in the SME Segment: A Case Study from the Slovak Republic

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Abstract: The aim of the article is to define and quantify the impact of specific economic risk sources on the quality of the business environment (QBE). The subject of the analysis was the evaluation of the impact of selected economic risk sources, including the macroeconomic environment, monetary policy and interest rates, and corporate financing on the QBE. Data was collected between 2018 and 2022 using an online survey method. A total of 480 SMEs from the Slovak Republic's business environment completed the questionnaire. Advanced statistical techniques, including descriptive statistics, correlation analysis, and linear regression analysis, were employed to evaluate the statistical hypotheses. The empirical results yielded several significant findings. All examined sources of the macroeconomic environment, such as the level of basic macroeconomic indicators, the state of the macroeconomic environment in the context of starting a business, and innovation activities of SMEs, determine the QBE. Other key factors that positively influence the quality of the business environment include: stabilization of the business environment by the central bank's monetary policy; the level of bank interest rates on the innovation activities of companies and availability of bank loans. The findings are significant not only for the SME segment itself and their owners and top managers but also for national-level institutions along with non-profit organizations assisting in improving the entire SME segment in the business environment.

Keywords: Quality of business environment, SME segment, Economic risks, Entrepreneurship, Case study

1. Introduction

The business environment is a dynamic and interconnected system influenced by a wide array of institutions and actors at both national and international levels. The complexity of this environment is shaped by interactions among economic, political, technological, and social factors, which are continuously evolving and interdependent (Gaganis et al., 2019; Blasiu). Understanding and monitoring these changes pose significant challenges, and many national and international organizations define specific indicators to ensure international comparability and facilitate the analysis of these dynamic processes (Yarmoliuk & Savchuk, 2022).

Some of the most extensively studied areas of the business environment include risk management, corporate financing and capital, employment, quality of human resources, social policy in connection with the labor market and legislation, legal frameworks for business operations, public finance, including tax and levy policy, antitrust policy, subsidy policy, licensing policy, certification systems, and other related fields. (Barata & Fontainha, 2017; Buno et al., 2015; Hanggraeni et al., 2019, Kotorri & Krasniqi, 2018; Rózsa et al., 2023).

The originality of the article lies in the comparison of research findings from empirical quantitative research on the impact of economic risk sources on the quality of the business environment over the years 2018 and 2022. The quantitative research was conducted based on the individual attitudes of owners and managers within the business environment of the Slovak Republic, with a sample size of 631 respondents.

The structure of the article is as follows. A critical literature review was conducted to identify significant economic risk sources determining the quality of the business environment. Subsequently, the article's objective, data collection methodology, questionnaire and variables, statistical hypotheses and methods, and the demographic structure of the research sample were formulated. The following section presents empirical research results, supported by the application of correlation and regression analysis. The discussion includes an international comparison of empirical results with similar studies in research articles. The conclusion outlines the limitations and future research directions.

2. Literature Review

The effect of economic risk sources on the quality of the business environment in the SME segment has been a significant area of research, particularly given the crucial role SMEs play in the global economy (Manggu et al., 2024; Zsigmond & Mura, 2023; Petrů et al., 2018; Kozubíková et al., 2017; Virglerova et al., 2017). Economic risks, including macroeconomic instability, fluctuations in monetary policy and interest rates, and insufficient corporate financing have been shown to have profound impacts on SMEs' operational performance and growth potential (Çera et al., 2019; Yarmoliuk & Savchuk, 2022). Understanding and mitigating these risks is essential for ensuring the sustainability and competitiveness of SMEs (Belás et al., 2020; Rózsa et al., 2024). Various studies have explored these dimensions, highlighting the multifaceted nature of economic risks and their implications for the SME sector (Ajufoh et al., 2023; Belás et al., 2019).

Risks related to the labor force are widely discussed in terms of working and socioeconomic conditions (Devkota et al., 2023; Navickas et al., 2022), generation gap and performance (Cizrelioğulları & Babayiğit, 2022; Šakytė-Statnickė et al., 2023), migration (Přívarová et al., 2022), technological development (Andrade et al., 2023), incentives (Abou-Shouk et al., 2023), networking activities (Rozsa et al., 2022), workshops (Ključnikov et al., 2022a), and satisfaction (Matijová et al., 2023). Other aspects include firms' brand value (Plaikner et al., 2023), digital transformation (Krajcik et al., 2023), innovative organizational strategies (Civelek et al., 2023a), sustainable development (Civelek et al., 2023b), innovation performance (Civelek & Krajčík, 2022), and internationalization (Ključnikov et al., 2022b).

One of the primary economic risk sources affecting SMEs is the macroeconomic environment. Macroeconomic instability, such as fluctuations in GDP growth rates, inflation, and exchange rates, can create uncertainty and volatility, which in turn affect business planning and investment decisions (Lacko et al., 2023; Ceylan, 2021; Halim et al., 2017). Studies have shown that SMEs are particularly vulnerable to macroeconomic shocks due to their limited financial resources and lower resilience compared to larger firms (Altnaa & Neszmélyi, 2022; Pedauga et al., 2021). This vulnerability necessitates a robust understanding of macroeconomic trends and the implementation of strategies to mitigate their adverse effects.

Monetary policy and interest rates also play a crucial role in shaping the business environment for SMEs (Khariza et al., 2020). Changes in interest rates can affect borrowing costs, which are critical for SMEs that often rely on external financing for their operations and expansion. High interest rates can increase the cost of capital, making it more difficult for SMEs to finance new projects or manage cash flow (Ghosh, 2019).

Conversely, low interest rates can stimulate investment and expansion by reducing the cost of borrowing. However, sudden changes in monetary policy can create uncertainty, leading to cautious spending and investment behaviors among SMEs (Mtunya et al., 2017). Research by Ferrando et al. (2023) highlights the importance of stable monetary policy in fostering a supportive business environment for SMEs. Additionally, Caglio et al. (2021) emphasize that understanding the impact of interest rates through regression analysis can help SMEs make informed financial decisions.

Corporate financing is another critical factor influencing the quality of the business environment for SMEs. Access to finance is often cited as one of the main challenges faced by SMEs, and the availability of financial resources is closely linked to economic conditions. During periods of economic downturn, credit availability may decrease, and lenders may become more risk-averse, further limiting the financing options available to SMEs (Nguyen et al., 2021; Zubair et al., 2017).

The quality of the business environment for SMEs is intricately linked to various economic risk sources. Understanding and addressing these risks through informed policy-making and strategic business practices is crucial for fostering a resilient and dynamic SME sector. By leveraging insights from academic research and applying robust risk management frameworks, SMEs can better navigate the complexities of the economic landscape and contribute to sustainable economic growth.

3. Aim, Methodology and Variables

The aim of the article is to define and quantify the impact of specific economic risk sources on the quality of the business environment (QBE). The subject of the analysis was the evaluation of the impact of selected economic risk sources - the macroeconomic environment; monetary policy and interest rates; and corporate financing on QBE.

3.1 Data Collection

The respondent is defined as an owner or a top manager of a SME operating within the business environment of the Slovak Republic (SR). Data was collected between 2018 and 2022 using an online survey. The "Albertina" database was used in 2018 to identify and subsequently contact the respondents. Attitudes from the respondents were gathered using a survey method through the completion of an online questionnaire. The response rate was 5.3% (n = 329 respondents). In 2022, data collection was carried out through the panel agency MNFORCE, with a sample size of 151 respondents.

3.2 Statistical Hypotheses

The following statistical hypotheses (SHs) were formulated to achieve the aim of the scientific article:

SH1: The macroeconomic environment (EF1) is a statistically significant economic factor that has a positive effect on the quality of the business environment (QBE).

SH2: Monetary policy and interest rates (EF2) are statistically significant economic factors that have a positive effect on the quality of the business environment (QBE).

SH3: Corporate financing (EF3) is a statistically significant economic factor that has a positive effect on the quality of the business environment (QBE).

3.3 Questionnaire and Variables

Respondents could answer the statement with one of the five responses: strongly agree, agree, neutral, disagree, and strongly disagree (Likert scale responses). The questionnaire contained the following dependent variable (DV) and independent variables (IVs):

DV: The business environment in our country is of high quality and suitable for business (QBE).

IVs: Macroeconomic Environment (EF1) – EF11: I consider the macroeconomic environment in our country to be favorable for business activities. EF12: The state of the macroeconomic environment in our country supports the initiation of new businesses. EF13: The current macroeconomic environment supports innovative activities of companies. EF14: The current level of basic macroeconomic indicators (GDP, employment, inflation) supports business and creates interesting business opportunities.

Monetary Policy and Interest Rates (EF2) – EF21: The central bank's monetary policy positively influences the business environment. EF22: Interest rates in banks positively affect the business environment. EF23: Interest rates in banks positively influence the innovative activities of companies. EF24: The central bank's monetary policy stabilizes the business environment.

Corporate Financing (EF3) – EF31: Companies have a good access to bank loans. EF32: Bank loan conditions are acceptable for companies. EF33: The cost of loans is acceptable for companies. EF34: Banks positively influence the quality of the business environment.

3.4 Statistical Methods

Regression analysis is used not only for predicting the future values of the dependent variable in time series but also for identifying causal relationships between variables. By applying linear regression models, the significance of indicators (determining the direction and strength of influence using RC1, ..., RC3) on QBE is verified. LRM is appropriate to apply because all variables are identically scaled (same metrics - response scaling: 1 – strongly agree, ..., 5 – strongly disagree) and are formulated in such a way that the respondents' attitudes towards selected economic factors (EF1, ..., EF3) converge linearly with their attitudes towards statements regarding QBE.

In the first phase, descriptive statistics (mean, standard deviation, skewness, kurtosis) were calculated for the initial evaluation of statements related to the DV and IVs. In the second phase, paired correlation coefficients were used to determine the dependencies between the dependent variable (DV) and independent variables (IVs), which were presented through correlation matrices (Schmidt & Finan, 2018). The significance of the paired correlation coefficients was verified at the significance level ($\alpha = 0.05$). The estimation of regression coefficients of the independent variables was conducted using the least squares method (Hair et al., 2010). A regression coefficient is statistically significant if the p-value of the t-test is less than α ($\alpha = 0.05$; Salmerón et al., 2018). The general form of the linear regression function is as follows:

$$QBE = RC_0 + RC_1 \times EF_1 + RC_2 \times EF_2 + \beta_3 \times EF_3 + \varepsilon_n , \quad (1)$$

where: – dependent variable (quality of business environment); RC_0 – constant, RC_1; …; RC_3– estimate of regression coefficients; EF1, …, EF3 – independent variables (items of economic factors: EF1, ..., EF3); ε_n – random error.

LRM is verified using regression characteristics: multiple correlation coefficient (R), coefficient of determination (R^2), and adjusted coefficient of determination (Adj. R^2); ANOVA – F test. Negative dependence among the indicators of selected factors was verified using the Variance Inflation Factor (VIF). If the VIF value is less than 5 (Liao & Valliant, 2012), multicollinearity in the LRM is rejected. The Shapiro-Wilk test (S-W test) was applied to verify the normal distribution of errors. The assumption is accepted if the p-value of the S-W test is greater than the significance level (Salmerón et al., 2018). Bartlett's test was used to verify the assumption of homoscedasticity. This assumption is accepted if the p-value of the Bartlett test statistic is higher than the significance level (Yang et al., 2019). The presence of autocorrelation in the regression models was not investigated, given that the data is not from time series. All tests were conducted using SPSS Statistics vs. 27 software.

3.5 Structure of SMEs

The demographic structure of the SME research sample according to the characteristics of enterprises and respondents was as follows (2018: n = 329 / 2022: n = 151): i. Location of enterprise operation: Prešov Region 76/21 enterprises, Košice Region 75/14 enterprises, Bratislava Region 56/28 enterprises, Banská Bystrica Region 30/16 enterprises, Žilina Region 28/25 enterprises, Trnava Region 27/8 enterprises, Trenčín Region 20/24 enterprises, Nitra Region 17/15 enterprises; ii. Sector of business: Services 122/67 enterprises, trade 69/32 enterprises, manufacturing 51/13 enterprises, construction 39/19 enterprises, agriculture 20/3 enterprises, transportation 11/5 enterprises, other business sectors 17/12 enterprises; iii. Duration of enterprise operation: 104/46 enterprises operating for 1 – 5 years, 78/44 enterprises operating for 5 – 10 years, 147/61 enterprises operating for more than 10 years; iv. Size of enterprise: 234/111 micro-enterprises (up to 10 employees), 71/24 small enterprises (up to 50 employees), 24/16 medium-sized enterprises (up to 250 employees); v. Highest education level of the entrepreneur: 10/12 with secondary education without graduation, 95/61 with secondary education with graduation, 224/78 with higher education; vi. Gender of the entrepreneur: 251/81 male, 78/70 female.

4. Research Results

Table 1 presents the results of the descriptive characteristics (e.g. mean, standard deviation, skewness, and kurtosis) of the respondents' evaluation of the statements about the selected economic factors (EF1, …, EF34).

Table 1: Descriptive statistics of economic statements (2018/2022)

V	EF11	EF12	EF13	EF14	EF21	EF22	EF23	EF24
Mean	3.438/ 3.437	3.380/ 3.583	3.082/ 3.364	2.988/ 3.576	2.942/ 3.325	2.948/ 3.457	2.924/ 3.430	2.891/ 3.483
St. Dev.	1.063/ 1.257	0.990/ 1.163	0.888/ 1.061	0.985/ 1.122	0.869/ 1.105	1.027/ 1.057	0.892/ 0.983	0.848/ 1.057
Skew-ness	-0.976/ -0.722	-0.952/ -0.498	-0.699/ -0.405	-0.982/ -0.637	-0.524/ -0.660	-0.940/ -0.699	-0.809/ -0.206	-0.430/ -0.554
Kur-tosis	-0.364/ -0.610	-0.213/ -0.552	-0.004/ -0.333	0.082/ -0.422	0.252/ -0.192	0.155/ -0.098	0.098/ -0.272	0.211/ -0.213
V	EF31	EF32	EF33	EF34				
Mean	2.812/ 3.033	2.994/ 3.252	2.881/ 3.397	2.964/ 3.523				
St. Dev.	1.013/ 1.110	0.982/ 1.078	0.957/ 1.020	0.907/ 1.032				
Skew-ness	-0.855/ -0.714	-1.003/ -0.704	-1.031/ -0.601	-0.716/ -0.530				

V	EF11	EF12	EF13	EF14	EF21	EF22	EF23	EF24
Kur-tosis	0.438/ 0.230	0.168/ -0.098	0.323/ -0.176	0.196/ 0.229				

Note: EF11, ..., EF34 – Indicators of economic factors. Source: own data collection.

4.1 Effect of Macroeconomic Environment on the QBE

The results of verification of dependences between the indicators of EF1 and QBE are presented in the correlation matrix (see table 2).

Table 2: Dependences between macroeconomic environment and QBE (2018/2022)

	QBE	EF11	EF12	EF13	EF14
QBE	1				
EF11	0.423*/0.671*	1			
EF12	0.407*/0.810*	0.325*/0.709*	1		
EF13	0.382*/0.695*	0.227*/0.674*	0.412*/0.708*	1	
EF14	0.328*/0.607*	0.253*/0.661*	0.389*/0.615*	0.315*/0.606*	1

Note: * Statistically significant on the $\alpha = 0.05$; EF11, ..., EF14 – Indicators of macroeconomic environment. Source: own data collection.

The results of correlation analysis (see table 2) confirmed that there are the significant pairwise dependences between independent variables (indicators of macroeconomic environment) and quality of business environment on the $\alpha = 0.05$.

The results of verification of relationships between the indicators of EF1 (independent variables) and QBE (dependent variable) are presents in the LRM1 (see table 3).

Table 3: LRM1 – relationships between indicators of EF1 and QBE (2018/2022)

ANOVA – Analysis of variance					
Variability	Degree of freedom	Sum of square	Mean square	F- ratio	
Model	4/4	101.66/141.17	25.4/35.3	36.931/83.966	
Error	324/146	222.97/61.37	0.69/0.42	p-value	
Sum	328/150	324.63/202.54		<0.000/ <0.000	
Verification of regression coefficient in the LRM1					
Variable	Regression coefficient	Mean Square	t-Stat	t-Stat (p-value)	VIF value
Constant	0.994/0.284	0.221/0.199	4.497/1.428	0.000/0.155	-/-
EF11	0.269/0.083	0.046/0.068	5.821/1.222	0.000/0.224	1.150/2.575
EF12	0.183/0.561	0.055/0.073	3.365/7.678	0.001/0.000	1.388/2.574
EF13	0.228/0.199	0.058/0.077	3.949/2.591	0.000/0.011	1.255/2.364
EF14	0.122/0.096	0.052/0.067	2.346/1.442	0.020/0.151	1.240/1.999

Note: EF11, ..., EF14 – Indicators of macroeconomic environment. Source: own data collection.

The results of regression characteristics are follows (2018/2022): R = 0.560/0.835; R^2 = 0.313/0.697; Adj. R^2 = 0.305/0.689; SE = 0.830/0.648; n = 329/151. Also, the results confirmed (see table 3) that the LRM1 is a statistic significant for each time period (2018/2022) on the $\alpha = 0.001$. Linear regression function are follows:

2018: QBE = 0.994 + 0.269×EF11+0.183×EF12 + 0.228×EF13+0.122×EF14 (2)

2022: QBE = 0.284 + 0.083×EF11+0.561×EF12 + 0.199×EF13+0.096×EF14 (3)

where: – dependent variable (quality of business environment); EF11, …, EF14 – independent EF1.

The VIF values (see table 3) did not show the presence of multicollinearity in the LRM1 (2018 or 2022). The results of Bartlett´s test (BTS) and S-W test are follows (2018/2022): BTS(2018) = 0.428/BTS(2022) = 0.274; S-W(2018) = 0.249/S-W(2022) = 0.314. The hypotheses SH1_2018 and SH1_2022 were accepted. LRM1 confirmed the positive effect of macroeconomic environment on the quality of business environment.

4.2 Effect of Monetary Policy and Interest Rates on the QBE

The results of verification of dependences between the indicators of EF2 and QBE are presented in the correlation matrix (see table 4).

Table 4: Dependences between monetary policy with interest rates and QBE (2018/2022)

	QBE	EF21	EF22	EF23	EF24
QBE	1				
EF21	0.122*/0.577*	1			
EF22	0.129*/0.615*	0.188*/0.540*	1		
EF23	0.210*/0.547*	0.222*/0.515*	0.535*/0.708*	1	
EF24	0.270*/0.575*	0.330*/0.635*	0.294*/0.583*	0.315*/0.529*	1

Note: * Statistically significant on the α = 0.05; EF21, ..., EF24 – Indicators of monetary policy and interest rates. Source: own data collection.

The results of correlation analysis (see table 4) confirmed that there are the significant pairwise dependences between independent variables (indicators of monetary policy and interest rates) and quality of business environment on the α = 0.05.

The results of verification of relationships between the indicators of EF2 (independent variables) and QBE (dependent variable) are presents in the LRM2 (see table 5).

Table 5: LRM2 – relationships between indicators of EF2 and QBE (2018/2022)

ANOVA – Analysis of variance					
Variability	**Degree of freedom**	**Sum of square**	**Mean square**	**F- ratio**	
Model	4/4	29.46/99.44	7.37/35.21	8.085/35.206	
Error	324/146	295.17/103.10	0.91/0.71	p-value	
Sum	328/150	324.63/202.54		<0.000/ <0.000	
Verification of regression coefficient in the LRM2					
Variable	**Regression coefficient**	**Mean Square**	**t-Stat**	**t-Stat (p-value)**	**VIF value**
Constant	2.362/0.442	0.254/0.281	9.314/1.573	0.000/0.118	-
EF21	0.022/0.249	0.065/0.084	0.334/2.949	0.739/0.004	1.144/1.105
EF22	-0.017/0.323	0.062/0.099	-0.276/3.266	0.783/0.001	1.438/1.057
EF23	0.161/0.135	0.072/0.102	2.253/.328	0.025/0.186	1.469/0.983
EF24	0.262/0.212	0.069/0.091	3.803/2.325	0.000/0.021	1.230/1.057

Note: EF21, ..., EF24 – Indicators of Monetary policy and interest rates. Source: own data collection.

The results of regression characteristics are follows (2018/2022): R = 0.301/0.701; R^2 = 0.091/0.491; Adj. R^2 = 0.080/0.477; SE = 0.954/0.840; n = 329/151. Also, the results confirmed (see table 5) that the LRM2 is a statistic significant for each time period (2018/2022) on the α = 0.001. Linear regression function are follows:

2018: QBE = 2.362 + 0.022×EF21-0.017×EF22 + 0.161×EF23+0.262×EF24 (4)

2022: QBE = 0.442 + 0.249×EF21+0.323×EF22 + 0.135×EF23+0.212×EF24 (5)

where: – dependent variable (quality of business environment); EF21, …, EF24 – independent EF2.

The VIF values (see table 5) did not show the presence of multicollinearity in the LRM2 (2018 or 2022). The results of Bartlett´s test (BTS) and S-W test are follows (2018/2022): BTS(2018) = 0.150/BTS(2022) = 0.207; S-

W(2018) = 0.201/S-W(2022) = 0.639. The hypotheses SH2_2018 and SH2_2022 were accepted. LRM2 confirmed the positive effect of monetary policy with interest rates on the quality of business environment.

4.3 Effect of Corporate financing on the QBE

The results of verification of dependences between the indicators of EF3 and QBE are presented in the correlation matrix (see table 6).

Table 6: Dependences between corporate financing and QBE (2018/2022)

	QBE	EF31	EF32	EF33	EF34
QBE	1				
EF31	0.298*/0.548*	1			
EF32	0.257*/0.578*	0.533*/0.633*	1		
EF33	0.136*/0.577*	0.342*/0.642*	0.629*/0.781*	1	
EF34	0.244*/0.586*	0.408*/0.497*	0.493*/0.564*	0.533*/0.618*	1

Note: * Statistically significant on the α = 0.05; EF31, ..., EF34 – Indicators of corporate financing. Source: own data collection.

The results of correlation analysis (see table 6) confirmed that there are the significant pairwise dependences between independent variables (indicators of corporate financing) and quality of business environment on the α = 0.05.

The results of verification of relationships between the indicators of EF3 (independent variables) and QBE (dependent variable) are presents in the LRM3 (see table 7).

Table 7: LRM3 – relationships between indicators of EF3 and QBE (2018/2022)

ANOVA – Analysis of variance					
Variability	**Degree of freedom**	**Sum of square**	**Mean square**	**F- ratio**	
Model	4/4	38.08/94.34	9.52/23.58	10.764/31.822	
Error	324/146	286.55/102.21	0.88/0,74	p-value	
Sum	328/150	324.63/202.54		<0.000/ <0.000	
Verification of regression coefficient in the LRM3					
Variable	**Regression coefficient**	**Mean Square**	**t-Stat**	**t-Stat (p-value)**	**VIF value**
Constant	2.449/0.629	0.208/0.276	11.762/2.280	0.000/0.024	-
EF31	0.193/0.216	0.062/0.087	3.120/2.489	0.002/0.014	1.457/1.871
EF32	0.143/0.206	0.076/0.109	1.875/1.878	0.062/0.062	2.078/2.820
EF33	-0.101/0.117	0.074/0.121	-1.371/0.962	0.171/0.338	1.862/3.103
EF34	0.161/0.353	0.071/0.089	2.258/3.979	0.025/0.000	1.547/1.691

Note: EF31, ..., EF34 – Indicators of Corporate financing. Source: own data collection.

The results of regression characteristics are follows (2018/2022): R = 0.342/0.682; R^2 = 0.117/0.466; Adj. R^2 = 0.106/0.451; SE = 0.940/0.861; n = 329/151. Also, the results confirmed (see table 7) that the LRM3 is a statistic significant for each time period (2018/2022) on the α = 0.001. Linear regression function are follows:

2018: QBE = 2.449 + 0.193×EF31+0.143×EF32 -0.101×EF33+0.161×EF34 (6)

2022: QBE = 0.629 + 0.216×EF31+0.206×EF32 + 0.117×EF33+0.353×EF34 (7)

where: – dependent variable (quality of business environment); EF31, …, EF34 – independent EF3.

The VIF values (see table 7) did not show the presence of multicollinearity in the LRM3 (2018 or 2022). The results of Bartlett´s test (BTS) and S-W test are follows (2018/2022): BTS(2018) = 0.124/BTS(2022) = 0.253; S-W(2018) = 0.327/S-W(2022) = 0.142. The hypotheses SH3_2018 and SH3_2022 were accepted. LRM3 confirmed the positive effect of corporate financing on the quality of business environment.

5. Discussion

All indicators of the macroeconomic environment positively influence the quality of the business environment in Slovakia. Among the macroeconomic environment indicators, the favorable assessment of the macroeconomic environment by SMEs has the most significant impact on the quality of the business environment (EF11: RC = 0.269). Other macroeconomic environment indicators also have a significant (though weaker) positive impact on the quality of the business environment (EF13: RC = 0.228; EF12: RC = 0.183; EF14: RC = 0.122).

The most significant indicator of the economic factor “monetary policy and interest rates”, which positively influences the quality of the business environment in Slovakia, is the stabilization of the central bank's monetary policy (EF24: RC = 0.262). Also, significant (though weaker than EF24) is the positive impact of bank interest rates on the innovative activities of companies on the quality of the business environment (EF23: RC = 0.161).

The most significant indicator of corporate financing that positively influences the quality of the business environment in Slovakia is access to bank loans (EF31: RC = 0.193). Also, significant (though weaker) is the positive impact of banks on the quality of the business environment (EF34: RC = 0.161). The influence of bank loan conditions (EF32: t-test: p-value = 0.062) and the cost of loans (EF33: t-test: p-value = 0.172) is not significant.

6. Conclusion

The aim of the article was to define and quantify the impact of specific economic risk sources on the quality of the business environment (QBE).

All indicators of the macroeconomic environment positively influenced the quality of the business environment in Slovakia in 2018. The favorable assessment of the macroeconomic environment by SMEs had the most significant impact on the quality of the business environment among the macroeconomic indicators in 2018. Other macroeconomic environment indicators also had a significant positive impact on the quality of the business environment in 2018. On the other hand, the state of the macroeconomic environment and its support for starting a business had the most significant impact on the quality of the business environment among the macroeconomic indicators in 2022. Similar conclusions were reached in the studies by Liu, Q. (2021) and Lizhong (2020), where their research provides empirical evidence on the impacts of macroeconomic factors on the quality of the business environment.

The most significant indicator of the economic factor "monetary policy and interest rates" that positively influenced the quality of the business environment in Slovakia in 2018 was the stabilization of the central bank's monetary policy. On the other hand, according to respondents, the significant impact of interest rates on the business environment and the effect of interest rates on the innovative activities of companies were notable indicators with a positive influence on QBE in 2022. Additionally, the positive impact of bank interest rates on the innovative activities of companies was also significant for the quality of the business environment in 2018. The empirical evidence of the impact of monetary policy stabilization and interest rates on the business environment is confirmed, for example, by studies by Ma & Zimmermann (2023) or Klimova (2021).

The significance of the empirical findings from the conducted quantitative research lies in a deeper understanding of the economic determinants that influence the quality of the business environment. The findings can serve national policymakers in the area of business support for the small and medium-sized enterprise (SME) segment. Additionally, the findings can help owners and managers of SMEs, as well as educational organizations, to better understand and deepen their scientific knowledge, thereby contributing to the sustainable growth of the SME segment in Central European countries.

The conducted quantitative research has its limitations. The subject of the study was the individual attitudes of owners and managers of small and medium-sized enterprises from only one Central European country. The questionnaire was evaluated using linear regression models, which quantify causal relationships between variables in only one direction. Data collection was carried out over a longer time horizon of 4 years.

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Digital Transformation of Tax and Accounting Processes

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Abstract: The world today is changing rapidly in many ways. Fundamental changes that differ country by country are visible also in the area of taxes and accounting. New activities whose adoption is enabled due to the great development of technologies in fact exert pressure on individual economic subjects' actions in many areas. This is visible also in supporting activities like tax and accounting processing. Setting of business processes has to be therefore changed quite often as a reaction to the frequent changes in legislation regulating these areas. Legislation in these two areas, taken from the Czech accounting units' point of view, changes so often. Even if these changes of the legislative framework can be described as more frequent in the area of taxation (great change at least twice a year, often in the area of income taxes), this year the great change happened also in the area of accounting. In association with the adoption of the New accounting act started to be influenced set accounting processes of accounting units concerned. New accounting act should come into force since January 1, 2025. The aim of this contribution is to identify and, through the analysis of the development of digitalization tools, assess the possibilities of selected accounting units in the area of digital transformation of tax and accounting processes. This contribution uses, with the intention to describe and assess the situation in above specified areas, information focused on related significant legislative changes and relevant research methods to which belong literature research of professional publications, analysis of information and methodical support in specified area (provided mainly by the state authorities). The intention of the authors is to assess the degree of use of digitalization by selected, in the contribution further specified, accounting units. Therefore, in the final part of the contribution, obtained results are summarized using the method of synthesis.

Keywords: Accounting, Digitalization, Supporting processes, Taxation

1. Introduction

The origin of digitalization dates back to the early 1970s (3rd industrial revolution). That was the moment when electronization, information technologies (IT) and automation of production were used for the first time. Then, during the 4th industrial revolution, fast internet, integrated and flexible information and communication technologies (ICT) and data storage (Cloud), are introduced (Veber et. al, 2018).

Schallmo and Williams (2018) define digitalization as "the use of digital technologies and of data (digitized and natively digital) in order to create revenue, improve business, replace/transform business processes (not simply digitizing them) and create an environment for digital business, whereby digital information is at the core." Digitization is then seen as a tool used when trying to develop digitalization of the businesses, funded organizations, public administration, etc. It is usually introduced as "the process of using digital information technologies to convert analog data into its digital counterpart." (Samoilenko, 2023).

Digitalization and its development is present on many levels of human-made networks, society, industry or organization (Samoilenko, 2023). Schallmo and Williams (2018) state that digital transformation affects different areas of society and the economy by opening up new opportunities for networking and enabling collaboration between different actors. As stated by Leitner-Hanetseder et. al (2021), digitalization is taken by the current society as one of the biggest and most permanent changes influencing many areas of people's lives. Digitalization is widely used also in business entities. These subjects are focused on digitalization of all relevant areas of business activities. To them belong also areas of accounting, taxes, document work, online communication with the customer, etc. (Veber et. al, 2018). The reason is obvious, among other things, from the statement by Anton (2023), who confirms that digitalization is a process that accounting firms are also subject to if they want to remain competitive and meet the needs of communication with customers. Losbichler and Lehner (2021) say that digitalization in accounting manifests itself both on the side of automating routine activities and on the side of supporting or automating demanding analytical activities (machine forecasts and involvement of artificial intelligence).

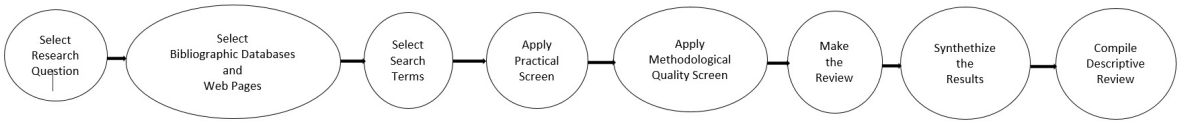
Tendencies leading to support of digitalization are present everywhere. Compiled contribution deals with an interesting and up to date issue, digitalization of tax and accounting processes and tries to emphasize importance of process management and its tools in this area. The aim of this contribution is to identify and, through the analysis of the development of digitalization tools, assess the possibilities of selected accounting units in the area of digital transformation of tax and accounting processes. Literature review and analysis mentioned in the following part of this article will focus on these areas. The authors will assess the situation

from the perspective of Czech companies that focus on accounting and tax processing. Authors try to consider positive impact of digitalization, even if there can be also negative impacts identified. This type of digitalization impact was assessed in other works of the authors and is not the subject of this article. This article will focus on tools used by business entities for the development of digitalization in taxation and accounting. The authors will also add information relating to measurement of the rate of digitalization.

2. Methods

To be able to make this assessment, authors of the article conducted the qualitative research. Undertaken method was document and text analysis. With the intention to identify the relevant literary sources were also used systematic literature review (see Figure 1) and traditional literature review (Moahmmed, 2021).

Authors expectations were that there are online sources in the form of information provided by web pages of public and private subjects dealing with this issue and also databases administered by the state authorities and other organizations (Czech Statistical Office, European Commission or OECD).



Source: Own processing according to Fink (2014), 2024

Figure 1: Steps of systematic literary review

To sum up, to be able to compile this article, its authors used most often these methods:

- Literary research of the current state in analysed area (systematic literature review, traditional literature review, document and text analysis).
- Analysis of the current state of digitalization of taxes and accounting processes set by the Czech legislative (Act No. 365/2000 Coll., Act on Public Administration Information Systems and on Amendments to Certain Other Acts, Act No. 12/2020 Coll., Act on the Right to Digital Services and on Amendments to Certain Acts, etc.).
- Analysis of the data provided by European Commission (EC).
- Synthesis of information that enables the authors to identify and describe the possibilities of selected accounting units in the area of digital transformation of tax and accounting processes.

3. Results and Discussion

3.1 Systematic Literary Review

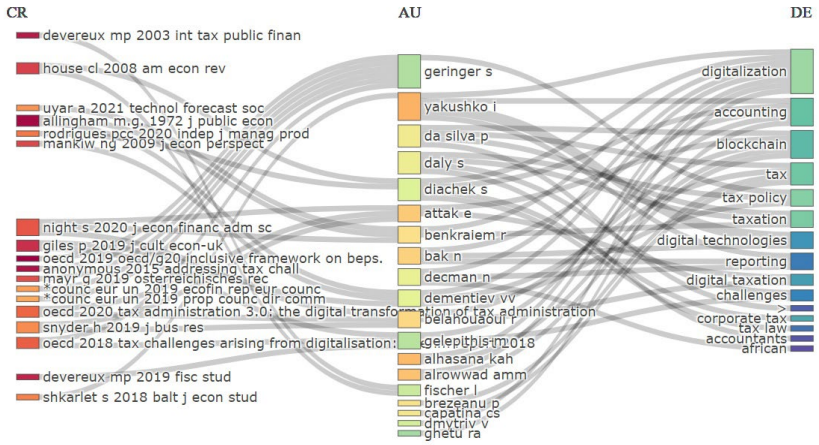
The first step leading to compilation of related parts of this article was a systematic literary review. This review was focused on searching the literary sources dealing with influence of digitalization on tax and accounting processes issue.

Research question was set as: “Are there any articles dealing with our issue published in Web of Science database?” The intention was to find and assess the findings of various authors in the analysed area. Authors tried to search for articles dealing with all three terms, digitalization, taxation and accounting. 32 articles were found. The results included 24 articles in journals, 7 articles in proceeding papers, 1 early access article and 1 review. Therefore, there was no necessity to narrow the selection by searching just in the titles. There was also no necessity to limit the search by years of publication. Articles in analysed area have been published since 2018 till 2024. Results of this review are visible in the following figures 2 and 3. Figure 2 shows the main data (number of sources, number of documents, etc.). Figure 3 is a three-field plot showing the connection between selected sources (CR), authors (AU) and key words (DE).



Source: Own processing, 2024

Figure 2: Results of systematic literary review



Source: Own processing, 2024

Figure 3: Results of systematic literary review (three-field plot)

Selected articles were further analysed. 4 articles of the highest relevancy were then selected as the starting point helping the authors compile the introductory parts of this article. These were articles written by Rakovský (2021), Belahouaoui and Attak (2024), Vishnevsky (2022) and Ponomareva (2022).

The authors decided to use also other sources (web pages, databases) focused on this issue. Therefore, the traditional literature review was also done.

3.2 Current State of Taxes and Accounting Processes Digitalization in the Czech Republic

In this part of the article, information about the current situation of the Czech accounting units in the area of taxation and accounting are given.

In the field of taxation and accounting, digitalization is primarily focused on digitization associated with the transcription of data in paper form into electronic form. The storage of data and any other processes associated with working with data are also addressed here. In connection with digitization, the Czech Republic has adopted a document called "Digital Czech Republic, the path to a digital economy". This document should serve to build a digital marketplace. The process of digitalization of public administration and improvement of citizens' access to public digital services is solved by the Act No. 12/2020 Coll., Act on the Right to Digital Services and on Amendments to Certain Acts.

Digitalization in taxes (the Czech Republic)

Entrepreneurs and companies keep tax records in selected accounting software. The accounting software is able to create various tax declarations. All the data is created and stored in the storage, the software overwrites the data and creates the tax declaration that the user needs.

Tax administration is provided by the Financial Administration. Financial Administration maintains a website where it is easy to find various forms or information related to taxes. Digitalization of tax administration is ensured by the Digital Information Agency, who sets the new standards, introduce comprehensive methodology and supervision of the process of digitalization. Governance of public affairs is currently ensured using the tools shown in table 1.

Table 1: Tools used for public affairs governance

Tool	Area of use
eGovernment	*Communication with state and public administration institutions in electronic form.*
Czech POINT	*Contact points solving requests for extracts from public and non-public registers and submissions to the state administration.*
"Data box"	*Communication with state authorities (Czech Social Security Administration, health insurance companies).*
"My Taxes"	*An application that allows filling out electronic forms, save them and send them through the EPO application or through the Online Tax Office (DIS+).*
Electronic submissions for financial administration (EPO)	*Electronic filing office. (Electronic submission of tax declarations.)*
Online Tax Office (DIS+)	*Online Tax Office. (Electronic submission of tax declarations.)*

Source: own processing, 2024

Digitalization in accounting (the Czech Republic)

Nowadays, accounting is mainly carried out using information and communication technologies (ICT). This may be called computerised accounting. Manually processed recording of information about the economic transactions of the company was moved to a digital form. The same way as many other activities, accounting has become much faster and simpler, because of the use of ICT. Electronic accounting also provides easier archiving of all data.

Among the digital tools currently used by the Czech accounting units belong:

- Data mining. (Tool used to ensure extraction of data from documents and its transformation to usable information.)
- Electronic signature. ("Data in electronic form that is attached to or logically connected to a data message, and which serves as a method to unambiguously verify the identity of the signed person in relation to the data message". (Act No. 227/2000 Coll., Electronic Signature Act and Amendment of Certain Other Acts))
- Time stamp. (Service that enables to clearly demonstrate time of document creation – related to legal consequences).
- Artificial intelligence. (So far, the transcription of received receipts and invoices with the help of artificial intelligence.)

The same way as in other countries, accounting in the Czech Republic is regulated by legislation. As the main legislative document is taken Act No. 563/1991 Coll., Accounting Act. This document was revised and its new version came into force on January, 1, 2024. Its validity was postponed to 2025. In this document are currently included issues related to artificial intelligence, digitalization, international accounting standards or functional currency.

Economic entities providing their goods or services in the Czech Republic (with the obligation to keep accounts or those keeping accounting records on a voluntary basis) can keep accounting records using:

- Internal accounting (ensured by own employee of the company).
- Outsourcing (ensured by an external firm/experts specialized in provision of accounting services).
- Cloud (software on which the accounting is operated).

Digitalization in the area of taxes and accounting is closely related to the purchases and use of facilities enabling to secure network connections and the ability to share and work with data. Information focused on

this issue are provided by variant organizations (Czech Statistical Office (CZSO), European Commission (EC) or Organisation for Economic Co-operation and Development (OECD)).

The intention of the authors was to assess, on the basis of statistical data, the level of use of digitalization by selected accounting units operating in the Czech Republic. Next part of the article will therefore describe and explain the indicators used most often for evaluation of the rate of digitalization in individual countries of the European Union (EU). The authors will try to focus on the rate of digitalization reached by business units in the Czech Republic.

3.3 Data Provided by EC and OECD

European Commission and OECD gather and store the data on EU countries level of digitalization. There are several indicators used for evaluating rate of digitalization in individual countries. Some of them are described in the following table 2.

Table 2: Selected indicators of the rate of digitalization

Abbreviation	Indicator	Principle
DAI	Digital Adoption Index	*It focuses on measuring the extent of digital technology diffusion within and between countries.*
DDI	Digital Density Index	*It serves government leaders and businesses to understand, measure and manage digital technologies more easily, as well as to create strategies to support competitiveness and growth.*
DESI	Digital Economy and Society Index	*It monitors the development of digital competitiveness of the EU member states.*
DFI	Digital Futures Index	*It explores who is leading the global race to adopt new innovations and technologies and create the world's digital future.*
DGI	Digital Government Index	*Assesses digital government in different countries according to how the environment is set to enable the use of technology and data leading to the digital transformation of the public sector.*
DMI	Digital Maturity Index	*It is used to identify and document proven practices in the use of information processes and technologies for tax collection.*

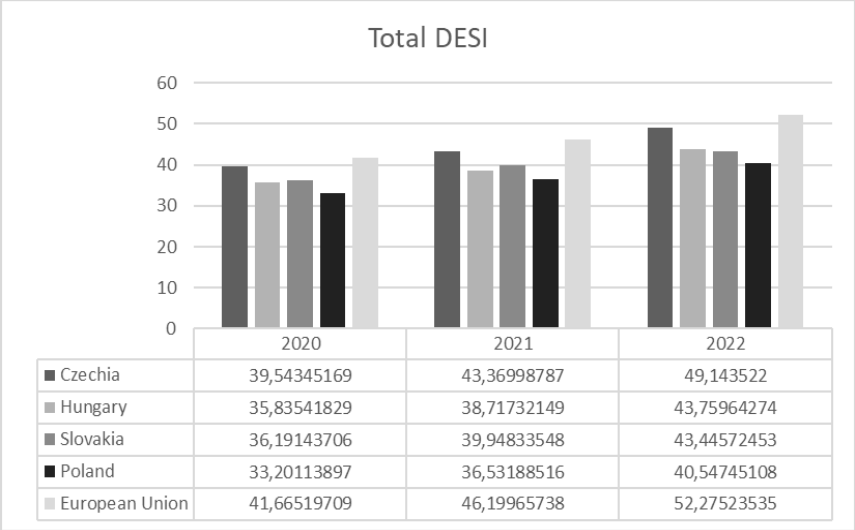
Source: Own processing in accordance to Kepková (2024), 2024

Even if these indicators monitor activities in many areas, it is possible to use them as the starting point for measuring the level of digitalization in the area of taxation and accounting at least in the Czech Republic. Considering the fact that the interaction in the field of taxation and accounting takes place between business and public administration entities, it is possible to assume that all parties involved have appropriate tools for this. These tools are thus implemented and used by both businesses and the public sector.

Situation and development of the EU countries in the area of digitalization is evaluated mainly using the Digital economy and society index (DESI). That is the reason why authors also started with analysis based on data provided by DESI. The DESI index is a composite index that consists of four basic measured areas: Human capital, Connectivity, Integration of digital technology and Digital public services.

Use of DESI was different till 2022, when this indicator was taken as the tool for comparison of individual EU countries. Since 2023 is its setting a little bit different. EC compile this index with different purpose which is defined as emphasizing “the need to accelerate and deepen the collective efforts, including through policy measures and investment in digital technologies, skills and infrastructures.” (EC, 2023) Next figure (4) presents the position of the Czech Republic since 2020 (year when Covid-19 started) till 2022 (change of DESI setting).

For the comparison with the Czech Republic were used other V4 countries, EU average was also added. Authors focused on the adoption of digitalization at the side of businesses. Figure 5 shows V4 countries position from the point of view of Integration of digital technology which is one of the DESI dimensions. Integration of digital technology dimension can be further divided to sub-dimensions, digital intensity, digital technologies and e-Commerce. Figure 5 shows the total amount of these three sub-dimensions. Used evaluation scale is 0 – 100 for figures 4, 5 and 6.

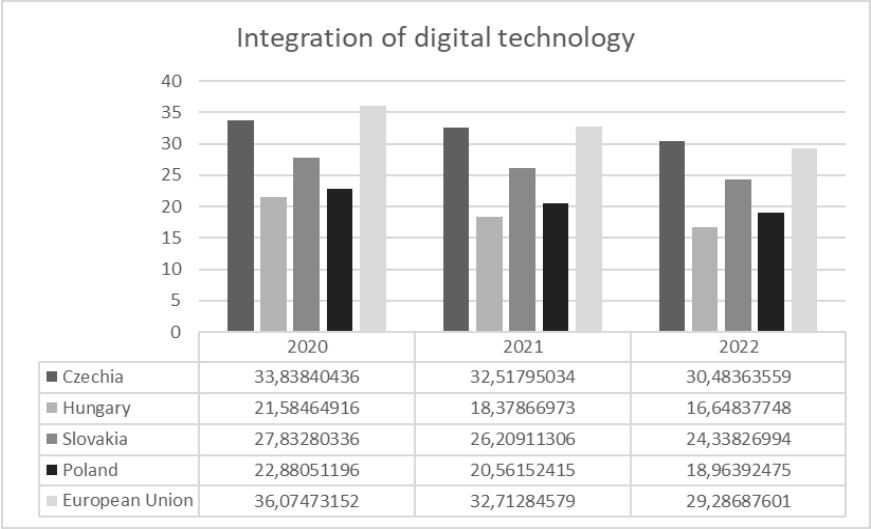


	2020	2021	2022
Czechia	39,54345169	43,36998787	49,143522
Hungary	35,83541829	38,71732149	43,75964274
Slovakia	36,19143706	39,94833548	43,44572453
Poland	33,20113897	36,53188516	40,54745108
European Union	41,66519709	46,19965738	52,27523535

Source: Own processing according to EC, 2024

Figure 4: DESI values for V4 countries (2020 – 2022)

As shown in Figure 4, position of the Czech Republic is quite good in all three analysed years. The values are below the EU average, but above the values reached by other three analysed countries in analysed three years. This enables to see the situation in the Czech Republic in this area as satisfying, but it is necessary to go deeper to individual dimensions and sub-dimensions the DESI index consists of.

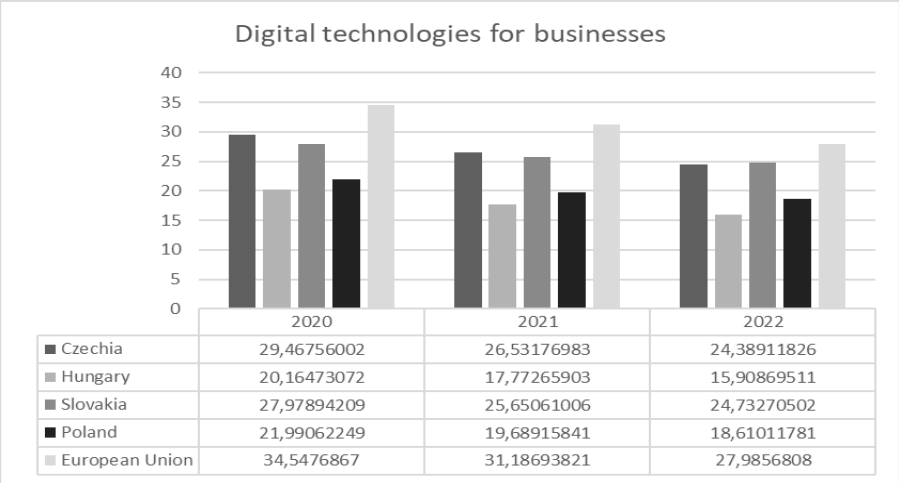


	2020	2021	2022
Czechia	33,83840436	32,51795034	30,48363559
Hungary	21,58464916	18,37866973	16,64837748
Slovakia	27,83280336	26,20911306	24,33826994
Poland	22,88051196	20,56152415	18,96392475
European Union	36,07473152	32,71284579	29,28687601

Source: Own processing according to EC, 2024

Figure 5: DESI - Integration of digital technology - values for V4 countries (2020 – 2022)

For example, when focusing on the Integration of digital technology dimension of DESI, position of the Czech Republic is in all three years better than position of the next three analysed countries, but the Czech Republic is still below the EU average in 2020 and 2021. The situation goes better in 2022. If the authors went to greater detail of information provided by EC, there were the possibility to extract individual components of DESI. Next figure (6) presents the position of V4 countries from the point of view of component called Digital technologies for businesses. Used score is again 0 – 100.



	2020	2021	2022
Czechia	29,46756002	26,53176983	24,38911826
Hungary	20,16473072	17,77265903	15,90869511
Slovakia	27,97894209	25,65061006	24,73270502
Poland	21,99062249	19,68915841	18,61011781
European Union	34,5476867	31,18693821	27,9856808

Source: Own processing according to EC, 2024

Figure 6: DESI - Digital technologies for businesses - values for V4 countries (2020 – 2022)

Digital technologies for businesses consists of values observed for Artificial intelligence, Big data, Cloud, e-Invoices, Electronic Information Sharing, ICT for environmental sustainability and Social media.

As visible in Figure 6, position of the Czech Republic is again quite good. The values are below the EU average and almost always above the values reached by the rest of V4 counties. There is just one exception relating to the values in 2022, when was the Czech Republic overtaken by Slovakia that achieved a better value.

When assessing the information provided to the authors by DESI, it is possible to say that the conditions for digitalization are in the Czech Republic good. This is visible from its position in Total DESI. It is also necessary to say that there is visible increasing tendency in Total DESI, but decreasing tendency in the Integration of digital technology indicator and also in Digital technologies for businesses indicator. From this, it is possible to conclude that development of activities associated with digitalization has decreasing tendency. It indicates that it will be necessary to improve this situation for example through the introduction of new user friendly ICT tools in this area. This also means that increase in Total DESI has to be caused by increases in other observed areas (dimensions).

To be able to make more detailed conclusions leading to recommendation for both sides, businesses and state administration, situation should be also assessed from the point of view of public sector, but this is going to be the subject of authors' further research.

4. In Conclusion

Compiled article focuses on digital transformation in tax administration and accounting management. The approach of article authors corresponds to the researches presented by other authors focusing on this area. The authors agree with the thoughts of Vishnevsky (2022) that it was also established that requirements for taxes and tax policy depend on the technologies' life cycle.

Authors introduced tools and methods used in the Czech Republic as a support for digitalization of tax and accounting processes. It is obvious that thanks to the process of digitalization of taxes and accounting adopted by accounting entities, time is saved in the processes taking place in the economic department of these entities. There is also a considerable saving of paper material and a reduction in the incidence of errors in data entry to the system. In addition, digital taxes and accounting make it easier for an entity to control outstanding receivables and payables. Today, it is commonplace to use software to generate value added tax (VAT) returns, VAT control reports and others in the prescribed format for submission to the relevant tax authority.

Last part of the article was focused on measuring the level of digitalization. It is done with respect to the original intention of the authors, which was to assess, on the basis of statistical data, the level of use of digitalization by accounting units operating in the Czech Republic. Therefore, they also presented the possibilities of measuring the level of digitalization. Most often used indicators of digitalization level were described and finally DESI was used as an example showing the current position of the Czech Republic among V4 countries and also in relation to EU average in the area of digitalization. Authors focused specifically on assessment of dimension called Integration of digital technology and also on DESI component called Digital

technologies for businesses. It was found that position of the Czech Republic among the countries selected as the sample for comparison is good. Development of the digitalization in the Czech Republic needs to be assessed in relation to individual measured DESI dimensions and components. Total DESI seems to have increasing tendency.

To sum up, it is possible to say that digitalization has positive impacts (these were described above), but also negative impacts (these were described by the authors in other research papers and will be surely studied by them also in the future) that appear very often in the social areas and relates to the availability of tools used in digitalization for the general public. This area is seen by the authors as possible field of their future research similarly as the assessment of the state of digitalization from the point of view of entities belonging to the public sector.

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Entrepreneurship Education in an International Context: Skills, Attitudes and Competencies

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Abstract: Entrepreneurship plays an important role in the economic development of the nations by driving innnovation, economic efficiency, and job creation. On the other hand, entrepreneurship education and international education seem to be an important antecedent for entrepreneurship intentions. In this context, universities and campuses have an important role in fostering entrepreneurial activities, namely extra curricular and curricular programs that empower young and nascent entrepreneurs to develop skills, attitudes and competencies that can later be applied to business creation. The main objective of this study is to present the extra curricular program, EXIT program, and confirm its impact on entrepreneurial skills, attitudes and competencies acquired or developed by students. This study employs a mixed research approach that includes both qualitative and quantitative methods. The results reveals that EXIT program effectively contributes to the development of various attributes associated with student resilience. It notably boosts critical thinking, creativity, initiative, problem-solving, proactivity, responsibility, cooperation, social responsibility, and a balanced mix of ambition, optimism, and realism. EXIT's impact on student skills development underscores its substantial positive influence, especially in domains like teamwork and communication. Feedback from the focus group discussions attested to the overall positive reception of EXIT by participants. The program demonstrated its effectiveness in improving their entrepreneurial skills, facilitating multicultural experiences, and encouraging collaborative efforts.

Keywords: Higher education, Entrepreneurship, Entrepreneurship intention, International education, Blended intensive program

1. Introduction

In a knowledge-based society, organizations value the role of innovation and entrepreneurship. Entrepreneurial activity can improve organizational competitiveness, encourage social transformation and promote the development of more sustainable products and services.

Entrepreneurship education is a key factor for socio-economic and sustainable development (Gangi, 2017). Thus, education for entrepreneurship is becoming increasingly important, particularly in today's dynamic world where changes can be expected or unexpected, reversible or irreversible and can vary in intensity (Miceli et al, 2021). In this context, the acquisition of entrepreneurial attitudes and skills by students becomes a differentiating factor highly valued by organizations. On the other hand, international education is also crucial today, because it allows students to overcome cultural and linguistic barriers and fosters knowledge and understanding of other cultures, languages, behaviors, and realities, enhancing student´s career opportunities (Sabet & Chapman, 2022).

The main objective of this study is to present the EXIT program and confirm the impact of this program regarding the entrepreneurial skills, attitudes and competencies acquired or developed by students. EXIT is a Blended Intensive Program (BIP) on Entrepreneurship. BIPs are a new format of Erasmus+ mobility. Every BIP combines online teaching with a short period of physical mobility, where students can spend one week at another university alongside peers from other European universities and experience different cultures, behaviors, values, in real organizational context.

Organized in two main parts, the first part of the study introduces a brief reflection about entrepreneurship education and international education in developing entrepreneurial intentions and activity. The second part presents the BIP, which aims to equip students, as future entrepreneurs and agents of change in organizations, with entrepreneurial skills, attitudes and competencies necessary to increase their opportunities.

2. Literature Review

Entrepreneurship plays an increasingly important role in economic development and contributes to the development of innovations, increases economic efficiency, and creates new jobs (Sutter et al., 2019). So how can individuals become more entrepreneurial to participate in this activity?

Entrepreneurship intention (EI) is determined by attitudes that are affected by "exogenous influences" such as traits and situational variables (Ajzen, 1991; Krueger et al., 2000; Costa & Mares, 2016; Mares, Costa & Galina, 2017). Among the determinants of EI, entrepreneurship education seems to be an important antecedent, and several studies establish a correlation between entrepreneurship education and entrepreneurial activities (Henderson & Robertson, 2000; Galloway & Brown, 2002; Peterman & Kennedy, 2003; Souitaris et al., 2007; Izquierdo & Buelens, 2008; Solesvik et al., 2013; Pfeifer et al., 2016; Nabi et al., 2018; Cui et al., 2021; Sun, Shi & Zhang, 2023).

According with Ratten and Jones (2020) entrepreneurship education is defined as the process of providing individuals with the concepts and skills to recognize opportunities that others have overlooked and to have the insight and self-esteem to act where others have hesitated. For Ratten and Usmanij (2021) besides the positive aspects related to entrepreneurship education there is a challenge involved, as not everyone is able to think or act entrepreneurially.

In fact, the subject has also garnered increasing interest among researchers, and several studies on entrepreneurship education with various approaches centered on different aspects have emerged. Some attempt to understand how the pedagogical use of a simulation can contribute to social entrepreneurship education (Costin, et al, 2018), or to illustrate the importance of case methodology in entrepreneurship and training education, particularly in Creative industries (Ó Cinnéide, 2010), or to evaluate the impact of having entrepreneurs as invited teachers in schools and their possible contribution by sharing their experiences (Blenker & Christensen, 2010), or to assess the entrepreneurial competence in entrepreneurship education and training (Lans & Gulikers, 2010) or even to learn from experience (Cope & Watts, 2000; Politis, 2008) and learn from failure (Testa & Frascheri 2015).

Several educational programs of entrepreneurship have emerged, focused on the development of entrepreneurial attitudes and recognizing the importance of this theme in the overall education of young people (Costa & Carvalho, 2012). Entrepreneurship education among youth can foster the acquisition of skills and the development of essential attitudes to create a new business. Tipically, entrepreneurship education courses include a range of topics such as financial management, human resources, new product development, creativity, market research, business plan, etc. These courses and programs enable students to enhance their entrepreneurial knowledge, skills, attitudes, and even personal qualities (Wu et al., 2022).

According to the model of Heinonen and Poikkijoki (2006) the results of youth entrepreneurship education can be measured considering three dimensions:

- Attitudes (self-confidence, initiative, risk-taking, creativity, problem solving);
- Knowledge (technical, economic and financial literacy, management knowledge);
- Competencies (communication, presentation and transmission of ideas, teamwork, ability to explore opportunities in the various phases of the entrepreneurial process, including opportunity evaluation, execution and business plan).

As defined by Heinonen and Poikkijoki (2006, p. 84) "The aim of entrepreneurship education is to integrate the skills and attributes of an entrepreneurial individual with the entrepreneurial process and related behavior."

During the Blended Intensive Program (BIP) on entrepreneurship, students had the opportunity to develop this kind of skills, as well as the international / multicultural competencies mentioned above, integrating them in the entrepreneurial process (EP), since, during this program, the students have the opportunity to work in the five phases of EP: idea generation, opportunity evaluation, planning, company formation/launch and growth.

3. International Education

International education is a critical tool of soft power (Lomer, 2017). In a polarized world, where international understanding is sometimes difficult, the ability to influence the behavior or interest of other stakeholders in international entrepreneurship context can be a competitive advantage. Cultural immersion and the exposure to the values and customs of a host country through international education is an important training for future entrepreneurs. For this reason, international education has increased in recent years.

In fact, international education in higher education institutions (HEIs) has grown significantly both in terms of volume and in scope and complexity over the last decades, evidencing a strong concern and effort to respond to the global economy and cultural forces (Welch & Denman, 1997; Goby, 2007).

The commoditization of higher education provided a new understanding of international education. Today international education is seen as a service good that provides career opportunities (Sabet & Chapman, 2022). It is consensual that this education provides additional skills and competencies that are likely to increase job prospects. It is widely established that students with international education develop several entrepreneurial key skills through international mobility, such as:

- Self-awareness, self-confidence, sense of identity, and personal independence;
- Being informed, greater interest in global affairs and cross-cultural perspectives;
- Organizational skills, project management, decision-making, creativity and taking on responsibility;
- Vision, independence, experience, broader outlook and attitude;
- Problem-solving, coping strategies and risk taking;
- Patience, flexibility, adaptability, open-mindedness and humanity;
- Team work and team leadership skills;
- Fluency, accuracy and appropriateness of language competence;
- Mediation skills, conflict resolution, sensitivity, humility and respect;
- Forging of relationships and networks;
- Challenge to personal stereotypes, cultural relativism;
- Enhanced intercultural communication, conducting business inter culturally;
- Cultural empathy;
- Non-judgmental observation, respect for local values without abandoning one's own;
- Cultural understandings, ways of thinking and adaptation to complex cultural environments Key skills required by employers;
- Self-awareness;
- Initiative and enterprise;
- Willingness to learn;
- Planning and organizing;
- Integrity;
- Commitment/motivation;
- Problem-solving;
- Flexibility;
- Self-management;
- Team work;
- Communication skills;
- Foreign languages;
- Networking;
- Leadership;
- Customer service;
- Interpersonal skills.

Intercultural skills and international education offer more employability in the global job market (EAIE, 2012; Karacsony et al., 2022; Sabet & Chapman, 2022). The benefits are not limited to better understanding of foreign work culture, in fact students with international education are more confident and self-reliant. Furthermore, these students have wider intellectual horizons and a greater ability to appreciate other perspectives (Yeravdekar & Tiwari, 2014; Sabet & Chapman, 2022).

4. Methodology

4.1 Research Design

This study used a case study design and adopted a mixed research approach that includes qualitative and quantitative methods. Mixed methods research explicitly offers a framework for combining methods (Timans et al., 2019). The main advantage of use these mixed methods approaches is that they allow for the use of several data collection methods, which can contribute to a more robust research and minimize the weaknesses of a single-method research. Additionally, some experts believe that the mixed method approach improve the

validity of the data collected, and provides stronger evidence of the results obtained (Khoo-Lattimore et al., 2019).

4.2 Data Collection

For the quantitative study sample and data collection, a structured survey was applied. The survey consisted of Likert-scale and open-ended questions. The survey was developed to assess the impact of the EXIT program on students. Students were asked questions such as: "How satisfied are you with your participation in the project?" and "How relevant is the topic addressed in this project?". It was also intended to analyze the degree of satisfaction with the activities carried out and the project's contribution to the development of entrepreneurial attitudes and skills in participants.

For the qualitative study, a semi-structured group interview (focus group) was carried out. Through the focus group, it was intended to obtain more detailed information about the students' satisfaction regarding their participation in the project, as well as to identify positive and negative aspects of the project. Focus group included questions such: "What did you like most about EXIT program?" and "What skills and attitudes have you improved by participating in this project".

The analysis of student participation in EXIT program by country of origin underscores the program's international appeal and diversity (Table 1). Portugal, Belgium, and the Czech Republic had the largest contingents, indicating strong local and international interest. Smaller but still notable representations from countries like Austria, the Netherlands, Poland, and Latvia highlight the program's broad reach across Europe. This diverse participation enriches the experience for all students and contributes to the global perspective fostered by EXIT program.

Table 1: Student population

Country	Institution	Students
Austria	St. Pölten University of Applied Sciences	5
Belgium	EPHEC asbl	5
	UC Leuven Limburg	5
Czech Republic	Institute of Technology and Business in České Budejovice	5
	College of Polytechnics Jihlava	4
Latvia	BA School of Business and Finance	1
Netherlands	Rotterdam University of Applied Sciences	5
Poland	Wyzsza Szkola Bankowa WE Wroclawiu	4
Portugal	School of Business and Administration	16
TOTAL		50

4.3 Online Questionnaire

For the quantitative study, an online questionnaire was administered to all students who participated in the EXIT. It was managed through Google Forms and made accessible by a link to capture anonymously the students' evaluation about the project. The questionnaire was divided into 2 sections. In the first section was requested information on respondents' demographic data (namely, age, gender, nationality and home institution). Section two was dedicated to collect data regarding the project evaluation.

The number of questionnaires filled in was 32 of the total of 50 students with a return rate of 64%.

To ensure the clarity of the questionnaire, 5 participants were invited to check their understanding of the survey questions. After their feedback, some of the questions were rephrased to provide more accurate ideas of the questions in the questionnaire.

4.4 Focus Group

After the completion of the project, a focus group was held with Portuguese students. A semi-structured interview guide was developed based on the insights obtained from the questionnaire that was used to collect data. The focus group approach was chosen, because it offers the advantage of enabling students to present diverse perspectives, while also facilitating the exchange and comparison of their experiences (Kvale, 1996). The students were encouraged to openly describe and discuss their experiences and highlighting aspects that they

considered important in the project participation. Eight students agreed to take part in an online focus group, which lasted approximately 40 minutes. It was audio recorded and then transcribed.

4.5 Data Analysis

Quantitative and qualitative data were analyzed separately. For the quantitative data, it was collected, compiled, and checked for consistency and accuracy before being entered using Microsoft Excel. Then, frequency tables and other descriptive statistics were generated.

Content analysis was used to evaluate the outcome of the focus group for the qualitative data.

5. Results

The analysis of the results from a survey applied to the students as well as from the focus group allowed to understand several aspects and dimension that are presented below.

5.1 Quantitative Results – Student Survey

The collected sample of student survey was composed of 32 valid answers, representing a response rate of 64% (Table 2).

Table 2: Number of students that participated in the survey

Country	Number of participating students	Number of replies	Response rate (%)
Austria	5	4	80
Belgium	10	8	80
Czech Republic	9	7	77.8
Latvia	1	1	100
Netherlands	5	2	40
Poland	4	2	50
Portugal	16	8	50
Total	50	32	64

Regarding the sociodemographic data, the majority (84.4%) were aged up to 24 years. More specifically, those aged between 19 and 21 years represented more than half of the respondents (56.3%), followed by those aged between 22 and 24 years old (28,1%). The age mean is 22 years, the youngest aged 19 years old and the oldest respondent was 31 years old. Regarding gender, most participants were female (78.1%).

Project Evaluation

Concerning the satisfaction level with the project (Figure 1), it was possible to verify that data was concentrated among the highest levels of satisfaction with the majority (75%) in the level of 5 to 7 of Likert scale used. However, it is essential to pay attention to the percentage of respondents who indicated that they were "Slightly Dissatisfied" or "Dissatisfied" (3.1% and 18.8%, respectively) to identify areas for improvement. This feedback is crucial for ongoing program development, ensuring that EXIT continues to meet the expectations and needs of its participants.

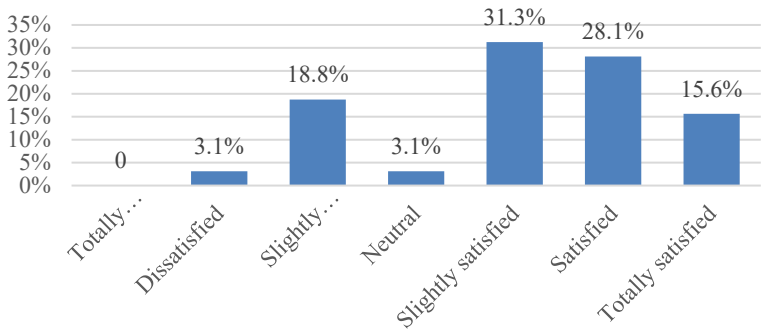


Figure 1: Students' overall level of satisfaction with the project

The assessment of the topic's relevance in EXIT, focusing on "Entrepreneurship, Innovation, and Technology in Tourism and Hospitality," provided insights into participants' perceptions of the program's topic.

Figure 2 shows that the majority of participants recognized the value of the addressed topic in this project. The combination of "Relevant" and "Totally Relevant" responses, totaling 40.6%, indicated a substantial level of approval for the chosen topic. While there were a few participants who found it "Slightly Irrelevant" or "Totally Irrelevant," their numbers were relatively low. Overall, EXIT's topic appeared to resonate with a significant majority of participants.

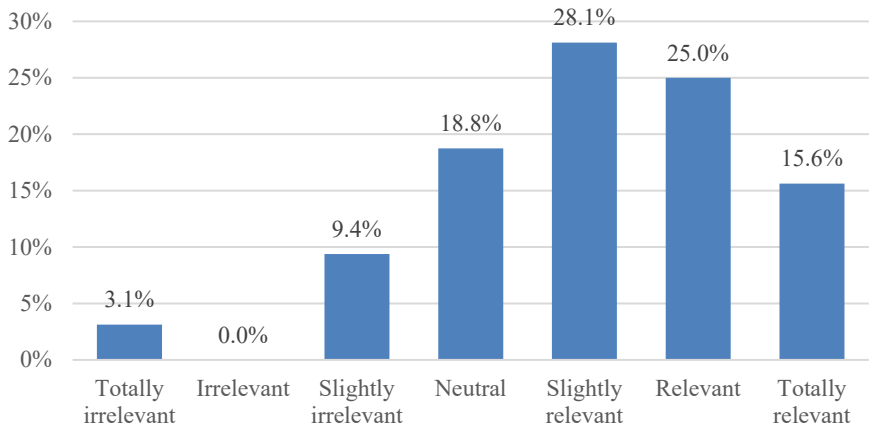


Figure 2: Topic relevance

The feedback from students who participated in EXIT provided valuable insights into their satisfaction with the various facilities and leisure activities offered during the program.

The analysis of student evaluations on the facilities and leisure activities within EXIT indicated a generally positive experience (Table 3). Students were particularly pleased with "Watching the Dolphins" and the "Special Dinner," both of which received the highest mean scores. In contrast, accommodation, lunches, and coffee breaks received moderately positive ratings, indicating satisfaction but with potential areas for improvement. The feedback highlights the importance of delivering engaging and memorable leisure activities, as they significantly enhance the overall participant experience and contribute to the success of the program.

Table 3: Facilities and leisure activities evaluation

Item	Mean	Std. Deviation
Accomodation	5.47	1.414
Lunches	5.19	1.635
Coffee Breaks	5.22	1.539
Watch the dolphins	6.25	1.047
Special dinner	6.38	1.264

Note: 1-Totally dissatisfied; 2-Dissatisfied; 3-Slightly dissatisfied; 4-Neutral; 5-Slightly satisfied; 6-Satisfied; 7-Totally satisfied

Participants in EXIT engaged in various activities throughout the program, and their feedback provides valuable insights. The mean scores assigned by students to different activities offer a quantitative perspective on their perceived effectiveness and satisfaction (Table 4).

As can be seen in the following table, brainstorming received the highest mean score, showing that students found this activity particularly engaging and productive. It suggests that participants valued the creative process and the generation of innovative ideas, which aligns with the entrepreneurial spirit of EXIT.

The international forum, as well as the preparation and presentation of the websites also presented averages above 5, demonstrating that in general the participants enjoyed carrying out these activities. The mean score of these activities indicates that participants generally considered them beneficial but perhaps with some room for improvement.

On the other hand, the preparation of the financial plan received a lower mean score compared to the other activities. This suggests that students encountered challenges or had concerns about this particular task. It could be perceived as complex, demanding, or in need of improvement in terms of instruction or support.

Table 4: Activities evaluation

Item	Mean	Std. Deviation
International Forum	5.06	1.294
Brainstorming	5.31	1.635
Business Model Canvas	4.81	1.615
Business Website	5.06	1.759
Presentation of the websites	5.25	1.344
Financial Plan	3.63	1.718

Note: 1-Totally dissatisfied; 2-Dissatisfied; 3-Slightly dissatisfied; 4-Neutral; 5-Slightly satisfied; 6-Satisfied; 7-Totally satisfied

Project impact on students

The impact of EXIT on student, as measured by various attitudes, is an important indicator of the program's effectiveness in fostering valuable entrepreneurial skills.

It was possible to verify that EXIT has a predominantly positive impact on various attributes related to student. It significantly enhances critical thinking, creativity, initiative, problem-solving, proactivity, responsibility, cooperation, social responsibility, and a balanced mix of ambition, optimism, and realism. These findings indicate that the program effectively cultivates these valuable attitudes in participants.

While the program encourages risk-taking, there may be potential for further development in this area. The impact on ethics is an area where the program might consider additional emphasis to foster ethical considerations among participants. Overall, EXIT positively influences students.

Table 5: Contribution of the project in the development of attitudes

Item	Mean	Std. Deviation
Critical Thinking	5.22	1.475
Creativity	5.75	1.270
Initiative	5.56	1.480
Risk-taking	4.63	1.699
Problem solving	5.25	1.778
Proactivity	5.28	1.442
Ethic	4.78	1.581
Responsability	5.63	1.185
Cooperation	5.94	1.216
Social responsability	5.53	1.270
Ambition, optimism and realism	5.22	1.453

Note: 1-Totally disagree; 2-Disagree; 3-Slightly disagree; 4-Neutral; 5-Slightly agree; 6-Agree; 7-Totally agree

After rating the impact of their participation in the project on the development of a set of attitudes, students were asked to identify the main skills developed by participating in the project. The analysis of EXIT contribution to student skills development showed a strong positive impact, particularly in areas such as teamwork and communication. These findings underscore the project's ability to enhance critical skills for future professionals. The slightly lower percentages in conflict management, exploring opportunities, and contingency capabilities suggested potential areas for program refinement to ensure a more comprehensive skills development experience.

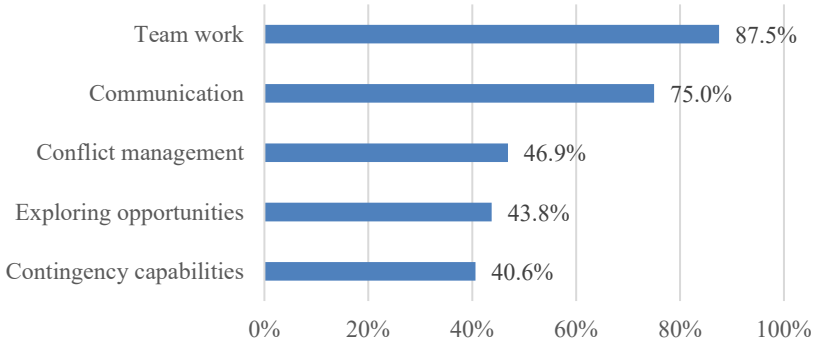


Figure 3: Contribution of the project in the development of students' skills

The study also sought to establish whether the students had developed any business-related knowledge from their participation in EXIT. According to Figure 4, majority of respondents indicated that they deepened their knowledge in the areas of management and finance (71.9% and 65.6%, respectively) through the EXIT program. These high results suggests that the program is highly effective in teaching management and finance principles.

With only 50% of respondents indicating a deepening of knowledge in marketing, this is an area with potential for improvement. This moderate percentage suggests that while essential marketing concepts are being covered, there may be gaps in the depth or breadth of the subject matter.

On the other hand, website development had the lowest percentage, with only 43.8% of respondents reporting a deepening of knowledge. This indicates a significant area for development in future editions.

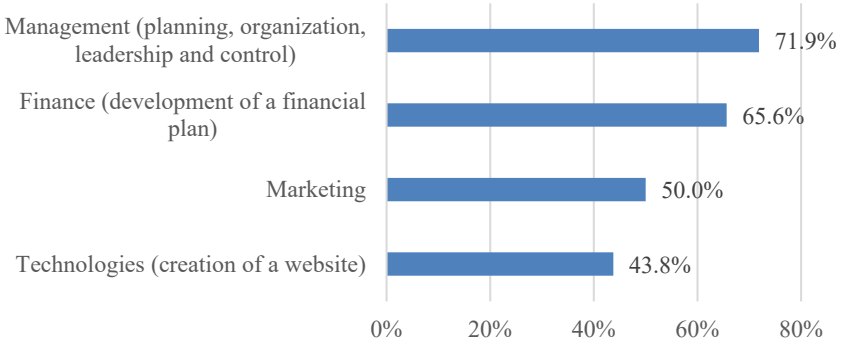


Figure 4: Contribution of the project in the development of knowledge

The recommendations made by students who participated in EXIT provided insight into the perceived value of the project and their willingness to endorse it to their peers. The analysis of recommendations by students who participated in EXIT overwhelmingly supports the project (Figure 5). The fact that 87.5% of participants would recommend it to their colleagues is a strong evidence to the program's positive impact and perceived value.

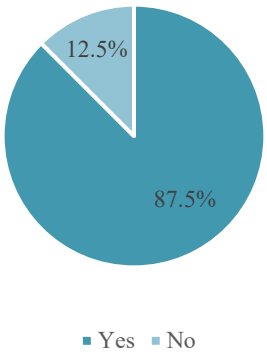


Figure 5: Program recommendation to other colleagues

5.2 Qualitative Results - Focus Group

Eight students participated in the group interview (focus group). The focus group aimed to gather in-depth insights from students who participated in EXIT, specifically to understand their opinions and experiences related to the project. Students were encouraged to provide sincere feedback, and the discussion provided valuable feedback on various aspects, including the program's effectiveness, learning outcomes, and areas for improvement.

Positive Aspects:

- Skills Development: Participants overwhelmingly expressed that the program significantly enhanced their entrepreneurial and teamwork skills. They emphasized that the hands-on approach of "learning by doing" allowed them to apply theoretical knowledge to real-world situations. This experience positively influenced their confidence in their entrepreneurial capabilities.
- Cultural Exposure: Students appreciated the multicultural environment of EXIT, highlighting the diversity of backgrounds and perspectives within their teams. They noted that working with international peers broadened their horizons and increased their cultural awareness, which they considered a valuable aspect of the program.
- Cohesion and Collaboration: The participants emphasized the strong teamwork and collaboration that developed during the project, especially during the face-to-face sessions. They noted that working together with their peers, who came from diverse cultural and educational backgrounds, fostered a sense of unity and cohesion among the group members.

Negative aspects:

- Difficulty Working in Online Groups:
- One of the recurring themes in the discussion was the challenges students faced when working during the online sessions. Some reported difficulties in areas such as communication, collaboration, and team dynamics. This issue can be attributed to the virtual nature of the project and the inherent challenges of online teamwork. Respondents indicated that, during the online sessions, they experienced some difficulties in establishing personal connections and building relationships with their teammates through digital interactions. The online environment also posed challenges in terms of team dynamics. Participants reported difficulties in coordinating efforts, setting clear roles, and maintaining engagement within virtual groups. These challenges were seen as potential barriers to effective collaboration, which is essential for the success of the project.
- The implications of this issue are twofold: first, it impacted the quality of teamwork, making it less effective and cohesive than in-person collaboration. Second, it may have hindered the participants' ability to leverage diverse skill sets and perspectives within their groups. These challenges raise concerns about the program's adaptability to the online format and the need for better strategies to facilitate effective virtual teamwork.
- Tasks Complexity:
- Students mentioned that the in-person tasks were more demanding. The complexity of these tasks required a significant investment of time and effort. Some felt that certain in-person tasks were significantly more demanding than others, causing an imbalance in the effort required. Addressing this issue is essential to ensure a fair and equitable experience for all participants. Striving for a more even distribution of effort across tasks and groups can enhance the overall quality of the program and alleviate undue stress on students.

6. Conclusions

This paper presents an International Intensive Program on Entrepreneurship and underscores its significance in fostering the development of students' skills, behaviors, and attitudes. The program effectively met the motivations and expectations of students participating in EXIT. It provided them with the opportunity to enhance their skills, interact with diverse individuals, and collaborate in a multicultural environment.

This study highlights the importance of an entrepreneurship education program, not only in providing theoretical knowledge but also in cultivating an entrepreneurial mindset by nurturing entrepreneurial skills, behaviors, and attitudes among its students.

Furthermore, the analysis of the results demonstrates the efficacy of the "learning by doing" approach, promoting both the acquisition of valuable knowledge and healthy competition among students. This was evident in the strong teamwork and cohesion displayed by the groups.

The analysis of student evaluations provides a valuable perspective on the effectiveness of various EXIT activities. While some activities received high mean scores, indicating strong satisfaction, others, like the Financial Plan, appear to need attention or potential improvement. This feedback underscores the importance of continuous program refinement to ensure that all activities align with the participants' expectations and learning objectives. Addressing these insights can help enhance the overall experience and educational outcomes for future EXIT participants.

The feedback from the focus group discussions indicated that participants generally responded positively to EXIT. It was effective in enhancing their entrepreneurial skills, fostering multicultural experiences, and promoting collaboration. The challenges raised were seen as opportunities for program refinement. Overall, the insights from this focus group will be valuable for future program enhancements and improvements.

The negative aspects raised during the focus group discussions provide valuable insights into areas that require attention and improvement in the EXIT program. The challenges associated with online group work and the demanding nature of in-person tasks are significant concerns that should be addressed. By acknowledging these issues and developing strategies to mitigate them, the program can continue to provide a valuable and enriching experience for future participants. Additionally, a review of task complexity and time management in the in-person activities can help ensure a fair and manageable workload for all students. This evaluation also yielded valuable suggestions for improvement, which are essential for ensuring the continuous enhancement of the EXIT program.

The main limitation of this study is the sample size. The size of our sample limits the robustness and reliability of more detailed statistical analyses. Advanced techniques and the exploration of correlations often require larger datasets to produce meaningful and generalizable results. With a smaller sample, there is a higher risk of statistical anomalies and reduced confidence in the findings. In this way, we chose to present a range of statistics and figures to provide a clear and accurate representation of our data without overextending the analysis.

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Enhancing Innovation in Higher Education Institutions: Barriers, Actions and Strategic Instruments for Sustainable Innovation

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Abstract: Innovation and sustainability have become increasingly important in recent years in education and research, helping to address global challenges and strengthening the collaboration between universities and industry. Integrating sustainable innovation practices in higher education institutions (HEI) plays a key role in creating a support system for academic and industrial collaboration and delivering value to society. Sustainable innovation involves making intentional changes to an HEI organization's philosophy and values, as well as to its products, processes, or practices. It serves the specific purpose of creating social and environmental value in addition to economic returns. Even so, there is still a need to improve the transfer of knowledge and technology as an integrated system between university and industry. The paper explores how universities develop an environment favourable for innovation while fostering a supportive culture for it. The article presents the findings from round table interviews involving forty participants with the following profiles: research managers, research advisors, innovation advisors, project managers, project support staff, researchers in education processes, support staff for researchers in project implementation, solution development, technology transfer offices, and other similar profiles. For the discussion three exploratory questions were given regarding the problems/barrier's universities face in sustainable innovation, actions that should be taken to increase innovation potential, and means/instruments of innovation in an academic environment. An extra question was presented looking for suggestions for possible actions and means as strategic steps for a brief period intervention of 6-12 months. This work sheds light on several critical aspects related to sustainable innovation in HEIs by investigating barriers hindering innovative thinking, exploring organizational and individual-level actions, and examining the means and instruments of innovation in an academic environment. The research data has offered valuable insights into effective strategies for overcoming barriers and creating an environment that fosters innovation. Furthermore, the study provides practical recommendations and short-term strategies for empowering universities to create a vibrant culture of innovation and maximize their impact on research, education, and knowledge transfer.

Keywords: Innovation, Universities, Impact, Strategies, Sustainability, Education

1. Introduction

Innovation, Sustainability, Digitalization and Entrepreneurship are emerging areas in universities (Kreiterling, 2023). The role of universities is crucial in fostering innovation as they are centres of knowledge creation and dissemination, and can, therefore, manage effective transfer and utilisation of knowledge and bring economic and societal impact (European Union, 2019). Consequently, universities explore more innovation and sustainability through their research, rethink the education system, and try different models of how to deliver and transfer innovation outcomes to real-world applications and make a positive impact (Kreiterling, 2023). Higher education institutions (HEIs) could integrate innovative thinking concepts and practices into various aspects of their operations. These encompass education and curricula, research endeavours, facility and campus operations, community engagement and awareness, organizational management and frameworks, as well as evaluation and reporting mechanisms. (Lozano, et al., 2015).

The Organisation for Economic Co-operation and Development (OECD, 2005) defines innovation as the implementation of a new or significantly improved product (good or service), or process, a new marketing method, or a new organizational method in business practices, workplace organization or external relations. The concept of the entrepreneurial university was developed by Etzkowitz and Leydesdorff (2000) and became one of the key concepts for the triple helix model where universities need to evaluate the traditional role of education and research and add a third mission that contributes to the economic growth and the transfer of research results from the lab to the society and economy. Innovation, from a university research point of view, and the way it is used in this study is defined as the process of translating knowledge and findings generated through academic research into new or improved products, services, processes, or systems that bring about positive societal, economic, or environmental impact. Innovation involves the application of creative thinking, experimentation, and collaboration to develop solutions that address pressing challenges, meet market needs, or create opportunities for societal advancement (Etzkowitz and Leydesdorff, 2000).

The fusion of education, research, innovation, sustainability, technology, business, and an entrepreneurial mindset is creating the playground for achieving competitive and sustainable developments in society.

Universities have to take on this new role of facilitators of innovative thinking by creating, developing, and applying new innovative environments (Morawska-Jancelewicz, 2022).

1.1 Research Questions

Overcoming some of the barriers requires HEIs to change their education and research mindset and establish a robust innovation strategy aligning with their overall objectives, set clear goals, and define a roadmap for execution.

The main goal of this article is to inspect how sustainable innovation is set in the holistic picture of universities. The following research questions (RQs) have been established for this paper.

RQ1 What problems/barriers do universities face in sustainable innovation?

RQ2 What are the actions that should be taken to increase the innovation potential in universities?

RQ3 What are the means/instruments of innovation in an academic environment?

The three Research Questions have been followed by an action question: Propose 3 actions and means as steps for the next 6-12 months.

1.2 Contextual Framework

Higher education institutions are facing many challenges in education, research, and innovation. The HEI is affected by the changes and innovations that take place in societies and economies globally. It is widely held that HEI should adhere to these changes and models, and innovate accordingly (Barber, et al., 2013). Under the new circumstances, HEIs should rethink their model of functioning; create knowledge that can be commercialised into new products and services; educate researchers and students in innovation and new ways to implement the science at the same time as acquiring funding for their research.

Research has already found certain barriers that HEIs are facing in enhancing their capacity for delivering innovation. In recent years, the universities expanded rapidly, and as seen by Hall and Lulich (2021), even though universities adopted innovation, entrepreneurship and transformation in their strategic plans, there are still some missing parts: plans do not express visions of bold initiatives, restructuring or 'bold innovation'; do not express the type of competitive drive; do not necessarily provide mechanisms to fulfil the goals; no facts about measured changes. It is common for HEIs to encounter difficulties when attempting to translate innovative ideas into practical, scalable solutions. Several barriers often impede the HEIs from thinking about innovation from research and development and implementation of innovation in future commercial solutions (Gkrimpizi, Peristeras and Magnisalis, 2023) and among these barriers are the lack of planning and focus, issues related to applicability and continuity of actions, and resistance to change.

Another dimension of introducing sustainable innovation in HEIs and education relates to the need to establish a collaborative work environment within HEIs. According to Margalef García and Pareja Roblin (2008), fostering such an environment presents a significant challenge. The authors emphasize the importance of facilitating collaboration among colleagues, staying open to new ideas, sharing power and supporting others by allocating time for teamwork and colleagues (Margalef García and Pareja Roblin, 2008). Furthermore, in a study on the successful adoption of a new blended learning approach, Garrison and Kanuka (2004) found that the creation of clear institutional policies for innovation, the establishment of supportive organisational structures at HEIs, such as contact points or specialised units, and a managerial strategic approach to innovation are essential.

Some authors suggest that in addition to the managerial support for innovation initiatives as a "top-down" approach, there must also be a buy-in from the academic staff for the strategic orientation towards innovation at HEIs. MacKeogh and Fox (2009) highlight those negative attitudes among academic staff towards innovations, low acceptance of new actions and education models, and lack of awareness about the potential and quality of these innovations emerged as barriers to the integration of innovation in universities.

Therefore, understanding and addressing these barriers is crucial for HEI to navigate the path towards innovation and unlock its true potential. The lack of planning and focus is a common barrier that HEIs face when attempting to drive innovation (OECD, 2016). Without a clear strategic roadmap and goals, it becomes challenging to align efforts and allocate resources effectively.

Efforts to enhance innovation potential within academic settings involve several drivers and actions. The facilitation of closer engagement with industry and businesses as part of everyday research activities fosters knowledge exchange, technology transfer, and collaborative research initiatives that align academic efforts with

real-world challenges and opportunities. Well-functioning links between universities and companies can stimulate economic growth (Mansfield, 1991; Salter and Martin, 2001) and help solve societal problems.

Brennan, et al. (2014) mention that integration of innovation in the university research context encompasses a wide range of activities including, but not limited to, technology transfer, commercialization of research outcomes, interdisciplinary collaborations, and the development of entrepreneurial mindsets among researchers and students. As such, innovation and the innovation capacity of a nation depend not only on the strength of individual players (firms, universities, government research laboratories, etc) but more importantly on the links between those actors (Morlacchi and Martin, 2009). These benefits may be delivered through the commercialisation of technologies resulting from academic research.

Schumpeter's definition of innovation is linked with the economic and growth aspect of innovation by defining it as the commercial or industrial application of something new, such as a new product, process, or method of production, but it may also manifest itself as new markets or sources of supply, as well as new forms of a commercial business or financial organisation (Schumpeter and Swedberg, 2021). Additionally, cultivating a new organizational culture, strategy, and priorities within universities is essential. Equally important is the development of knowledge in innovation and the building of competencies among researchers. Innovation is a new product, but it may also be: a new process of production; the substitution of a cheaper material, newly developed for a given task, in an essentially unaltered product (Kline and Rosenberg, 2010); the reorganization of production; internal functions, or distribution arrangements leading to increased efficiency; better support for a given product; lower costs or an improvement in instruments or methods of fulfilling innovation.

Furthermore, establishing a robust support system within universities is crucial. Such systems provide guidance, mentorship, and resources to facilitate the translation of research outcomes into practical applications. Innovation and sustainability have become increasingly important in recent years in education and research in addressing global challenges and strengthening the collaboration and transfer of knowledge between public education and private sectors (Kozirog, Lucaci and Berghmans, 2022).

Finally, ensuring access to resources, such as experts in intellectual property rights (IPR), innovation, and related fields, is vital for navigating legal and commercial aspects of innovation, protecting intellectual assets, and maximizing the impact of academic research. Technology Transfer Offices (TTOs) are pivotal in facilitating the transfer of research outcomes to commercial applications (Morawska-Jancelewicz, 2022), leveraging expertise in IPR and commercialization strategies (Weckowska, 2015). Additionally, adding new competencies and practices in innovation and sustainability could make a university stand out in its domains, attracting approaches to new research and actions (UNESCO ESD Monitoring and Evaluation, 2012) thus, by adopting a comprehensive and holistic approach, HEIs can make significant strides towards achieving the Sustainable Development Goals.

Considering the above-mentioned issues, HEI innovations have to be nurtured via changes in collaboration and managerial processes, sustainable ecosystem and industry collaboration, funding strategies and efficient allocation of resources, and new skills and competencies for students and the academic staff, to name a few. To unveil the barriers, actions, and drivers that will create more innovative universities, this study presents the research questions and the methodological background of our analysis, which is then followed by an in-depth description of the respective research results.

2. Method

We looked at the research styles that could be used to answer best our need to explore the barriers to innovation and the research questions, and we conducted a round table discussion to answer our research aims for this study. The choice of research style depends on the aim of the research, the research question, the degree of desired research autonomy, the level of investigator/interviewer intervention, the level of participants freedom to speak on a given question, the available resources, the time frame, and aesthetics (Crabtree and Miller, 1999; Brewer and Hunter, 1989). As shown in Figure 1 below (Brewer and Hunter, 1989 cited in Crabtree and Miller, 1999) the study is at the description stage and the qualitative research questions were used to describe better the status of the innovation in universities.

The purpose of the round table discussion is to provide a place for the exchange of ideas and discussion of their relevance in the way of generating innovation) in the field of research where this is applied (Crabtree and Miller, 1999) Round table discussions are part of the qualitative research and are small group discussions where everybody has an equal right to participate. A round table is not a public meeting - it is a focus event to closely explore specific issues identified elsewhere or to identify contemporary issues not addressed before, it can be used to explore solutions, define actions, and develop strategies. A round table confronts issues and ideas rather

than people and aims to create a win-win situation rather than a win-lose scenario (Day, 1998; Ashton, de Angelis and Graf, 2014). The premise on which the idea of round tables is based is simple – participants, be they researchers, administrators, experts, local authority employees, members of community-based organisations or members of the public, are seen as being of equal stature (Day, 1998).

Aim	*Analysis Objective*	*Research Question*	*Research Style*
Identification	Identify/name	What is this? Who is that? What is important here?	Field, doc-hist, philos
Description	Qualitative description	What is going on here? What is the nature of the phenomenon? What are the dimensions of the concept? What variations exist? What meanings/practices occur in lived experiences?	Field, doc-hist, philos
	Quantitative description	How many? How much? How often? What size? How is the phenomenon distributed over space?	Survey
	Normative description	What is the value of a phenomenon?	Field, doc-hist, survey, philos
Explanation			
Generation/ association	Interpretive, explanation, generation	What is happening here? What patterns exist? How do phenomena differ and relate to each other? How does it work? How did something occur/happen?	Field, doc-hist
	Statistical, explanation, generation	What are the measurable associations between phenomena? Does variable x relate to other variables? Why does it work? Why did something occur?	Doc-hist, survey
	Deductive, explanation	Given these premises, then _____?	Philos
Explanation			
Testing/ prediction	Causal confirmation	What will happen if __? If __ then __? Does one variable cause the other?	Exper
	Theory testing	Is the original theory correct? Does the original theory fit other circumstances? Are there additional categories or relationships?	Field, doc-hist, survey, exper
Intervention/ control	Prescription testing Evaluation	Is __ more effective than __? Does __ have greater efficacy than __? How can I make "x" happen? What difference does this program/intervention make?	Exper (RCT) Field, survey

NOTE: Doc-hist = documentary-historical; exper = experiment; philos = philosophical;
RCT = randomized control trial.

Brewer and Hunter, 1989 cited in Crabtree and Miller, 1999

Figure 1: Research Aims, Analysis Objectives, Research Questions and Appropriate Research Styles

Round table discussions are a qualitative research method characterized by their interactive and collaborative nature, facilitating in-depth exploration of complex topics through participant-driven dialogue. They offer a platform where diverse perspectives can converge, allowing participants to share insights, experiences, and opinions in a conversational format. This method promotes rich data collection by encouraging open discourse and enabling participants to build upon each other's contributions, thereby generating nuanced understandings of the research topic. Moreover, round table discussions can foster consensus building among participants, leading to the identification of common themes, priorities, and potential solutions to research questions or issues under investigation.

However, despite their benefits, round table discussions present challenges: there is a risk of certain participants dominating the conversation, potentially marginalizing quieter voices and limiting the diversity of perspectives represented in the data. Organizing and conducting round table discussions can be time-intensive and logistically demanding, involving coordination of schedules, management of participant dynamics, and facilitation of meaningful dialogue. The qualitative part of the description phase chosen for this study and for the research questions seeks to explore the meanings and perceptual experiences of the practices to capture the holistic vision and interdependent nature of the system. There was no 'leader' as such, but there would be a facilitator to ease the work process and to maintain focus and scribes to record the process, decisions, and actions.

To uncover the problems and challenges faced by HEIs in fostering innovation, we organised a series of round table discussions - as part of the problem description step of the research. The primary objective was to identify and understand the barriers that hinder innovation within the university setting and determine the necessary actions to overcome them.

Based on the Day (1998) and Crabtree and Miller (1999) studies, we designed the fifteen-minute discussion tables: within an hour time slot, a maximum of four round table presentations took place. In the general setup of the arrangement, the host was the presenter and introduced the theme for two minutes then switched to the moderation of the open discussion. The goal of the round table discussions was to find out from the participants

about the innovation barriers and actions they have noticed in their institution. To be a part of the study, the participants were informed that their answers would be anonymised, and professional notes would be taken.

The round table discussion ran in a small scenario: the participants had to imagine they were the appointed managers of the newly created "Innovation Driver Unit" in their organisation, for which they needed to develop and implement the unit strategy. To help in creating the strategy the RQ questions have been unveiled to the participants on a flip chart sheet as shown below.

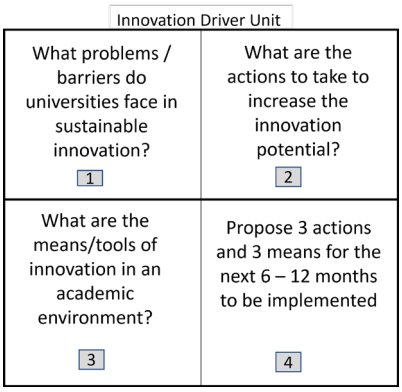


Figure 2: Material used for the round table discussions

The questions were asked one by one and approximately three minutes for discussion was given. Notes were taken on the flipchart while the discussion was taking place and confirmed with the participants that the notes were what they were expressing. The research conducted in this study involved only four groups of forty participants at the same conference, which may present a limitation in terms of the diversity of ideas collected. The restricted number of participants and their professional profiles may not fully capture the wide range of perspectives and experiences necessary to comprehensively understand the barriers and drivers of sustainable innovation in higher education institutions. To address this, the intention is to replicate the setup with an additional 2-3 events, incorporating participants from varied profiles and levels in HEIs management.

3. Result

The results of this paper have been collected while implementing four rounds of 15-minute round table discussions at the EARMA (European Association of Research Managers and Administrators) Conference 2023: Widening and Deepening of the RMA Profession, 24-26 April, Prague. The conference aims were to share best practices in research, innovation and education in HEI and network and it was attended by 1,400 participants from the Research Management and Administration community; 40 representatives from universities, applied sciences institutions, and research centres worldwide participated in the round table discussions. The profiles of the participants were: research managers, research advisors, research advisors or professional experts in pre-award and post-award phases of projects, innovation advisors, project managers, project support staff, researchers in education processes, support staff for researchers in project implementation, solution development and technology transfer office contacts, and other similar profiles. Discussions were organized in groups of ten, each comprising diverse professional backgrounds.

The answers from the flipchart have been inserted in a database coding the rounds, questions, and answers, and creating 5-6 labels for each question to classify the answers. The labels have been correlated with the Contextual Framework and the literature review.

3.1 Observations from the Round Table Discussions (Data Collection)

During the collection of data, four round table discussions were run, and the lead researcher of the table and presenter made sure not to allow one person/sector of the table to dominate the discussion and ensured that everyone got a chance to speak.

The observations gathered from conducting the round table interviews at the conference provided valuable insights into the dynamics and effectiveness of the discussions. Firstly, the attendance numbers did not vary significantly across (10 to 11 participants per table). Secondly, the participants at the tables had different professional backgrounds and were from different organisations, creating a balance and adequate representation in the group. Thirdly, the clarity of the process varied: some participants found the guidelines straightforward, while others required additional explanations regarding the research questions (RQs) being

addressed. During the discussion, no person was appointed to answer, but if there were no answers, then the lead researcher asked about the type of organisations they were from and if there was something that they could tell about their organisations. It made people comfortable to talk about the areas that they knew and quickly they were happy to talk about the other areas and aspects of innovation that were on the flipchart sheet. The allocated time of 15 minutes per discussion group was thought sufficient for the exchange of ideas, yet some persons or groups desired more time to dive deeper into their specific barriers or actions.

There was a noticeable trend towards thematic discussions aimed at harmonizing perspectives and responses among participants. Interestingly, differences emerged between attendees from higher education institutions (HEIs) and applied sciences university's regarding their opinions and experiences. While some topics prompted consensus, particularly among HEI representatives, discussions with applied sciences participants often brought forward distinct viewpoints, reflecting their unique operational contexts and objectives such as close collaboration with industry or product-based research.

When the four questions were answered, a short oral summary was given and then there was an exchange of business cards or email addresses for further contact if interested. The tables ran one after the other for one hour, changing groups every fifteen minutes.

Overall, these observations emphasize the importance of facilitating robust thematic discussions to enhance the effectiveness and inclusivity of future round table interviews.

3.2 Results from the Round Table Discussion

The general results obtained after the execution of the round table are shown below, answering each of the established research questions (RQ). The focus here is on the objective reporting of the participants' answers, leaving the interpretation and implications for the discussion section.

3.2.1 Problems/barriers that universities face in sustainable innovation

The motivation behind the RQ1 'What problems/barriers do universities face in sustainable innovation' lies in the desire to understand and address the barriers and challenges that research and education organizations encounter in their transition towards a culture of innovation. By identifying these barriers, the study aims to shed light on the specific needs of universities as they strive to embrace innovative thinking. The results (represented in Figure 3) present the recorded responses and corresponding numbers that highlight specific barriers faced by universities in sustainable innovation according to the participants.

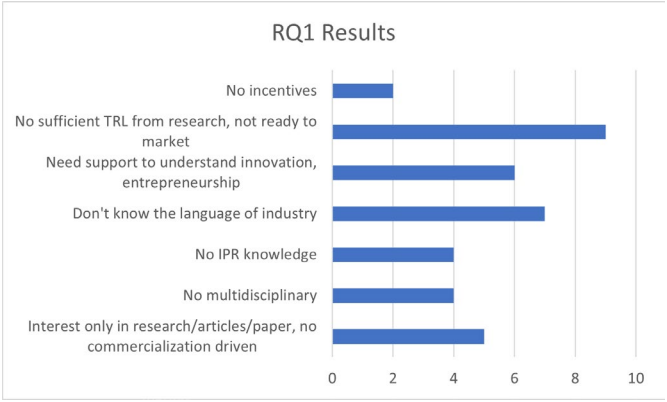


Figure 3: RQ1 answers from participants

Nine participants noted a lack of a sufficient Technology Readiness Level (TRL) in research, suggesting that the outcomes are not yet ready for market commercialization and a clear link with the lack of knowledge on IPR (4 answers). Seven participants expressed a lack of familiarity with the language and dynamics of the industry. Six participants highlighted the need for support in understanding innovation and entrepreneurship and other skills to build the innovation thinking approach, to move away from the interest in only scientific research articles. Lastly, two participants indicated a lack of incentives for innovation within the university environment.

3.2.2 Actions that should be taken to increase the innovation potential in universities

The RQ2 – 'What are the actions to take to increase the innovation potential in universities?' motivation lies in the appeal to identify specific actions that can be implemented at both the organizational and employee levels

to foster and enhance innovation within universities. The results (represented in Figure 4) present the recorded responses and corresponding numbers that highlight various strategies and actions needed to promote engagement with businesses and foster innovation within universities.

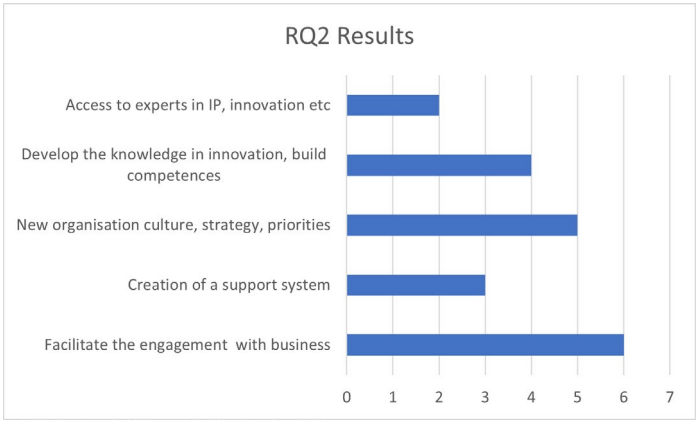


Figure 4: RQ2 answers from participants

Six participants emphasized the importance of facilitating engagement with industry and businesses in day-to-day research. Five respondents highlighted the importance of cultivating a new organizational culture, strategy, and priorities. Four respondents stressed the need to develop knowledge in innovation and build competencies. Other answers emphasized the creation of a support system, and the need to access resources such as experts in intellectual property (IP), innovation, and related fields.

3.2.3 Measures/instruments of innovation in an academic environment

The motivation behind RQ3 'What are the means/instruments of innovation in an academic environment?' intends to identify and understand the various drivers, tools and instruments that can be employed to foster innovation within an academic setting according to the participants at the round table discussions. The results (represented in Figure 5) present the recorded responses and corresponding numbers that highlight the means and instruments of innovation within an academic environment.

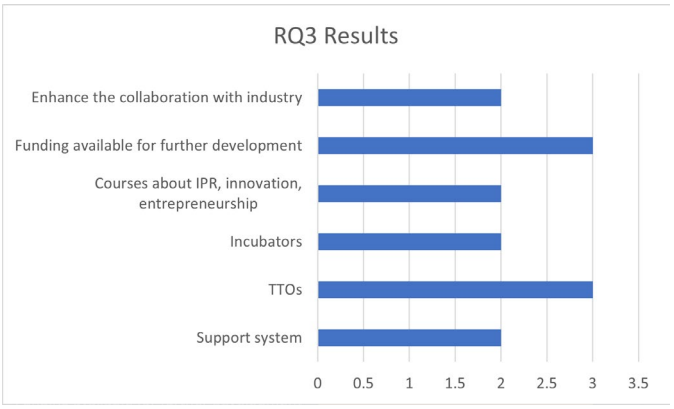


Figure 5: RQ3 answers from participants

Three participants mentioned the significance of Technology Transfer Offices (TTOs) and the other three respondents emphasized the lack of availability of funding for further development. Two participants emphasized the importance of a support system. Two participants highlighted the role of incubators in fostering innovation and others highlighted the need to enhance collaboration with industry. Similarly, two participants mentioned the importance of offering courses and programs focused on Intellectual Property Rights (IPR), innovation, and entrepreneurship.

3.2.4 Actions and measures as strategy steps for the next 6 – 12 months

The Q4 is a question addressed to the participants to propose actionable solutions for overcoming the barriers and challenges identified. The motivation for using this Q4 lies in the desire to identify and recommend specific actions and tools that can be implemented in the short-term to medium strategy to facilitate the transition of

universities towards a sustainable innovation approach. Recognizing the urgency and need for immediate progress, this study aims to explore and highlight the initial steps that universities can take within a defined timeline to foster sustainable innovation.

Our results (represented in Figure 6) present the recorded responses and corresponding numbers that highlight recommended actions and means to foster sustainable innovation within universities and answers given by the participants at the round table.

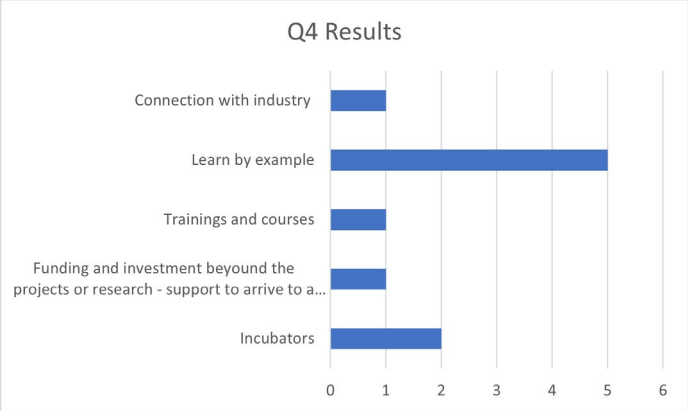


Figure 6: Action Question 4 Answers from participants

Five participants emphasized the importance of learning by example by creating ambassadors from the researchers who followed the innovation path. Two participants emphasized the importance of incubators for nurturing collaboration with industry and creating innovative ventures and startups emerging from academic research. Other participants stressed the value of training and new skills, stronger TTO offices with experts in the field of innovation and commercialization.

4. Discussion and Conclusion

The paper discusses the barriers, drivers, and supportive actions that HEI could implement in their strategies and activities for implementing sustainable innovation in their research and education for their students and academic staff. The findings in this study underscore the importance of various means and instruments in fostering innovation within HEI. The four research questions were posed to the participants with the specific motivation to determine the barriers that research and education organisations are facing; determine the needs that they have in switching to innovation thinking, the actions that they need to take and the tools that should be used to reach better outcomes. The sub-sections are following the structure of the Research Questions.

4.1 Problems/Barriers That Universities Face in Sustainable Innovation

Through the investigation of barriers hindering the implementation of sustainable innovation in HEI, we have identified key insights that can inform strategic interventions and foster innovative thinking within the institutions. From the theoretical part, the findings show the gaps in planning, applicability, and resistance (Gkrimpizi, Peristeras and Magnisalis, 2023). Similarly, the academic stakeholders emphasize they lack time, consistent funding and strategies for innovation (Hall and Lulich, 2021) and the universities are not oriented to the commercialization of knowledge (Barber, et al., 2013). Even more, they lack the language of industry and innovation literacy and dynamics of the industry (MacKeogh and Fox, 2009). Equally, many participants noted unfamiliarity with industry language and dynamics, as well as the prevalence of low TRL levels where research often stagnates due to inconsistent funding and strategies. Moreover, they emphasise that the academic focus and evaluation as of now is on research and publications and not driven by commercialization. The findings of the barriers and problems HEIs face in introducing sustainable innovation thinking underline the multifaceted nature of barriers hindering its implementation.

4.2 Actions That Should be Taken to Increase the Innovation Potential in Universities

The study's exploration of actions to increase innovation potential, such as fostering engagement with industry and cultivating a new organizational culture, contributes to the academic discourse on the triple helix model of university-industry-government relations (Etzkowitz and Leydesdorff, 2000). Furthermore, it is essential to equip students and researchers with skills and resources in innovation, entrepreneurship, IPR, and multidisciplinary approaches, while fostering a culture that recognizes and rewards innovation as a research outcome. Where

now in most universities only scientific papers are formally recognised as research outcomes leading to an absence of incentives for researchers to integrate sustainable innovation in their fields. The participants' emphasis on engagement with the business sector, interdisciplinary collaboration, and the development of entrepreneurial mindsets among researchers and students aligns with the growing body of studies and authors advocating for a holistic approach to innovation in academia (Correia, et al., 2024).

4.3 Measures/Instruments of Innovation in an Academic Environment

The study shows that, in addition to the need for stronger TTO offices, access to adequate funding is crucial for supporting the progression of innovative ideas from concept to commercialization as many of them tend to have a lower TRL and that is making the commercialization path harder. While some organisations recognise the support of the TTOs as drivers for innovation others are still lacking the systems or the instruments used are too weak. The TTO support system (Weckowska, 2015; Morawska-Jancelewicz, 2022) should ensure access to experts in IP, innovation, business, commercialization, and related fields. Other measures that have been highly recommended by the participants are training, courses and programs focused on IPR, innovation, and entrepreneurship to equip researchers and students with the necessary knowledge and skills to navigate the innovation landscape effectively. From the theory and interviews, we can see that collaboration with industry stakeholders is important for fostering the development of innovation hubs, (Siebert, Wasserman and Fisher, 2019) knowledge exchange and joint research initiatives. Those collaborations are enhancing universities' innovation capabilities and ensuring the relevance of their research. Furthermore, a supportive system in the HEIs, including incubators, provides resources and mentorship to accelerate entrepreneurial ventures stemming from academic research and has been highlighted as important by the participants, which aligns with the studies and research looking at academia as an entrepreneurial ecosystem and support systems for innovations. (Correia, et al., 2024). Additionally, by exploring the means and instruments of innovation in an academic environment we show valuable insights on effective strategies to be implemented for overcoming barriers and creating an environment that stimulates innovation.

4.4 Actions and Measures as Strategy Steps for the Next 6 – 12 Months

The practical recommendations provided in this study offer valuable insights for university strategic managers, administrators, and policymakers aiming to foster a vibrant culture of innovation. The proposed actions and short-term strategies, acting like drivers that the study identified in the discussion with the participants are providing actionable recommendations to accelerate the transformation of universities' innovation culture and practices such as:

- To create Ambassadors for Innovation: identify researchers who have successfully navigated the innovation path and can serve as a model for others; promote their success stories.
- To establish Incubators to nurture collaboration with industry and to incentivize and support innovative activities such as startups emerging from academic research.
- To develop training and courses for researchers and students with target programs in the development of competencies in innovation, entrepreneurship, and IPR.
- To improve access to additional funding through better industry collaboration and investment to support the development and commercialization of research with a lower TRL.
- To strengthen the TTO and the support system to provide guidance and resources for researchers and innovators.
- To cultivate a new organisational culture by developing strategies that prioritize innovation within the HEIs and support risk-taking and creativity among researchers and students.

Overall, this study shows that there is not just one way to bring more innovation and commercialization of research created on the HEI, but it is a mix of actions and tools that universities have to take to cultivate a culture of sustainable innovation, drive impactful research outcomes, and contribute to solving societal challenges while advancing economic development. As for future work, there are several avenues for further exploration. Further research in the field could continue the study and conduct use-case studies to examine real-life examples of universities successfully implementing sustainable innovation practices, thus providing valuable insights into effective strategies and their outcomes. Additionally, investigating the role of policy frameworks and government support in facilitating sustainable innovation in universities would contribute to understanding the broader institutional context.

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Library Trends and Developments in a Technologically Driven Era

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Abstract: The rapid evolution of digital technologies has significantly impacted how libraries operate and serve their communities, leading to a transformative shift in library services internationally. Despite the widespread acknowledgment of this digital shift, there remains a substantial gap in understanding of how libraries are adapting to these changes, particularly in terms of integrating digital innovations to enhance user access and engagement. This study aims to bridge this knowledge gap by examining the directional trends of library development in the context of digital transformation. By analysing library services in three regions - Europe, the United States of America, and Asia - critical adaptations and innovations are identified that are shaping the future of library services. The goal is to illuminate the current landscape and propose strategic directions to help library stakeholders with planning and implementation.

Keywords: Library trends, Library transformation, Library services innovation, Community engagement, Sustainable evelopment

1. Introduction

Recently, the advent of digital technology has fundamentally altered the information access and management landscapes, heralding a new era of rapid global change. These advancements have transformed business operations and societal interactions by influencing infrastructural and functional paradigms of libraries. As institutions of knowledge transmission, libraries are now at a critical juncture, requiring comprehensive adaptation to remain relevant and effective in today's digital-centric world (Thiruppathi, 2024).

Initially, the transformation in libraries was primarily reactive, responding to broader digital shifts that were reshaping industries. Innovations such as digital databases, e-books, and online access points became fundamental, yet integration of these technologies varied widely (Chowdhury, 2010). This disparity in adaptation highlighted significant gaps in library services, with many institutions struggling to align their offerings with evolving demands from patrons. (Borgman, 2003; Lankes, 2011, Lal et al., 2022; Nie, et.al., 2022).

The digital era presents challenges and opportunities for libraries: the rapid pace of technological change demands continuous learning and adaptation, often straining existing resources and capabilities (Abdin, et.al., 2023). Yet these technologies also offer unprecedented opportunities to enhance service delivery, expand resource access, and innovatively engage with communities (Aharony, 2019; Sain & Negi, 2023). In this context of transformation and challenge, the present research examines how libraries in Europe, the United States of America, and Asia are navigating these changes.

This situation compels a need for understanding specific adaptations and innovations that libraries are implementing in response to digital transformation and social movements. By identifying common challenges which they face and successful strategies, insights into the evolving role of libraries in a data-driven age may be discerned. The goal is to provide a clear, comprehensive view of how libraries can harness digital technologies to thrive, enhancing their service as essential sources of knowledge for all generations.

The following sections will explore the literature on economic, technological, social, and environmental changes in libraries, establish a methodology for this study, and discuss findings in detail. A set of recommendations will be formulated to guide library stakeholders in strategic planning and implementation.

Research Objective

The primary aim of this study is to discern and systematically understand library growth and development trends in response to digital technological advancements. By investigating how libraries in different regions adapt to, and integrate, these technologies, common challenges and successful strategies will be identified to potentially inform future developments in library services. There is a special focus on 1) assessing the impact of digital technologies on library service models in different geographical contexts; and 2) identifying key trends in digital adoption and innovation in libraries that enhance service delivery and user engagement. By setting targeted

objectives, actionable insights may be provided to enhance the academic discourse on digital transformation in libraries and practical guidance for their strategic development.

2. Literature Review

The literature review explores the intersection of digital transformation and library services, highlighting significant trends, challenges, and innovations that have emerged in the library sector as a response to technological advancements and social movements. This review synthesises existing research to build a comprehensive understanding of how digital technologies are reshaping libraries. Library development content and perspectives in economic, technological, social, and environmental changes for different regions are all considered.

2.1 Digital Transformation in Libraries

Digital transformation in libraries encompasses a wide range of technologies, from automated management systems to digital archives and electronic resources (Anuradha, 2018). Connolly, et al. (2019) indicate that in addition to being about the adoption of digital instruments, digital transformation also involves rethinking library operations and services to enhance user interaction and information access. Libraries are increasingly adopting digital platforms to boost outreach and interactivity with users (Smith & Wong, 2019). While the benefits of digital transformation are clear, challenges are also substantial. Many libraries face technological, financial, and human resource constraints that hinder full-scale implementation of digital initiatives. In addition, continuous training and development are needed to educate library staff in new technology (Eje, & Dushu, 2018; Han et al., 2016). Privacy and security concerns related to digital services also pose ongoing challenges (Saha, 2024; Bright et al., 2020).

2.2 Enhancing Library Services Through Digital Innovation

Digital innovations have allowed libraries to transcend traditional boundaries, offering services such as remote access to collections, digital lending, and virtual reference services (Papy & Jakubowicz, 2018). Wu & Chen (2012) and Ekere et al. (2016) assert that these services have significantly increased user satisfaction and engagement. Internationally, libraries are currently emphasising digital technology use to facilitate access to information resources, augmenting user engagement (Lal et al., 2022; Eje & Dushu, 2018). Examples include creating digital collections; audiobooks; online databases accessible anywhere, anytime; self-service systems for borrowing and returning books and paying fines; as well as promoting user digital literacy and skills (Phanphai, et al., 2024). Dabas (2008) observes that digital technology library services are a development connecting all library stakeholders in an opportunity to access services equally. Kaur and Sharda (2020) and Nie, et.al. (2022) underline the use of cutting-edge technology such as artificial intelligence (AI) and robots in libraries of China as progressive library service quality advancement.

2.3 Access to Information Resources

Digital technologies are essential for enhancing access to information. E-resources, digital archives, and online databases are now essential components of library offerings (Gururaj & Arunkumar, 2014). The transition to digital access has potentially democratised access to information, making resources available to a wide audience without limitations of physical space or geographical boundaries (Strömqvist, 2023). Several nations in Europe, the Americas, and Asia are focused on providing universal and equal access to information by considering Open Access, as well as opening educational resources and online remote access to content and services (Ifla, 2022). One such service, digital preservation, makes it possible to store and safeguard data resources, extending their lifespan. Hazarika (2020) adumbrates methods and strategies, as well as advantages and disadvantages, of academic library digital preservation. Her findings may help libraries formulate digital preservation guidelines.

2.4 Sustainability and Environmental Practices

Library development trends broaden beyond technology and innovation to environmental friendliness and sustainability. Green library research is represented by Singh and Mishra (2019); Antonelli (2008); Ephraim (2003); Beutelspacher and Meschede (2020); Bincy and Vasudevan (2023); McElrath and Sutherland (2015); Rachman and Ratnasari (2022); Sudhakar (2023); Gupta (2021); Okojie and Igbinovia (2023); Beutelspacher and Meschede (2022); and Edwards (2011). These studies emphasise library sustainable development, prioritising environmentally friendly design, energy-saving technology, and minimising carbon footprints operationally while maximising positive environmental impact (carbon handprints). Policies and standards for environmentally responsible operations should be developed by educating users and society about sustainability.

2.5 Community Engagement and Inclusivity

Many modern libraries are developing into community centers, offering a wide range of services beyond the traditional scope of libraries. Moran, M. (2021) emphasises the importance of libraries in promoting community cohesion, increasing educational access, and celebrating cultural diversity. Inclusivity and access are essential for libraries to serve entire communities, especially the marginalised and underserved, including people with disabilities and other minorities.

2.6 Innovation in Library Services and Space Management

Khongmalai & Distanont (2018) generally define innovation as a tripartite concept, comprising: 1) industrial or organisational novelty; 2) development from extant knowledge; and 3) commercial potential for wide acceptance and use to benefit the economy, society, and the environment. In libraries, innovation is essential for developing and improving services to meet economic, social, environmental, and technological advancements. These changes potentially disrupt libraries, especially after the Coronavirus disease 2019 (COVID-19) pandemic, which marked a widespread shift to digital communication and learning. Awoyemi and Awoyemi (2021); Gholami et al. (2018); Lal et al. (2022) show that libraries are rapidly adapting to meet changing user needs by introducing new service models and employing space creatively (Sain & Negi, 2023; Ikolo, 2022). Many institutions have developed service innovations, such as the cashless library. Users may borrow materials, return them, and pay fines through convenient methods like quick-response (QR) code scanning. Some libraries are also using gamification concepts to heighten user engagement (Walsh, 2014; Adedokun, et al., 2021; Downie & Proulx, 2022). Simultaneously, library design strategies and flexible space may expand multi-purpose resource functionality. Libraries can also contain new sites emphasising hands-on learning and support innovation, such as makerspaces, launch pads, or coding clubs. These learning areas encourage creative knowledge exchange through experience of trial and error, leading to innovation. This aligns with the future direction of education, shifting from rote memorisation to a learner-centered approach. Creativity is promoted by encouraging critical thinking, logical reasoning, problem solving, and collaboration. Libraries may also serve as mental health support spaces for students, employees, and the community. One example of a new approach to library design management is the Life space concept proposed by Kornkaew, et al., (2024). The library is divided into four spaces: for learning, co-working, inspiration, and performativity. This innovative spatial arrangement has been shown to increase user satisfaction.

2.7 Business Model and Revenue Stream

Recently, libraries have faced budget cuts and closures. Rapid technological developments and a changing environment were accelerated by the COVID-19 pandemic. These led to increased demand for easy remote access to information and library services. In response, libraries adapted their business models. Bennett and Orr (2015); McCombs (2002); Munstedt (2019); Wilkinson (1998); Million and Haggerty (2020); Jennings and Garczynski (2020); Kumara and Sathish (2013) evaluate new business model development to generate revenue from multiple channels. Ghalavand, et.al., (2022) scrutinises different library types internationally to find multiple new revenue sources, including service fees, social network use, web space, e-commerce principles, marketing, and activity-based fundraising.

Despite extensive studies on the adoption and impact of digital technologies in libraries, there remains a gap in understanding of how these technologies are integrated into library strategies and operations across different regions. The long-term impact of digital transformation on library sustainability and community engagement also remains underexplored.

2.8 Funding and Support

Funding and support are critical for sustaining library operations and fostering innovation. Libraries in Europe benefit from EU grants and public/private sector partnerships, reflecting a collaborative approach to securing financial resources. In the United States, libraries use a combination of public funds, private contributions, and grants, along with advocacy efforts to secure funding. In Asia, library funding mechanisms vary by country, with significant investments in certain regions and impactful private philanthropy supporting high-profile projects. These diverse funding strategies enhance library services and infrastructure.

3. Research Design and Methodology

3.1 Research Approach

Qualitative research was done to obtain insight into library digital transformation strategies. This approach is suitable for exploring complex phenomena contextually, especially when boundaries between the phenomena and context are ambiguous (Yin, 2016). Qualitative methods facilitate a detailed examination of processes and outcomes associated with digital technology implementations in libraries.

3.2 Data Collection

Data was gathered as secondary data: concepts, theories, research, and articles related to library development; in-depth interviews with stakeholders, including administrators, librarians, and users; and observation. Each interview focused on the participant's experience with integrating digital technologies into library services. Document analysis included the examination of internal reports, strategic plans, and public documentation related to digital strategies and social movements of libraries. Purposive sampling targeted libraries that have undergone significant library development initiatives over the past five years. This ensured that findings would reflect the latest practices and challenges in library development. Libraries of different sizes and types were included to encompass a broad spectrum of operations and contexts.

3.3 Data Analysis

The data analysis process involved several stages:

- Data preparation: This stage involved transcribing the interviews and organising the secondary data, which included concepts, theories, research articles, and internal documents related to library development.
- Coding and categorisation: Using NVivo, a qualitative data analysis software, to systematically code the transcribed interviews and categorise the data into relevant themes. This process involved identifying recurring patterns and key themes related to digital transformation challenges and strategies in libraries.
- Thematic analysis: The coded data were grouped into broader themes reflecting the main aspects of digital transformation in libraries across the selected regions. This stage included analysing the data to identify trends, common challenges, and successful strategies.
- Result synthesis: The findings from the thematic analysis were integrated into a comprehensive narrative that highlights the critical adaptations and innovations shaping the future of library services. This synthesis involved comparing and contrasting the data across different regions to draw meaningful insights.
- Validation and interpretation: The results were cross-checked with existing literature to validate the findings and interpret their implications for library development in a technologically driven era. This stage ensured that the conclusions were grounded in both the primary data and the broader research context.

4. Results and Discussion

The findings were analysed from the data collected by interviews and document analysis. The results were organised by key themes identified in the thematic analysis, reflecting eight main aspects of digital transformation in libraries across the selected regions as shown in Table 1.

Table 1: Key trends identified

Dimension	Europe	United States	Asia
Digital Transformation	The development trend focuses on digitalisation, digital preservation, improving the e-infrastructure for researchers in the form of digital repositories to support the Open Science Data Cloud (OSDC) for widespread secure access to information resources. In addition, digital technology has been used to develop and improve digital access and access to collections,	Highlighting the shift towards digital mediums, libraries are increasingly leveraging electronic books and databases, alongside innovative digital technologies, to enhance service. This approach reflects a broader trend towards adapting library offerings to meet evolving digital needs of users.	Swift acceptance of cutting-edge technologies, including AI and robotics, alongside digital platforms in Asia, especially China. This trend underscores a regional proactive approach to integrating advanced technological solutions to expand library services.

Dimension	Europe	United States	Asia
	including library virtual reality applications.		
Sustainability	Libraries are increasingly relying on sustainability and environmentally friendly designs, aligning projects with broader European Union (EU) environmental policies. This shows a commitment to integrating green practices in library infrastructures.	An increasing emphasis on using sustainable practices in operational and construction phases, while launching community sustainability efforts. This shift reflects a growing library managerial commitment to environmental responsibility.	New incorporation of sustainability in design and function, prioritising green library initiatives. This is a significant move towards environmentally responsible library management and operations. The Green Library Award is presented in Thailand by the Thai Library Association (TLA), originally under the royal patronage of His Majesty King Bhumibol the Great.
Community and Cultural Focus	Libraries are expanding offerings to include multilingual collections and services, reflecting community linguistic diversity. In addition, hosting cultural and community-focused events boosts cultural preservation and community ties.	Libraries are evolving into vital community centers, providing an array of services, emphasising social support and educational initiatives. This evolution helps foster educational development and offers a wide range of social services to meet community needs.	Bolstering educational initiatives to preserve cultural heritage, libraries are essential resources for academic enrichment and preparation for competitive endeavors, supporting educational pursuits and cultural conservation.
Inclusivity and Accessibility	Ensuring access for all community members, including migrants and refugees, by providing multilingual resources. This commitment to inclusivity serves diverse populations. Many libraries have also explored Open Access through transformative agreements, such as The Finnish Consortium for Electronic Resources (FinElib), which collaborates with the publishers Nature Research and Association for Computing Machinery (ACM). Several nations are discussing fair data and online remote access to content and services.	Ensuring inclusivity, and accessibility as well as promoting diversity, equity and inclusion (DEI), libraries are designing services to cater to underserved communities. The goal is to foster an environment that is welcoming and equitable for all population segments.	Initiatives are being launched to address needs of diverse linguistic and cultural groups as well as enhancing accessibility for people with disabilities. These efforts vary across different regions, reflecting a commitment to inclusivity and adaptation of services to meet unique requirements of all community members.
Funding and Support	Mainly financed through public funds and EU grants, libraries also benefit from a longstanding tradition of public/private sector partnerships. Likewise, there is a model highlighting a collaborative approach to securing financial support and resources for library services and projects.	Libraries are financed by a combination of public funds, private contributions, and grants, with advocacy efforts used to secure funding. This financial strategy reflects a multifaceted approach to garnering support for library operations and initiatives.	Differences by nation in library funding are evident, with notable investments in certain regions. Impactful private philanthropy and corporate sponsorships also support high-profile library projects. This financial landscape showcases a diverse array of mechanisms to enhance library services and infrastructure.
Service Innovation	Libraries are innovating with alternative service formats such as pop-up and mobile libraries to extend their reach into underserved communities and implement digital book lending services. This innovation strategically shifts towards ensuring library service accessibility and inclusivity in diverse environments.	Libraries are introducing innovative services, including tool-lending and seed libraries, while incorporating onsite social services. This broadens library functions to diverse, community-centric services beyond traditional book lending, adapting to varied user profiles.	Libraries are leading the way with user engagement innovations, including deploying mobile library services, establishing online reading communities, and introducing café spaces in libraries. They also leverage technology to offer personalised services to patrons. This includes the creation of more interactive, user-centered library experiences.

Dimension	Europe	United States	Asia
Space Management	Repurposing historical structures for library facilities and integrating versatile, multi-use spaces for a variety of programs and gatherings. This strategy innovatively blends architectural heritage with contemporary library services, creating dynamic environments to support diverse community engagement.	Transforming library spaces to enhance flexibility and community orientation, incorporating coworking areas, meeting zones, and relaxation spots, while also embracing the use of outdoor spaces for extended engagement. This redevelops libraries into versatile, inclusive environments catering to a wide range of activities and community needs.	Advancing library architecture to blend technological advancements with versatile design, creating visually appealing environments conducive to learning. This drive offers functional educational spaces while prioritising aesthetic value through an inviting user atmosphere.
New Business Model	Investigating alternative financial strategies, such as crowdfunding for targeted initiatives, introducing membership dues for access to exclusive services, and forging collaborations with local enterprises to back specific programs. This proactive exploration of diverse revenue streams sustains and enhances library operations and offerings.	Shifting towards diverse financial resources, libraries are increasingly renting out spaces for special events, conducting fee-based workshops, and forming strategic alliances with corporate entities and nonprofit organisations. This trend boosts financial stability and expands service offerings through innovative collaboration.	Embracing the concept of mixed-use spaces, libraries are incorporating commercial areas such as cafés and bookstores to generate revenue. This model is supported by engaging in public-private partnerships to facilitate innovative projects. This approach helps ensure financial viability while enhancing the library's role as a community hub.

in libraries. These findings identify good practices and trends from Europe, the United States, and Asia, it is crucial to provide concrete strategies that library stakeholders can adopt to drive future developments.

Enhancing Digital Infrastructure

Invest in Advanced Technologies: Libraries should allocate resources to integrate advanced digital technologies such as artificial intelligence, robotics, and mobile applications. Upgrading existing systems and incorporating these technologies will improve service delivery and user engagement.

Staff Training and Development

Continuous skill enhancement: libraries must invest in ongoing training programs to ensure staff are proficient in the latest digital tools and technologies. Partnerships with educational institutions and professional organisations can provide accredited training opportunities.

Leadership training: promote leadership development programs to equip library managers with the skills needed to lead digital transformation initiatives effectively.

User-Centered Service Design

Personalised user services: utilise data analytics to gain insights into user behavior and preferences, enabling the creation of personalised services and recommendations.

Inclusive and accessible services: ensure digital services are accessible to all users, including those with disabilities, by incorporating assistive technologies and making digital content accessible.

Community Engagement and Inclusivity

Expand community outreach: develop outreach programs to serve underserved and marginalised communities, including mobile libraries, digital literacy workshops, and collaborations with local organisations.

Promote cultural and linguistic diversity: offer multilingual services and resources, and host cultural events and workshops to foster community engagement.

Sustainable Practices

Adopt green initiatives: implement sustainable practices in library operations, such as using energy-efficient designs, reducing waste, and utilising eco-friendly materials.

Digital preservation strategies: develop strategies for digital preservation to ensure the long-term accessibility and safeguarding of digital content.

Innovative Business Models

Diversify revenue streams: explore alternative revenue generation methods like crowdfunding, membership fees, and partnerships with local businesses. Libraries can also offer fee-based workshops, rent out spaces for events, and sell branded merchandise.

Flexible Space Management

Create multi-purpose spaces: design adaptable library spaces that can serve various functions, such as coworking areas, learning area, performative areas, and event venues. This includes using modern furniture and technology to support diverse activities.

Focus on user-centric design: implement design strategies that prioritise user comfort and convenience, creating inviting environments that encourage learning and collaboration.

5. Conclusions

This qualitative research study explored library trends and developments in Europe, the United States of America, and Asia. There, libraries are currently facing diverse challenges in the volatility, uncertainty, complexity, and ambiguity (VUCA) era. Libraries require guidelines and strategies for transformation in different dimensions, including digital technology, service innovation, information resource access, sustainability, community engagement, and inclusivity. In addition to maintaining accurate and reliable information services, libraries must also progress from traditional models. They should incorporate digital technology to develop service innovations and focus on user needs. Changing from the identity of a book or resource repository and reading space has led to exciting new possibilities internationally. Libraries should also prioritise sustainability, environmental- and user-friendliness, as well as diversity, equity and inclusion (DEI). Understanding these adaptation strategies will enable libraries to plan transformation strategies to support future use and achieve sustainability. Practically, the findings offer practical inspiration for library directors and policymakers to help prioritise investments and design programs to maximise the benefits of digital transformation.

6. Limitations and Future Research Directions

The present study may be limited by focusing on libraries that have already adopted digital technologies. Future research could explore libraries in the early stages of digital transformation to provide a fuller picture of the transition process.

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Governmental Policies and Sustainable Outcomes in EU: How Innovations Change the Game?

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Abstract: Environmental degradation is one of the main challenges in today's world. Impact on the environment can be reduced through the introduction of clean and more efficient technologies. And innovation plays a crucial role in this process by replacing old equipment and methods. There are different ways how researchers understand sustainable innovations and sustainable innovation ecosystems. The terms "sustainable" and "sustainable development" have become very widely used in recent years. Sustainability is crucially important for the development of regions and national economies. Existing literature on the topic of sustainable innovation ecosystems includes vague and ambiguous definitions of sustainable innovation, as well as ways to measure it. A number of studies analyse the impact of different factors on conventional innovations and eco-innovations. However, not enough research has been done on the effects of innovations on all three dimensions of sustainable innovations, which are economic, environmental, and social. The aim of the article is to define whether governmental policies that promote innovation and sustainable development lead to environmental, social, and economic improvements in the EU countries. Our study uses the Eurostat data for 27 European Union countries. The literature review will include studies on sustainable innovation ecosystems. In the second chapter, we will describe the sustainable innovation ecosystems and ways to measure the sustainable outcomes of innovations. We study sustainable innovation ecosystems on a national level. We use partial least squares structural equation modeling (PLS-SEM) to determine the influence of governmental policies on sustainable outcomes, with product and process innovation as mediating variables. Under sustainable outcomes, we mean the economic, social, and environmental improvements on a national scale. The analysis is based on applying a quantitative method with empirical data using SmartPLS software. The results demonstrated a significant direct impact of governmental policies on innovation, as well as on environmental and social outcomes. However, they showed no indirect impacts connected to innovations. The results contribute to the current state of knowledge on sustainable innovation ecosystems and give policymakers valuable insights on factors that influence such ecosystems.

Keywords: Sustainable, Environmental policy, Eco-innovations, Governmental innovation, Firms, EU, PLS-SEM, SmartPLS

1. Introduction

Increasingly concerned with the deterioration of the environment and the quality of human life, caused mainly by society's profit orientation (Tran et al., 2023), environmental and sustainability research has become one of the fastest-growing fields today. In the field of environmental issues, research has focused, for example, on consumers' green intentions and behavior (Hoang & Tung, 2024) or the green activities of companies, for example, the banking sector (Cardona Valencia & Calabuig Tormo, 2023). In the field of sustainability, current literature has focused mainly on factors that can determine the green behavior of companies (Horbach et al., 2023; Kotkova Striteska et al., 2024), how the government sector can support corporate initiatives in sustainability (Karman et al. 2024a; Sein and Darfo-Oduro 2024), and circular economy practices (Karman et al., 2024b). The main reason for this boom can be considered the threat to ecological stability (White et al., 2021), which represents a significant threat to human health (Bouchoucha, 2021) and social well-being (Omri et al., 2022), which stimulates interest in sustainable practices and innovation (Dmytrenko et al., 2024).

"Environmental degradation" includes climate change (Nguyen et al., 2023), biodiversity loss (Tan et al., 2022), pollution, and natural resource depletion (Ali et al., 2021). Addressing these issues has become a priority for researchers, policymakers, and industries. There is a growing emphasis on sustainable solutions across sectors. Innovations in technologies and practices are crucial in mitigating environmental degradation (Arranz, 2020; Durán-Romero et al., 2020). Sustainable innovations addressing environmental, economic, and social issues are essential to holistic development (Purvis et al., 2019). These innovations increase productivity and competitiveness while ensuring environmental protection and social well-being (Zhang et al., 2021). Sustainable innovation ecosystems involving diverse stakeholders are fundamental for sustainable growth (Durán-Romero et al., 2020; Janahi et al., 2022).

However, the literature (Purvis et al., 2019; Wei et al., 2022) reveals a lack of consensus on definitions and metrics for sustainable innovation, leading to confusion and research gaps. Many studies have examined the impact of various factors on traditional innovation and eco-innovation (Baeshen et al., 2021), but comprehensive research on the three-dimensional effects of innovation—economic, environmental, and social—is scarce.

Our study assesses whether government policies promoting innovation and sustainable development lead to improvements in these three dimensions in EU countries. Using Eurostat data from 27 EU countries, we evaluate the efficacy of government policies in promoting sustainable outcomes. Advanced analytical techniques, such as partial least squares structural equation modeling (PLS-SEM), and empirical data through SmartPLS software, enable a nuanced understanding of the relationship between government policies and sustainable outcomes. This approach explores the mediating effects of product and process innovations on achieving sustainability goals. The anticipated results will provide insights into sustainable innovation ecosystems and guide future policy and research directions in sustainable development.

The rest of the paper is organized as follows: Section 2 reviews the literature on governmental policies and sustainable innovations. Section 3 describes the data and methodology. Section 4 presents the results and discussion. The final section concludes with a summary of contributions and suggestions for future research.

2. Theoretical Background

2.1 Sustainable Innovations

The term "sustainable" has become a buzzword in recent years (Brink, 2022). The Brundtland Report (1987) of the United Nations defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs". Sustainability is crucial for the development of regions and national economies. However, "sustainable" often causes confusion by being used synonymously with 'eco-friendly" (Nill & Kemp, 2009; Karakaya et al., 2014; Wei et al., 2022). True sustainability includes economic, social, and environmental dimensions, known as the "three pillars of sustainability" (Purvis et al., 2019). Boons et al. (2013) pointed out that sustainable innovation is a three-dimensional concept. Eco-innovation, reducing negative environmental impacts (Horbach et al., 2012), is part of sustainable innovation, which improves performance in all three sustainability aspects (Boons et al., 2013). Mazaheri et al. (2022) and Hermundsdottir and Aspelund (2021) include all three pillars in their assessments of market-based instruments and firm competitiveness, respectively.

Despite the belief that environmental protection hinders economic growth, both are interconnected. Economic growth provides financial resources, while the natural environment underpins economic activities. Both are crucial for societal well-being. Innovations promote sustainability by saving money and reducing pollution (Gunarathne, 2019). Efficient production methods exemplify how economic growth and environmental protection can coexist. Innovation, a goal of sustainable development by the UN, influences production processes and end products. Gunarathne and Peiris (2017) found that eco-innovations positively impact economic and social indicators. Innovations that reduce energy consumption and enhance recycling foster both environmental and economic sustainability, preserving financial resources (Ashford & Hall, 2010). Innovations for social sustainability include healthier working conditions and creating jobs for disadvantaged groups.

2.2 Role of Policymakers in Enhancing Sustainability

Porter and Van der Linde (1995) were among the first to study the influence of environmental policy on innovativeness, proving the positive impact on competitiveness and sustainability. According to Demirel and Kesidou (2019), three main drivers for innovation are market pull, technology push, and regulation stimulus. Hojnik and Ruzzier (2016) highlighted regulatory pressure as a driver and barrier for eco-innovations, noting companies invest in environmental innovations only if economically beneficial. Government regulations, alongside technology push and market requirements, are key innovation determinants (Horbach et al., 2012). Díaz-García et al. (2015) noted innovation is driven by internal and external factors, including government regulation.

Researchers (Ramanathan et al., 2017; Cohen and Tubb, 2018) recognize the positive impacts of governmental policies on reducing greenhouse gas emissions, though overly restrictive policies can have adverse effects (Mulatu, 2018; Wolde-Rufael and Mulat-Weldemeskel, 2021). Firms lack incentives to innovate if policies are too lenient (Ben-David et al., 2021). Studies in the EU (Neves et al., 2020) and OECD (Martínez-Zarzoso et al.,

2019) countries show stringent environmental policies positively influence carbon dioxide emissions. Governments enhance eco-innovations through measures like environmental taxes (Bashir et al., 2020), emission trading schemes (Zimmermannová et al., 2019), and subsidies (Gerarden, 2023). Regulation efficiency depends on internal (management, human resources) and external (government pressure and support) factors (Chu et al., 2018).

2.3 Approaches to Measure Sustainable Innovations

Gunarathne (2019) attempted to define a framework for measuring sustainable innovation, dividing indicators into economic, social, and environmental directions. Rauter et al. (2019) developed the Sustainability Innovation Performance indicator with four dimensions: social, environmental, process efficiency, and product sustainability. Gunarathne and Peiris (2017) highlighted the difficulty of finding a universal measuring system due to the complexity of sustainability dimensions. They used economic indicators like output and cost, environmental indicators like reduced land use, and social outcomes like projected salary increases. Measuring social benefits remains challenging, partly due to data availability. Common indicators for measuring sustainability in innovations are summarized in Table 1.

Table 1: Examples of sustainable innovation indicators

Economic	Social	Environmental
Profit from the sale of new product	Increase in employees' income thanks to new technology	Energy saved
Cost savings from the adoption of new technology	New workplaces created	Water saved
Increase of firm's worth	Taxes paid increase	Air, soil, and water pollution decreased
New consumers and suppliers	Safety improvements	Waste reduced

3. Hypotheses Development and Methods

This study draws upon the existing literature that emphasizes the multifaceted nature of sustainability (Purvis et al., 2019) and the integral role of governmental policies in fostering innovation within firms. It is evident from the review that while environmental, economic, and social dimensions of sustainability are interconnected, the impact of governmental policies through innovation acts as a critical mediator in achieving sustainable outcomes. Studies highlighted in the theoretical background, such as those by Porter and Van der Linde (1995) and others, demonstrate a positive correlation between regulatory frameworks and innovation in the corporate sector. These findings suggest that well-designed government interventions can catalyze advancements in sustainable practices among firms. Given this backdrop, the study formulates its hypotheses to systematically investigate the direct and mediated influences of governmental policies on the economic, environmental, and social outcomes of European firms. The hypotheses aim to capture the dynamic interactions between policy-driven innovation activities and broader sustainability goals, thereby contributing to a deeper understanding of sustainable innovation ecosystems within the European Union. We establish the following hypotheses:

> *H1: Governmental policies have a positive influence on the economic outcomes of European firms through innovation.*

This hypothesis builds on the evidence suggesting that public procurement for innovation and other policy instruments enhance firm-level economic performance by fostering innovation outputs and outcomes, thus supporting broader economic sustainability (Stojčić et al., 2020).

> *H2: Governmental policies have a positive influence on the environmental outcomes of European firms through innovation.*

Reflecting on the regulatory impacts of initiatives like the EU Emissions Trading Scheme (ETS), this hypothesis posits that environmental regulations effectively induce firms to adopt eco-friendly practices, thereby aligning with environmental sustainability objectives (Martin et al., 2016).

> *H3: Governmental policies have a positive influence on the social outcomes of European firms through innovation.*

This hypothesis is grounded in the findings of Ludvig et al. (2018), who explore the potential of EU and national policies to support social innovation in rural areas. Their research underscores the significant impact of these

policies on enabling community-oriented innovations, which cater to vulnerable social groups and address societal challenges at large. The effectiveness of such policies in promoting participatory inclusion and supporting the social fabric of rural communities highlights their critical role in achieving social sustainability. The influence of innovations as a tool for sustainable development was, in particular, proven by Loučanová et al. (2022), who studied the innovativeness of Slovak SMEs. Skare & Porada-Rochon (2022) proved that innovation is a crucial factor in reaching sustainable growth on macro and micro levels through the application of energy efficiency measures.

This study employs a quantitative approach to assess the influence of governmental policies on the sustainability outcomes of European firms. Utilizing a robust dataset, primarily sourced from Eurostat, we examine the domains of Science and Innovation alongside Sustainable Development. Additional data regarding the Human Development Index (HDI) is derived from the United Nations database. These datasets provide a comprehensive view of the innovation landscape across the European Union, allowing for nuanced analyses of policy impacts on firm performance.

To analyze the relationships posited in the hypotheses, Partial Least Squares Structural Equation Modelling (PLS-SEM) is employed using SmartPLS 4.0 software. This method was chosen for its ability to handle complex models and small samples effectively, which is particularly pertinent given that the dataset comprises observations from all 27 EU member states.

The dataset was rigorously prepared by removing empty and missing values to ensure the integrity of the analysis. PLS-SEM was applied to evaluate the impact of independent variables on dependent variables through mediating variables, providing insights into how governmental policies influence sustainability outcomes at the firm level. By structuring the methodological approach around these components, the study aims to provide a thorough understanding of how governmental initiatives in the realm of innovation and environmental regulation can drive sustainable development within the European business sector. The study's variables are carefully defined to capture the multifaceted nature of governmental policies and their impact on firm-level innovation and sustainability outcomes. These variables are categorized into latent and manifest types, as detailed in Table 2.

Table 2: Variables description

Latent variable	Manifest Variable	Type	Source
Environmental policies (GP)	Public R&D expenditures as % of GDP	Independent	Eurostat
	Total taxes as % of GDP		
Governmental innovation (Innov)	Enterprises with process innovations (as % to all)	Mediating	
	Enterprises with product innovations (as % to all)		
Economic (Econ)	FDI per capita	Dependent	
	Employment rate		
Environmental (Env)	Recycling rate		
	Circular material use rate		
Social (Soc)	Income distribution		
	Corruption Perception Index (social)		
Control (Ctrl)	GDP per capita	Control	
	Human Development Index		UN

4. Results and Discussion

The following Figure 1 and Table 3 describe the results of the SEM model.

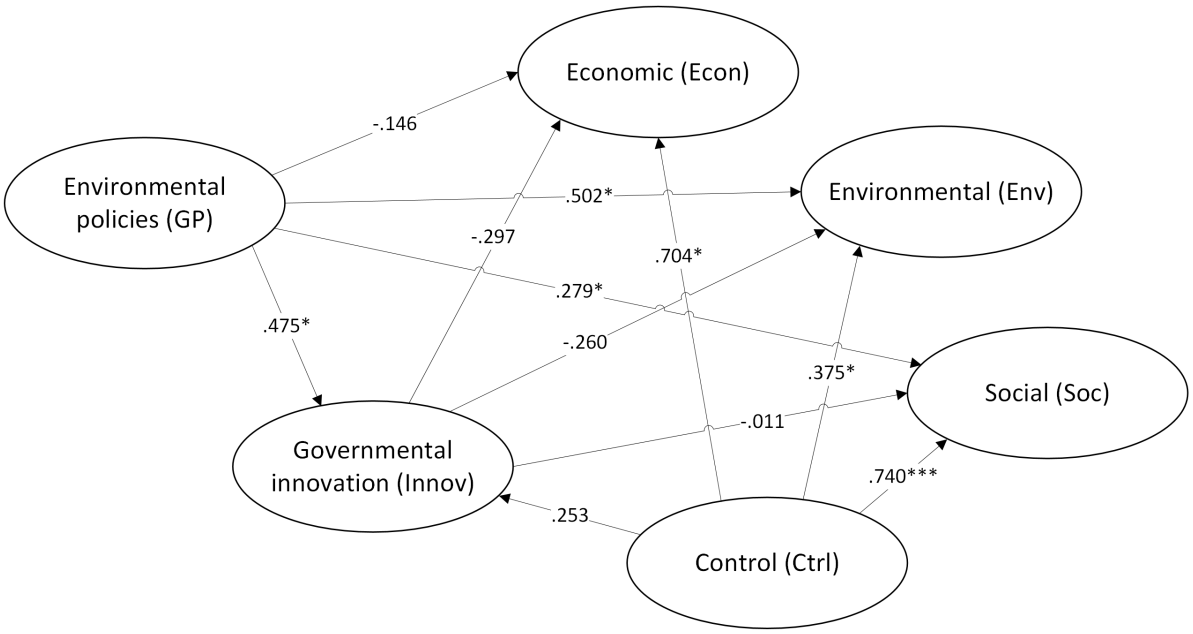


Figure 1: Bootstrapping results for the SEM model

Note: * p < 0.05; **, p < 0.01; ***p < 0.001; solid line = direct relationship, dashed line = indirect relationship.

Table 3: Direct Effects

	Original sample (O)	Sample mean (M)	Standard deviation (STDEV)	T statistics (|O/STDEV|)	P values	
GP -> Econ	-0.146	-0.466	0.450	0.325	0.745	
GP -> Env	0.502	0.503	0.208	2.415	0.016	*
GP -> Innov	0.475	0.516	0.186	2.550	0.011	*
GP -> Soc	0.279	0.260	0.121	2.298	0.022	*
Innov -> Econ	-0.297	-0.094	0.384	0.772	0.440	
Innov -> Env	-0.260	-0.250	0.240	1.087	0.277	
Innov -> Soc	-0.011	-0.001	0.129	0.086	0.931	
Ctrl -> Econ	0.704	0.797	0.330	2.136	0.033	*
Ctrl -> Env	0.375	0.363	0.189	1.986	0.047	*
Ctrl -> Innov	0.253	0.207	0.226	1.120	0.263	
Ctrl -> Soc	0.740	0.750	0.116	6.408	0.000	***

*Note: * p < 0.05; ** p < 0.01; ***p < 0.001.*

The results of the SEM analysis indicate that government environmental policies (GP) have a positive direct impact on environmental (Env) and social (Soc) outcomes. In contrast, the data reveal that government environmental policies do not exert a notable effect on economic outcomes (Econ). It was also found that government policies have a positive effect on innovation (Innov). However, these innovations do not further affect any outcomes (Econ, Soc, Env). With regard to the control variable (Ctrl), the analysis demonstrated a significant positive effect on all three sustainable outcomes (economic, environmental, and social), with a specifically significant impact on social indicators. At the same time, the impact of the control variable on innovation was not statistically important.

As previously indicated, government policies do exert an influence on innovation. However, the impact of innovation on economic, social, and environmental outputs is not statistically significant. To further substantiate or refute the hypothesis that the innovation variable plays a mediating role, we conducted an indirect effects analysis. The results of this analysis are presented in Table 4.

Table 4: Indirect Effects

	Original sample (O)	Sample mean (M)	Standard Deviation (STDEV)	T statistics (|O/STDEV|)	P values
GP -> Innov -> Econ	-0.141	-0.049	0.189	0.744	0.457
GP -> Innov -> Env	-0.124	-0.131	0.143	0.868	0.386
GP -> Innov -> Soc	-0.005	-0.002	0.073	0.072	0.942
Ctrl -> Innov -> Econ	-0.075	-0.018	0.141	0.534	0.594
Ctrl -> Innov -> Env	-0.066	-0.044	0.088	0.748	0.454
Ctrl -> Innov -> Soc	-0.003	0.001	0.041	0.069	0.945

*Note: * p < 0.05; **, p < 0.01; ***p < 0.001.*

The results show that none of the indirect effects of government environmental policies (GP) through innovation (Innov) on economic (Econ), environmental (Env), or social (Soc) outcomes were statistically significant. These findings suggest that innovation does not function as a significant mediator in the relationship between government policies and these outcomes. Similarly, the control variables (Ctrl) through innovation did not have a statistically significant indirect effect on any of the outcomes. This confirms that the direct effects of government policies and control variables are crucial to understanding their effects on outcomes.

Results showed that governmental policies have a positive impact on innovations and on environmental and social outcomes. The stimulating effect of governmental policies on innovation was proved, in particular, by Horbach et al. (2012), Díaz-García et al. (2015), and Martin et al. (2016). Nevertheless, no effect of innovations or of governmental policies through innovations was recorded. Thus, our result is different from those of Loučanová et al. (2022) and Skare & Porada-Rochon (2022), who stated that innovation is crucial in achieving sustainability. Therefore, all our hypotheses were partially confirmed. Hypothesis number one was proven for the direct impact of governmental policies on innovations. Hypotheses number two and three were confirmed for the impact of policies on environmental and social outcomes. However, none of the hypotheses were proven fully, as there was no mediating effect of innovations in the selected countries. Thus, our outcomes contradict the results of Stojčić et al. (2020) for economic outcomes but partially confirm the results of Martin et al. (2016) and Ludvig et al. (2018) for environmental and social outcomes, respectively. The positive impact of environmental policies on environmental outcomes was also concluded by Martínez-Zarzoso et al. (2019), Wang et al. (2020), Wolde-Rufael and Mulat-Weldemeskel (2021), and Albulescu et al. (2022), who proved that governmental policies, in particular R&D expenditure, reduce the environmental pollution. Besides that, this study confirms the impact of governmental policies on innovation, which was approved by Stojčić et al. (2020). At the same time, results also disapproved of the statements made by Porter and van der Linde (1995), who proved the positive influence of governmental policies on economic performance. Control variables have a higher influence on sustainable outcomes than governmental policies do. However, governmental policies are more efficient in promoting innovation.

5. Conclusions

The article is an important contribution to the field, previously rarely studied – sustainable effects of innovations. Previous papers on the topic concentrate mainly on the theoretical side of sustainable innovations without measuring their real-life application. In our study, where we tested whether innovations lead to the achievement of sustainable outcomes, we came to the conclusion that governmental policies positively influence three types of indicators only directly and not through innovations. Innovations turned out to be not significant in improving the sustainable development indicators considered. So far, to the best of our knowledge, no similar studies have been done. For policymakers in the EU countries, our results show, that innovativeness doesn't necessarily mean sustainable outcomes. Nevertheless, the results also show that, despite the absence of indirect effects, governmental environmental policies are efficient not only in stimulating environmental indicators but also in improving social standards and innovativeness. Also, no matter what's the level of innovativeness, HDI and GDP per capita lead to sustainable improvements. For business strategies, the results mean that firms have to weigh various factors when introducing innovations.

Our research has certain limitations, as our data is restricted by the availability of indicators in the Eurostat database. For future research, we suggest studying the other indicators that are used to measure sustainability. For example, health indicators could be studied as social outcomes, GHG pollution levels as environmental, and GDP change as economic. Results for such indicators may differ from the results for indicators we used. Innovations could also be studied at the enterprise level, considering the effects of other governmental policies, like, e.g., environmental taxes.

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Faculty Participation in Technology Commercialization: The Roles of Process, Policies and Career

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Abstract: Technology commercialization has become an increasingly important activity for European and U.S. universities. Among the reasons for this importance have been declining government financial support for public universities, greater accountability to funding agencies, and increased expectations for commercialization revenues. Combined with recent economic uncertainty, the search for additional revenue sources has accentuated the need to better involve faculty in successful technology commercialization efforts. Thus, university administrators and technology managers face challenges in attracting, engaging, and retaining faculty participation in this effort. This paper reviews the relevant literature to understand how tenure and promotion policies can incentivize or disincentivize faculty members from pursuing technology commercialization projects. Prior research has focused primarily on the determinants of performance and benchmarking issues while faculty career path choices have been neglected. We address this gap in the literature by considering technology commercialization, faculty choice, and institutional policies in tandem. We conducted a systematic review of relevant literature on faculty involvement in technology commercialization and identified incentives and impediments for pursuing technology commercialization. Next we developed research hypotheses drawn from the literature review to assess faculty attitudes and activities, and their career development stage, based on the literature. Data collected through surveys will be used to test the hypotheses. We propose that the choice to participate in technology commercialization is a risk-payoff decision for faculty that depends on their career stage and subject matter area of work. As the faculty member becomes more secure in their position, such as tenured, the perceived risk of participation declines while the perceived reward value of incentives increase. As this perception changes due to career stage progress, we expect that faculty will be more inclined to participate in technology commercialization activities. We discuss how choices involving technology commercialization projects relate to a faculty career path and institutional technology commercialization policies, and how these policies are used to promote faculty participation in technology commercialization projects.

Keywords: Technology commercialization, Public policy, Promotion and tenure, Innovation, Academic entrepreneurship

1. Introduction

Successful university technology commercialization requires faculty, university administrators, and students to work together to form a company. Over recent years, many universities have promoted entrepreneurial training programs to engage graduate and doctoral students. Federal agencies such as NSF's I-Corps program have also promoted postdocs and faculty engagement in technology commercialization through formal training processes (Wright, Siegel, and Mustar, 2017). Thus, graduate-level students, postdocs, and faculties are becoming increasingly aware of the opportunities.

Having strong programs in place at the national level to support technology commercialization, such as NSF's STTR, SBIR, and I-Corps programs, can provide researchers with the support, training, and funding necessary to move ideas from the lab to the market. The internet, DNA amplification, 3D printing, magnetic resonance imaging (MRI), and Lasik eye surgery are just a few examples of world changing inventions supported by NSF programs (nsf.gov, 2024). Similarly, a university that has a capable, experienced, well staffed, and well funded technology commercialization unit can be a foundational conduit of innovations that are successful in the market and yield millions in licensing royalties for the university. UCLA received US $1.6 billion in royalty fees, patent income, and reimbursement payments from its development of Xtandi, an innovative prostate cancer drug, before selling future royalty interests for US $1.14 billion and potential additional payments based on future Xtandi sales (UCLA, 2016). As universities face financial uncertainties, having sources of royalty revenues can offer support for research and technology commercialization programs.

An extensive literature review of incentives and impediments for faculty engaging in technology transfer and commercialization indicates that royalties, patenting and licensing, publications are the biggest drivers to incentivize faculty participation, while misaligned reward systems and conflicts of interest are significant impediments to faculty participation.

2. Theoretical Background

Since the Bayh-Dole Act in 1980, academic entrepreneurship in the context of technology transfer and commercialization has become an important activity function for European and U.S. universities for various

reasons. This includes greater accountability to funding agencies, declining government financial support for public universities, and increased expectations for commercialization revenues. Additionally, recent economic uncertainty exacerbated the search for additional revenue which includes increased faculty involvement in successful technology commercialization.

2.1 Organizational Level Factors Affecting Participation in Technology Commercialization

2.1.1 National programs

National policies and programs to support technology transfer and commercialization have been offered by various federal agencies but until recently have received limited attention by academic entrepreneurship researchers. With recent changes to university funding models, academic entrepreneurship in the context of technology transfer and commercialization has become an increasingly important matter for universities.

In the US, the Bayh-Dole Act in 1980 opened a path for universities to commercialize their federally funded research. However, universities did not develop programs to facilitate technology transfer and commercialization until years later. As US universities have become more responsive to the benefits of technology, programs for promoting and supporting technology transfer on campus have become prevalent (Mowery et al, 2001). Similarly, other countries have adopted national programs to support faculty entrepreneurship, such as France's national program that allows university faculty, previously constrained, to set up university affiliated ventures (Mustar and Wright 2010). Similar national programs are Germany's EXIST (Ayoub, Gottschalk, and Müller, 2017), Canada's NRC Industrial Research Assistance Program (Niosi, 2006), and the NSF I-Corps program in the US (Huang, Fay, and Sheridan, 2017). Other related national programs designed to support academic entrepreneurship and technology commercialization include funding, such as the NSF SBIR/STTR in the US (Toole and Czarnitzki 2009; Siegel and Wessner 2012), innovation agencies and funding programs in France and the UK (Mustar and Wright, 2010), science parks, research centers, innovation awards programs, and entrepreneurship training programs (Hayter et al, 2018).

2.1.2 University programs and policies

On a university level, we consider the various programs and policies that universities provide for faculty academic entrepreneurs to encourage and support technology transfer and commercialization. Programs vary in implementation and results (Degroof and Roberts 2004; Wright et al. 2009) with some efforts were found to encourage licensing, related revenue sharing, and startups (Siegel et al. 2003a; Muscio, Quaglione, and Ramaciotti. 2016), while others were found to be discouraging (Markman et al., 2004).

For example, organizational incentives for participating in technology commercialization can be effective, such as a favorable royalty distribution formula in a licensing transaction that is shared with the faculty member who develops new technology (Link, Siegel, and Bozeman, 2007; Markman, Gianiodis, and Phan, 2008; Friedman and Silberman, 2003; Owen-Smith and Powell, 2003). Encouraging efforts can be expanded to include sharing royalty and licensing income with faculty, internally investing in technology transfer projects through internal funding or investing, and establishing relationships with local industry partners through research projects and student engagement. University technology transfer offices (TTOs) can serve a role in connecting inventors and commercialization oriented faculty with external industry partners interested in such projects. Other units on campus can help with related aspects such as patenting, copyrighting, licensing, and funding.

From a policy perspective, recognizing efforts to secure government or external funding for technology commercialization projects, such as NSF I-Corps, SBIR and STTR award programs, and private foundation support can encourage faculty participation. However, recognition is uneven across campus as some academic units, such as sciences and engineering, more often recognize TC efforts than other academic disciplines. Also, universities benefit from such external awards through financial support for the project and finance and administration (F&A) overhead charges that can be used to support university TTO units.

Unintended problems can occur due to inappropriate staffing and compensation practices of the TTO (Siegel, et al., 2003a,b), including a high turnover rate of technology licensing officers that can undermine the development of long term relationships between the university and industry, and insufficient business and marketing experience of TTO staff (Siegel, 2018; Markman, Siegel and Wright, 2008), which can be further complicated by differences in culture and perspective between faculty and staff and those in private industry (Palmintera, Joy, and Lin, 2007).

2.2 Individual Level Factors Affecting Participation in Technology Commercialization

It is important to consider faculty perspectives when reviewing technology transfer and commercialization programs as faculty perspectives may not align with university expectations, commercialization projects may take away valuable faculty time from teaching and research, or faculty may put their academic responsibilities ahead of industry concerns and project deadlines (Palmintera, Joy, and Lin, 2007). Also faculty perspectives may differ regarding whether a project is an opportunity or worth the effort. For example, untenured faculty may feel that participating is risky if technology transfer activities are not officially considered in faculty tenure decisions (Hamilton and Schumann, 2016; Renault, 2006). Female faculty members, tenured or not, may feel a bias against their efforts as male and tenured faculty members are more likely to engage in all types of technology transfer (Link, Siegel, and Bozeman, 2007). Also, the need for faculty researchers to publish as a requirement for tenure and promotion may conflict with the corporate need for confidentiality (Palmintera, Joy, and Lin, 2007).

Within the context of this project, we consider the different activities a faculty member has over their career such as teacher, researcher, administrator, along with the various nonwork roles they may have such as spouse, partner, parent, and community member, each of which represent additional responsibilities and commitments.

2.3 Influence of Faculty Career Stage on Participation in Technology Commercialization

There is a well developed research stream regarding careers, and in particular, the careers of academics (Zacher et al, 2019). However, few have addressed the influence of faculty career stage on the propensity to engage in technology transfer and commercialization activities.

Zacher et al (2019) characterized a career as the sequence and combinations of work-related roles people occupy across their lifespan (Arthur, Hall, and Lawrence, 1989; Super, 1980) and then distinguished career development as the process by which both individuals and their employers manage various tasks, behaviors, and experiences within and across jobs and organizations over time, with implications for employees' work-related identity (Brown, 2002; Greenhaus, Callanan, and Godschalk, 2000). For our purpose, Zacher et al's (2019) distinction highlights that career development research focuses on how individual and contextual factors influence changes in a person's career over time.

It is important to note that academic career development research and practice addresses scholarly-trained individuals at various ranks and employment arrangements (Baldwin and Blackburn, 1981). Within this study, our consideration is the interplay between the faculty member's activity choices at various stages of their career in regard to the policies and programs they encounter in their workplace organization. Most academic faculty engage in research, teaching, and administrative roles throughout or in particular phases of their careers. For instance, a professor may begin their career doing research, teaching classes, and later in their career taking on administrative roles, such as department chair or dean, and these roles may change based on changing circumstances faced during their career. Another important characteristic noted by Zacher et al (2019), originally observed by Roach and Sauermann (2010), is that compared to other occupations, academics typically have high intrinsic work motivation and a "taste for science" (p. 422) and they are more willing to accept a relatively lower salary, putting high value on working conditions that provide independence and flexibility. This is important when we later consider how faculty members evaluate career choices regarding technology transfer and commercialization.

Following Zacher, et al. (2019), we consider social cognitive career theory (Lent and Brown, 1996; Lent, Brown, and Hackett, 1994) and life-span, life-space theory (Super, 1980; Super, Savickas, and Super, 1996) as important frameworks for this study. Both are used in career development research and include content and process aspects of career development (Brown and Lent, 2016; Lent and Brown, 2013). We first discuss social cognitive career theory followed by a discussion of lifespan, life-space career theory.

Social cognitive career theory (SCCT) focuses on the development of career interests, making career choices, and individual and contextual influences on career behavior (Lent et al., 1994; Lent and Brown, 1996). The theory emphasizes individual agency, or a person's ability and motivation to influence their environment and their own career development. SCCT emphasizes the motivational roles of self-efficacy, outcome expectations, and performance goals and holds that self-efficacy and outcome expectations work in conjunction with ability by influencing the types of performance goals that people set for themselves.

Three important aspects are:

1. *individual characteristics and personal resources* which include demographic characteristics, personality traits, as well as relatively stable abilities, beliefs, attitudes, and motivation,
2. *contextual influences on career development* that include working conditions, social support, networks, career development programs and specific interventions, specific academic disciplines, professional societies, and societal and cultural contexts, and
3. *active regulation of behavior* in the context of career development or career choices and effort to achieve career goals (Lent et al., 2002), including actions related to academic career development, such as goal setting, long-term planning, specific strategies, and feedback (Zacher and Frese, 2018).

The important aspects of SCCT for this project are the roles of self-efficacy, outcome expectations, performance goals, and how self-efficacy and outcome expectations work in conjunction with ability, in part by influencing the types of performance goals that people set for themselves.

Next, we consider life-span, life-space theory (Super, 1980; Super et al., 1996) to identify additional important aspects of academic career development. Like SCCT, lifespan, life-space theory also considers individual and contextual characteristics, but its primary focus is on different life and career stages, as well as the work and nonwork roles that people occupy across their lifespan.

Based on lifespan, life-space theory, Zarcher, et. al, (2019) included two additional themes: (1) academic career development in and across different career stages, and (2) academic career development related to different work and nonwork roles. Regarding career stages within the developmental perspective of lifespan, life-space theory, Zarcher, et. al, (2019) reviewed studies that focus on distinct career stages, including early, middle, and late career (Slocum and Cron, 1985), as well as career stages involving growth, exploration, establishment, maintenance, and decline, and included a lifespan developmental approach to academic career development (Fasbender and Deller, 2017; Ng and Feldman, 2012).

Regarding work and nonwork roles, a central tenet of life-span, life-space theory is that people may occupy multiple work and nonwork roles at a single point in time and across their careers and lives (Super, 1980), which includes the academic career development of people in different life roles, such as professor and parent, and in several specific roles within the work context, such as a professor in teaching and administration roles.

3. Research Hypotheses

Based on the above discussion of technology transfer programs and policies and faculty career stages, we propose the following research propositions:

Hypothesis 1a: Organizational level factors positively and negatively affect faculty participation in technology commercialization.

Hypothesis 1b: Faculty career stage will moderate the effect that organizational level factors have on faculty participation in technology commercialization.

Hypothesis 2a: Individual level factors positively and negatively affect faculty participation in technology commercialization.

Hypothesis 2b: Faculty career stage will moderate the effect that individual level factors have on faculty participation in technology commercialization.

4. Methodology

In general terms, the methodology employed in this study will use survey questions based on the theoretical model constructs and relationships to query faculty at US universities on how organizational level factors, individual level factors, and career stage influence their participation in technology commercialization.

Figure 1 below shows the hypothesized relationships in the theoretical model.

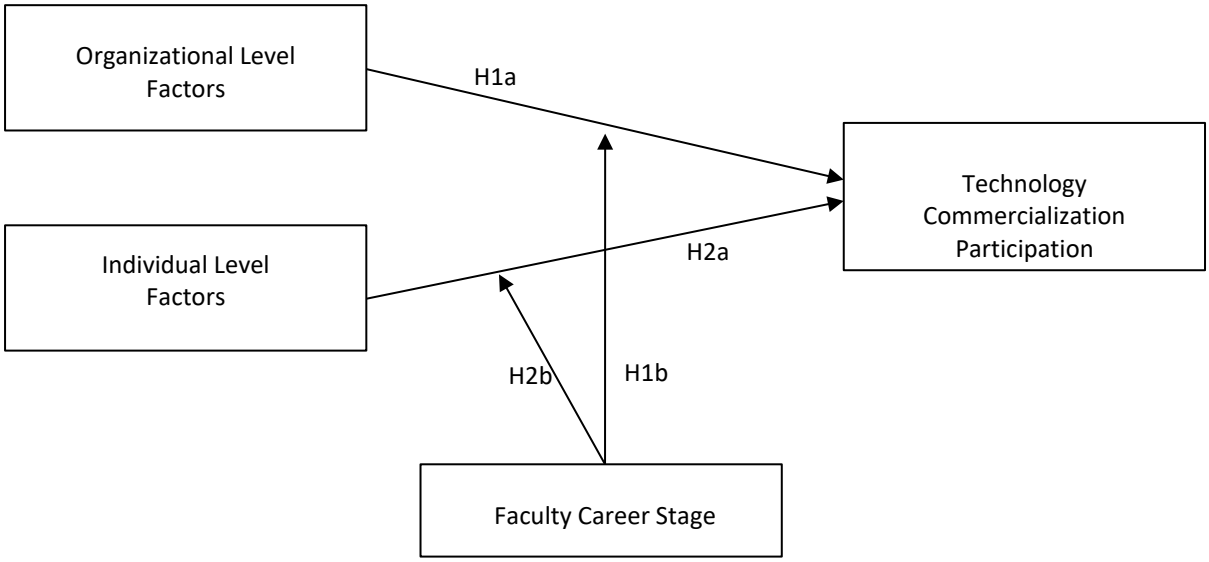


Figure 1: Theoretical model of the relationships between organizational and individual level factors on technology commercialization participation as moderated by faculty career stage

4.1 Operationalizing Key Concepts

For the purpose of this project, we define "technology commercialization" as the process of conveying results stemming from scientific and technological research to the marketplace and to wider society, along with associated skills and procedures. Examples of technology transfer include but are not limited to filling an invention disclosure, filing for a patent, copyright, or trademark, attempting to secure a licensing agreement, launching a startup or university spinoff, and other similar activities.

To operationalize "organizational level factors", faculty will be asked about their views regarding factors such as, but not limited to, university technology transfer and commercial programs and policies, prevalence on campus of national technology commercialization programs, such as NSF SBIR/STTR and I-Corps, sponsorship and funding relationships related to technology commercialization with private agencies on campus, technology transfer unit activities, university promotion and tenure policies related technology commercialization, and the general organizational climate relating to technology commercialization on campus.

To operationalize "individual level factors", faculty will be asked about their views regarding factors such as, but not limited to, entrepreneurial identity, role identity salience, ambivalence, supervisor championing, recent technology commercialization efforts, and technology commercialization intentions. Also, faculty will be asked about demographic characteristics, including but not limited to their age, gender, marital status, race/ethnicity, immigration status, highest education degree, scientific field or academic discipline, current position, tenure status, and years of experience.

To operationalize "faculty career stages", we will use a stage classification model developed in prior research and used in government job classifications. Based on Super's (1980) developmental dimension of the career lifespan theory, it is a widely accepted career development theory, and often applied to academic careers (Arthur, Hall, and Lawrence 1989; Lent and Brown 2013; Zacher et al., 2019). Moreover, academic positions are commonly structured in a four-tier system ranging from doctoral studies, postdoc and junior positions, lower-level senior to higher-level senior positions.

We will use a measure of career stages developed by Euraxess, a European Union backed platform listing vacancies for academic positions from countries in Europe and elsewhere, and adapted by Mantai and Marrone (2023) for a study of academic disciplines. The four career stages are:

- R1: First Stage Researcher (up to the point of PhD), includes research assistant and PhD roles
- R2: Recognised Researcher (PhD holders or equivalent who are not yet fully independent), includes post-doc, lecturer and senior lecturer roles
- R3: Established Researcher (researchers who have developed a level of independence), includes associate professor roles
- R4: Leading Researcher (researchers leading their research area or field), includes full professor roles

This four-tier structure is based on the European Commission (2011) framework and is common in academic careers world-wide (Fumasoli, Goastellec, and Kehm, 2015). This four category structure corresponds well to the stages discussed in the life-span, life-space theory (Super, 1980; Super et al., 1996), and is used to classify career stages in this study.

4.2 Survey and Data Collection

We will recruit faculty respondents from a range of academic faculty members from various disciplines, research areas, universities, and locations. We will develop a survey using accepted or adapted questions to test the hypotheses proposed as described above. Item responses will use a Likert scale. Survey questions and items will be pretested for validity and reliability. Surveys will be administered through a qualtrics-type platform. Data will be analyzed using statistical analysis software.

5. Discussion

Technology commercialization may never progress or come into existence without the human researcher's involvement. It is the participation of academic entrepreneurs and faculty researchers who provide the spark of ingenuity and vision of what can be that create innovation and take those ideas through development to viability. In this study we look to better understand how these individual faculty members view technology commercialization activities of the course of their career. Despite the importance of understanding the human players in this process, research into this area is sparse. Most of the work looking at the faculty member's professional and private lives focus on work life balance in terms of the organizational support for aspects of an employee's personal life (Balven, Fenters, Siegel and Waldman, 2018; Beauregard and Henry, 2009; Estes and Michael, 2005). The recognition of a faculty member having multiple roles at one time and over a career, roles that may conflict with each, has received only scant attention. Balven, et al. (2018) note that faculty concerns about not having enough time available for both academic and entrepreneurial activities highlight the importance of how organizational level factors may affect academic entrepreneurship.

6. Conclusion

In this study, our hypotheses are that the faculty career stage will moderate the effect both organizational and individual level factors have on faculty participation in technology commercialization. We proposed that faculty choice to participate in technology commercialization is a decision that depends on their career stage and is affected by both factors. In this paper we review relevant literature, offer research hypotheses, and describe how we will test our hypotheses. The relevant literature indicates that future work in academic entrepreneurship considers how processes regarding work life and role balance are swayed by university policy. Despite the importance of understanding the human players in this process, research into this area is sparse. This study seeks to address this gap in academic entrepreneurship and technology commercialization literature.

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Challenges of Preparing Students for International Entrepreneurship in the era of Artificial Intelligence

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Abstract: International entrepreneurship competencies in the era of rapidly developing artificial intelligence focus more than earlier on stepping out of one's comfort zone, asking the right questions, assessing the reliability of information sources, and developing cross-cultural teamwork readiness. The purpose of this research is to prepare students for collaborative learning situations where generative artificial intelligence tools have become widely available. The main research question is: What are the challenges in different types of entrepreneurial team-based action learning projects in the context of artificial intelligence? Learning concepts based on collaborative learning and improving the international networking readiness of students are presented. Practical implications of time zone differences, trust building and conflict management in international teams are analysed based on the experience of X-Culture projects. We compare the opportunities and challenges of applying generative artificial intelligence such as ChatGPT-4, Microsoft Co-pilot and Google Gemini Advanced when developing learners' own international business ideas to learning from international teamwork to assist foreign start-ups in entering new markets. Gaps in skills to apply human collaboration for critically assessing artificial intelligence summary answers and identifying possible hallucinations when comparing new potential foreign markets were revealed. Artificial intelligence applications can be used to form global student teams based on the similarity of entrepreneurial self-development visions of team members. Still, experimenting with prompts in these applications can also enhance readiness to compare the pros and cons of different international entrepreneurship concepts and intelligent questioning skills for coaching and consulting. Students can chat with AI in a role-playing manner that helps them understand how to manage cultural differences in international entrepreneurship teams. Online action learning driven by tasks of start-ups is an essential tool in the entrepreneurial learning approach that prepares students to understand the value and limitations of generative artificial intelligence tools for international entrepreneurship. This paper contributes to understanding the challenges in action learning of students for international entrepreneurship and ways to overcome these challenges in the era when generative artificial intelligence tools are changing learning and international entrepreneurship practices.

Keywords: International entrepreneurship, Collaborative learning, Networking, Online teamwork, Artificial intelligence

1. Introduction

Innovative entrepreneurial teams that involve members and partners from different countries are essential for developing international entrepreneurship. Educators at business schools should support learners by applying culturally inclusive educational technologies (Akinrinola et al, 2020). Thompson (2017) explained how digital tools make learning processes more interactive and enable international collaboration. Collaborative learning should prepare students for entrepreneurial team formation and combine online and face-to-face learning to develop a mindset, skills, and practice for starting a new venture. Still, such learning can support life skills even if learners do not start a new business during their studies (Neck and Corbett, 2018). Artificial intelligence (AI) applications such as ChatGPT-4, Microsoft Co-pilot, and Google Gemini initiate new opportunities and challenges in digital collaborative learning. These applications can facilitate learning by asking smart questions and reflecting on the responses in an interactive learning process (Rospigliosi, 2023).

Developing students' critical and reflective thinking skills is essential for preparing future entrepreneurs to make better decisions by using AI tools for informed reasoning (Bell & Bell, 2023). A pedagogical challenge is to distinguish the original work of students and artificially generated work (Gao et al, 2022), but a broader challenge is to assist students in understanding the role of individual entrepreneurs and international entrepreneurial teams in future situations where AI applications will be widely used for business idea generation, international marketing and communication.

Integrating entrepreneurship education with international business learning in international teams can be a tool for learning through student enterprises or assisting entrepreneurship practitioners in screening and entering new foreign markets. Both types of learning by doing create readiness for more innovative and internationally scalable start-up activities after university studies. However, collaborative action learning often requires the readiness of students to leave their comfort zone to experience interaction with new partners in new situations.

Teams in the digital workplace need to combine human communication and collaboration with new AI-enabled technologies (Lane et al, 2024). Students must be prepared to contribute to international entrepreneurial teams with diverse compositions and involve members from different countries and cultures. Our objective is to

identify the learning opportunities and challenges of entrepreneurial team-based digital action learning projects in the context of artificial intelligence.

2. Literature Review

Already some years ago, the entrepreneurial education discourse identified different departure points for entrepreneurship education (O'Connor, 2013). Applying learning by doing through practical venture creation and business idea implementation is a suitable framework if the student enterprise team is ready to jump-start such a process and their sector-specific resource base can be created during studies. Learning for future entrepreneurship by exploring development opportunities and crucial decisions of successful entrepreneurs in various countries, studying different types of entrepreneurship, including social entrepreneurship, and new business opportunities in emerging industries and the green agenda for regenerative futures (Camrass, 2020) is, however also operational for students to broaden their interdisciplinary knowledge base and to create their international network before launching a real start-up initiative.

In collaborative learning, students participate in small-group activities in which they share their knowledge and expertise. During the 1970s and 1980s, cooperative learning dominated as the general term for group-based learning in the research literature. However, since the beginning of the 1990s, collaborative learning has become a more popular term (Strijbos and Martens, 2001). Johnson et al (2007) explained how learning in groups is influenced by social interdependence. Dania and Griffin (2021) use the term "collaborative learning communities" when studying social media and collaboration solutions in the classroom. Collaborative learning can be implemented in a face-to-face classroom environment, but social media can also give input to collaborative learning. Social media has become influential in the daily lives of many students, and adoption of it for self-development may motivate entrepreneurial intentions (Do et al, 2020). Networking is a core entrepreneurial capability in attaining necessary resources, knowledge, and information (Morris et al, 2013). Elenurm (2012) explained how co-creative, individually innovative and imitative entrepreneurial orientations influence the networking needs of students. Innovative start-up businesses apply network learning to achieve their space in international markets (Caseiro and Coelho, 2019). In the era of AI, global networks that students develop in social media can be used to find inside information about emerging trends in foreign markets that generative artificial intelligence applications are not able to present. Although trained on massive, curated datasets, generative AI answers to prompts do not reflect recent developments in the marketplace after their training has finished, and new entrepreneurship trends are not documented in their online dataset used for training. AI collaboration with humans is the key to addressing new challenges and opportunities created by generative AI (Budhwar et al, 2023). The convenience of using ChatGPT and other AI applications could result in overreliance by its users, making them trust the answers provided by ChatGPT without critical thinking. Compared with traditional search engines that provide multiple information sources for users to make personal judgments and selections, AI generates summary answers for each prompt. Although utilising ChatGPT has the advantage of increasing efficiency by saving time and effort, users could get into the habit of adopting the answers without rationalisation or verification (Fui-Hoon Nah et al, 2023). Generative AI can generate seemingly correct responses that include misinformation as an outcome of hallucination. Susarla et al (2023) regard hallucination, including references to non-existent literature sources, as a serious challenge in the use of generative AI for scholarly activities.

Collaborative learning focuses on knowledge co-creation (Vuopala et al, 2019). In the AI era, knowledge co-creation assumes an understanding of what type of information humans representing different kinds of knowledge can add to prompt answers given by AI. The open innovation approach assumes collaboration and engagement with a wider variety of participants (Chesbrough, 2017). Forming an effectively performing founding team is among the most complicated tasks in building a new venture. The founding members of a start-up often represent different backgrounds and experiences and have varying expectations about their roles, leadership sequence and remuneration structure (Shepherd et al, 2021). Shah et al. (2019) stressed that in addition to complementary competencies of team members, common skills such as critical thinking, joint problem solving, sharing essential values, and mutual trust are necessary for effective entrepreneurial team functioning. Effectuation assumes that entrepreneurs use available resources, knowledge, and network connections as the starting point of their business initiative to develop and implement their business vision in adaptive ways and continuously modify their prediction and control space for future success (Sarasvathy, 2023). Building on the effectual approach for start-up team formation (Sarasvathy and Botha, 2022), ChatGPT's use for founding team creation as a pedagogical intervention is demonstrated by Hammoda (2024). After choosing the business idea of their team, students were asked to prompt ChatGPT for advice on the ideal founding team composition, the characteristics of the founding team or key members and suggested split of equity among

them. Students were advised to use different combinations of keywords and sentence structures until ChatGPT provided them with a satisfactory enough answer. Such use of AI could lead to rethinking the original business idea as the result of competencies suggested by AI for pursuing this business initiative.

Open innovation assumes the networking efforts of innovators to find early users and product development ideas outside their organisation. Rapidly internationalising small and medium-sized enterprises from emerging economies should also use a wide range of internal and external network sources (Puthusserry et al, 2020) during their post-entry business development stages. Collaborative learning can focus on a team's own entrepreneurial start-up development or engage learners in projects where student teams solve problems faced by entrepreneurs already operating in practice. Contributing to solving practitioners' problems enhances critical thinking (DeSimone and Buzza, 2013). AI-human collaboration challenges and solutions depend on the role of creativity, information search, critical thinking and teamwork in different directions and stages of entrepreneurial learning. There is a research gap in the field of specifying challenges of using AI in collaborative entrepreneurship learning and understanding opportunities to apply IT tools for developing international entrepreneurship skills.

3. Methodology of Pilot Research for Identifying Artificial Intelligence Opportunities and Challenges

Educational action research examines and reflects the potential and challenges of educational practices centred on learning projects in different formats and with various internal and external partners (Mandrup and Jensen, 2017). Collaborative inquiry for knowledge generation is methodologically well-positioned for studying academic and practice-based development and change initiatives based on new learning tools (Shani et al, 2023). The methodological departure point of our approach to identifying opportunities and challenges of AI applications in collaborative knowledge co-creation is a comparison of learning processes, where students start ideation for their entrepreneurship development journeys in student enterprise teams or contribute as a team to finding international business development opportunities for entrepreneurship practitioners. We discuss AI use in two types of collaborative learning projects where the author has been involved: X-Culture global teams, where Estonian Business School students have participated and the author's short course for students at Université Catholique de Lille on Doing business in the Baltic countries. The literature overview serves as the basis for formulating the following questions to compare these collaborative learning practices.

- How can AI applications support creating diverse and well-performing teams for project work?
- To what extent can AI applications enhance creativity and open innovation for entrepreneurship?
- What are the challenges of AI-human team collaboration in these projects?

4. AI Opportunities in X-Culture Global Projects

The global X-Culture https://x-culture.org consortium has been able to involve business students from more than 150 universities in 40 countries. X-Culture organisers allocate students to virtual project teams following the principle of geographical and cultural diversity of each team. Students have to build their team consensus on the international business opportunity challenge they choose to solve together by working online for a period of two and half months. Students must pass the pre-test to demonstrate their knowledge of online communication, knowledge-sharing tools, and X-Culture rules. Creativity in X-Culture is needed for identifying new international business opportunities that match the needs of enterprises they have chosen for their online project work and also for aligning knowledge-sharing styles of students from different cultures and for finding the best online collaboration tools, including social media applications, in situations where team members never meet each other in a physical space. There is no direct face-to-face contact with the client enterprise during project work. In fact, even more than a hundred teams may choose to prepare a report for the same enterprise. X-Culture team reports are graded by lecturers representing all universities where team members study. X-Culture coordinators divide students into virtual teams to represent as many countries as possible in each 5-6 student team to enhance cross-cultural learning. If students could specify their future entrepreneurship visions before forming teams, AI could be used to consider the similarity of future entrepreneurial self-development vision in the team formation process. That would make X-Culture teams more similar to start-up teams that usually involve team members pursuing similar business development visions. Research on X-Culture teams has demonstrated that teams which have more task conflicts during their first weeks of teamwork when they have to conduct industry analysis and choose concepts for assessing the international competitiveness of the project enterprise and tools for comparing foreign markets present at the end of their project better reports than teams, where team members do not recognise and address such conflicts (Elenurm and Fabritius, 2023). Using different

AI application prompts, such as "What are concepts and tools for comparing potential export markets?" gives student team members a broader mental space to specify additional prompts for comparing the pros and cons of each tool for a specific export product and service. Training by experimenting with specific prompts is a way to learn from task conflicts constructively and, at the same time, develop broader intelligent question-asking skills that are relevant for chatting with AI but also for consultancy and coaching.

Post-project self-reflection of X-Culture team members has indicated that some students are stressed when communicating with team members representing different work cultures and time zones. Extensive use of WhatsApp and other online messaging tools creates pressure to respond rapidly to inquiries from students living in a different time zone. To prepare students for the challenges of global online teamwork, we have asked them to write a review of relevant research papers that address these challenges and ways to be successful in online teamwork. AI applications add to such preparation a role-play dimension, asking students to describe the role of some potentially problematic team member from their point of view and making, for instance, a prompt "ChatGPT, imagine you are representative of a high-context culture. How can I collaborate with you on an online team project as a person from a low-context culture?" If needed, this conversation could be continued by asking, "Imagine that you, as a person from a high-context culture, do not follow the agreed deadline. How can you explain it?" to focus on specific challenges. When all team member in the online teamwork process compare their prompts to AI about possible cross-cultural teamwork challenges and answers they received from AI, they will improve their ability to understand potential differences of team members from other cultures. That is a way to avoid dysfunctional relationship conflicts.

X-Culture final reports demonstrate that although universities have usually set guidelines for compiling reference lists in written works, many students do not understand the importance of using in-text references in the era of AI. In some universities, AI use is officially now allowed. However, team members still use it to generate their sections of reports without giving reference to the application they use to compile their text. Without in-text references, a reader has difficulty checking if some fact statement is based on a reliable information source or if AI hallucinated it. Using AI tools allows students to save time in compiling a report, but teams should be guided to check the existence of the original sources of the summary text generated by AI. Training critical thinking to assess the reliability of information sources is essential when applying AI in online global teams. We have challenged some teams' generic final report texts by making ourselves a prompt to AI to compare export markets of a product chosen by a team. When presenting the AI answer to this team, we asked them to explain how their team report has used insider observations by their team members about new market trends that generative AI cannot access. Such discussion aims to lead students to understand their advantages as humans in international entrepreneurship compared to present generative AI applications and to be prepared for AI-human information exchange in future entrepreneurship initiatives.

5. AI Opportunities in a Short Region-Focused International Business Course

Doing business in Baltic countries in Lille (France) was a short 3-day course that involved only student teams of one French university. The final assignment of this course was preparing and presenting pitches about new French export products to a Baltic country chosen by each student team and proposing how their student team can find a start-up from a Baltic country to exercise entrepreneurship by assisting this start-up to develop their business in France. When developing their entrepreneurial ideas for promoting French export products, students relied heavily on well-known French food and beauty brands already available in Baltic countries. Students were encouraged to use prompts in AI chats such as "Which are competitors of French Camembert cheese in Estonia?". Both ChatGPT-4 and Gemini Advanced highlighted potential competing cheese types. Still, Gemini Advanced stated: "…hard to give precise brand names of competitors without knowing your specific location within Estonia." MS Co-pilot gave links to the Estonian Dairy Association webpage on cheese and some other web links for further market research. However, sharing information with students about webpages and online shops of the main Estonian retailers appeared to lead them more rapidly to identify competing brands and pricing info that AI applications did not reflect.

When searching for information about start-ups as potential cooperation partners from Baltic countries, start-up databases of these countries were introduced to students. Start-up Estonia database https://ecosystem.startupestonia.ee/intro states that its extensive information is gathered in cooperation with the digital deal room Dealroom.co, and AI is applied to gather data from public sources such as social media, domain & trade registers, job boards, analytics about web & mobile app usage, news articles in 30+ languages and investor portfolios. Students needed some instruction and training to navigate this database. In the context of identifying entrepreneurial cooperation opportunities, students mainly focused on start-ups that can offer French clients

online B2B software for logistic and recycling operations or online services for hotel and property management. The short format of the *Doing Business in the Baltic Countries* course demonstrated that general generative AI applications are helpful in structuring the key issues for assessing opportunities and competitiveness factors in foreign markets. However, AI, in its present general format, could only serve as a gateway for further analysis of time-sensitive data about foreign markets, such as retail prices of products. Specialised AI applications appeared to be more useful in finding cooperation partners for entrepreneurship. However, instead of writing a chat prompt, combining relevant search criteria was essential to dig out relevant information from such databases.

6. Discussion of Pilot Research Results

As an attempt to compare our two pilot research examples with broader suggestions of researchers and entrepreneurship developers, we applied three generative AI tools. The prompt based on the title of this paper was used: "How to prepare students for international entrepreneurship in the era of artificial intelligence? Answer should be a maximum 100 words". Gemini Advanced AI (2024, March 31) answered: "Here's how to prepare students for international entrepreneurship in the AI era (within the word limit):

- *AI Fluency:* Teach AI concepts, tools (coding and no-code), and how to leverage AI for market analysis, product development, and scaling a business.
- *Global Mindset:* Foster cultural understanding, international market knowledge, and adaptability to diverse business landscapes.
- *Critical Thinking:* Emphasise evaluating AI outputs, understanding its limitations, and making ethical decisions about its use.
- *Problem-Solving:* Focus on identifying real-world problems and using both AI and traditional methods to design innovative solutions with global appeal.
- *Collaboration:* Encourage collaboration with individuals from diverse backgrounds and expertise, including AI developers."

MS Co-pilot (2024, March 31) answer to the same question reflected as essential directions: soft skills and integrating AI with human skills, fostering collaboration between technology and human expertise. ChatGPT-4 (2023, March 31) gave a less structured answer. It, however, added to Gemini and Co-pilot answers interdisciplinary learning, understanding cultural differences and global market trends. Its answer text also stressed practical experience through projects, collaboration with AI-driven companies and fostering innovative mindsets and ethical considerations in AI deployment.

7. Conclusions for Further Action Research on AI Applications in Entrepreneurial Learning

At this research stage, we only have the first pilot experience of testing and discussing AI applications in learning processes that contribute to developing further action research agenda. AI applications open several new opportunities in the context of international entrepreneurship. AI prompt results can help young entrepreneurs in structuring their search for further information. AI can play a digital role as a potential new customer, competitor, or devil's advocate to identify the risks of a new entrepreneurship initiative. AI can be used to reflect and compare essential competencies, roles, and ways to overcome collaboration challenges in cross-cultural and digital teams. At the same time, students should be aware of generative AI hallucination features and be directed to checking and critically analysing the reliability of reports and research papers that have served as input for AI-generated answers to their prompts. A practical implication is the need to train database navigation and referencing skills. Entrepreneurship students should understand situations more profoundly, where AI answers should be compared with relevant research papers or updated media reflecting recent international business trends. Prompt writing for human-AI interaction is an essential skill to be trained. This skill can also be applied to interviewing entrepreneurship professionals and potential clients. New international entrepreneurship initiatives require time-critical specific data to choose countries for export. Such updated data is often missing in the text corpus used for training AI. Young entrepreneurs should understand both the present limitations of generative AI and its future potential to build up their careers in the AI era.

The limitation of the present paper is that it compares only two AI application use cases related to international entrepreneurship and business learning without a representative sample. However, the conclusions of this pilot AI application experience confirm Gemini's answer and Co-pilot's suggestions about soft skills and ChatGPT-4 focus on understanding cultural differences and global market trends through practical experience. Our use cases contribute to explaining examples of AI-driven opportunities and challenges for more extensive action research in future.

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Maximising Hackathon Impact: A Comprehensive Framework for Sustaining Post-Event Outcome

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Abstract: Since 2020, numerous guides and tools have been available for designing, planning, and running hackathons in fields such as software engineering, ICT, and healthcare. However, a substantial gap is observed in the post-event phase of hackathons' life cycle, directly affecting the sustainability of results. This bears significant implications for hackathon events per se, as well as for ecosystem stakeholders, in medium-term and long-term perspectives. This paper addresses the issue of low valorisation of hackathon-derived solutions and assists their direct exploitation. We aim to provide a framework for hackathon organisers, managers, policymakers, and intermediary bodies maximising impact of such events. To achieve this, we investigate the relationship between event-level success and ecosystem-level impact. We draw upon the practices and data from the ENTREPRENEDU project hackathons, a Horizon Europe-funded program coordinated by the E. Amaldi Foundation. This series of hackathons, held in three different countries, helped identify key aspects for further investigation and served as the groundwork to define/frame our research question. We conducted literature review, examining papers and reports to explore how hackathon-derived knowledge is valorised within entrepreneurial and innovation ecosystems. Our research aimed to identify how the already known success factors of a well-designed event contribute to the sustainability of outcomes and assess their relationship. We link hackathon success indicators juxtaposed to relevant factors. While acknowledging the complexity and multifactorial nature of innovation process and knowledge diffusion, we believe that our study advances the potential for hackathons' greater impact by providing a cohesive framework.

Keywords: Entrepreneurial ecosystems, Innovation, Hackathon, Ideation, Impact

1. Introduction

Hackathons have emerged as a prominent strategy to spur innovation and collaboration within entrepreneurial ecosystems. These events serve as dynamic platforms where entrepreneurs, developers, and subject matter experts convene to tackle complex challenges, often with a focus on harnessing the principles of open innovation.

Open innovation has become a pivotal concept in the realm of entrepreneurship, particularly for small and medium-sized enterprises (SMEs). This paradigm shift from closed to open innovation, as articulated by Chesbrough (2003), emphasises the importance of collaborative efforts and external partnerships in driving innovation. SMEs, which constitute approximately 90% of businesses and over 50% of employment globally, face unique challenges due to their limited access to resources such as funding, infrastructure, and specialised knowledge (Chesbrough and Bogers, 2014). Consequently, the adoption of Open innovation practices is crucial for their survival and growth, particularly in times of crises.

Substantial prior research concerning the continuation of hackathon outcomes and abundant overviews provide insights on the different types (Kollwitz *et al.*, 2019; Heller *et al.*, 2023), approaches (Chau, 2023), event structure and design (Kohne, 2019; Pe-Than *et al.*, 2022). The typical event management structure is roughly distinguished in three phases. Preparation, operation and follow-up (Kohne and Wehmeier, 2019).

Despite the wealth of available knowledge, hackathon follow-up phase is often neglected while this is precisely the time where considerable added value can arise (Kohne and Wehmeier, 2019). 35% of projects show some continuation activity post-hackathon, though only 5% of projects continue for more than five months (Nolte, 2020). The importance of sustaining hackathon outcomes has been identified, but it is essential to understand effective approaches and practices to be applied after the event completion (Medina and Nolte, 2020). These remarks raise notable implications on the affecting factors and expected outcomes of hackathons. Our work

aims to offer recommendations to support the organisation and execution of hackathons that achieve sustained success.

To explore our research question, we held a mixed-method study blending multiple sources of evidence as reports, case study analysis and participant observations from the ENTREPRENEDU hackathons to triangulate data and to increase the richness of information (Yin 2017). Qualitative data has been used to gain a more accurate picture of the dynamics of social relations that take place in inter-organisational projects, by examining the phenomenon of interest in its real-life context (Eisenhardt and Graebner 2007; Yin 2017).

We received observations through involvement in the jury committees, facilitation of local events and team coaching. We also conducted informal interviews and took field notes during the events to capture feelings and reactions related to emerging issues (Bertello *et al.*, 2022). Furthermore, the examination of multiple-case studies allowed us to gain significant insights from other relevant events through comparative review and provided a strong basis for theory building (Eisenhardt and Graebner 2007; Yin 2017). All data extracted during the hackathons gave us the opportunity to delve deeper into the participants' intentions and expected returns. We elaborate on the experience, insights and knowledge gained in the following section.

2. The ENTREPRENEDU Hackathons

The ENTREPRENEDU project launched an ambitious initiative to foster entrepreneurship and innovation in Europe through three hackathons with the brand name 'HackTheBusiness'. These events, held in Italy, Bulgaria, and Greece from June 2023 to March 2024, were designed as real business challenges to solve issues including DeepTech, space technologies and technologies for sustainability. Participants received live support from mentors and attended a total of 16 workshops, which enabled the 3 'HackTheBusiness' to generate a total of 94 business ideas.

Out of these 94 business ideas 13 winners (4 from the first two events and 5 from the last one) got awarded to participate to an exclusive Mentoring and Business Acceleration Programme of 60 hours, where experts from the ENTREPRENEDU consortium provided entrepreneurial education on several topics (e.g. Business Model Development, Crafting a Unique and Competitive Value Proposition, Investment Pitch, etc.) incorporating best practices from the events to support their continuation.

Participation in the HackTheBusiness and in the Mentoring Programme had the primary goal to equip participants with the necessary knowledge and tools to transform their ideas into successful business solutions. By organising these hackathons in low to moderate innovation countries, the project ensured a diverse mix of participants, stakeholders, and industry sectors, facilitating valuable interactions with innovation experts across Europe.

Table 1: ENTREPRENEDU hackathons per country

Place	Date	Vertical	Business Ideas	Individual Questionnaire Responses
Rimini, Italy	15-17/06/2023	DeepTech	30	9
Athens, Greece	25/11/2023	Space	35	37
Sofia, Bulgaria	26-27/03/2024	Sustainability	29	16

Source: Author's own processing on available data

The completion hackathons marked the conclusion of the project's second stage "Cross-Fertilisation and Challenge Generation" introducing the twelve teams to the "Venture Building Program". Though the format of each Hackathon varied to better fit the context, seize local opportunities, better involve local multipliers and stakeholders and address participants needs, all three hackathons were based on a common structure.

The overall satisfaction from participants of the ENREPRENEDU hackathons was high, revealing a generally positive experience. Most participants appreciated the collaborative atmosphere, access to mentors, and the opportunity to innovate. Few participants highlighted the need for better organisation and clearer communication regarding event logistics and expectations. Unique learning experience and the networking opportunities provided were among the deciding factors. Still the prospect of valorasition remained unclear.

Based on the experience gained from the three hackathons and the literature review presented in the subsequent section, we aim to develop a grounded approach that includes the most important factors for

assessing the success of hackathons. More critically, this approach will emphasise the sustainability of the projects generated during these events.

3. Hackathons' Success and Sustainable Impact

According to Nolte *et al.* (2018), hackathons, data dives, codefests, hack-days, sprints, and edit-a-thons have gained significant attention from both practitioners and researchers. These events, typically lasting between 24 to 48 hours, bring together diverse teams to engage in rapid problem-solving and innovation, often within a competitive framework.

The impact of hackathons on startups can be profound, offering numerous benefits such as networking opportunities, skill development, and the rapid prototyping of ideas. Hackathons serve as a microcosm of the open innovation environment, encapsulating the principles of collaborative innovation, external engagement, and problem-solving under constrained timelines (Hossain and Kauranen, 2016). In their work, Rexhepi, Hisrich, and Ramadani discuss the breadth of cooperation and its impact on startups' innovation performance. They highlight that engaging with a variety of partners—ranging from customers to competitors—enhances a startup's ability to innovate. This is because diverse inputs can stimulate creativity and lead to the discovery of novel solutions (Rexhepi *et al.*, 2019). Hackathons embody this principle by bringing together participants from various backgrounds to work on common challenges, thereby broadening the innovation landscape for participating startups.

Startups participating in hackathons often gain exposure to potential partners, investors, and customers, thereby enhancing their market visibility and credibility. The collaborative nature of hackathons enables startups to tap into a wider pool of expertise and resources, which can be instrumental in overcoming their inherent limitations. Furthermore, the intensive, goal-oriented atmosphere of hackathons can accelerate the innovation process, leading to the rapid development and refinement of new products and services (Huang *et al.*, 2013).

To further elaborate on the matter of impact we must provide a definition of the term within the hackathon setting. In general, 'results' are defined as the top three elements of the result chain: outputs, outcomes and impact (Belcher and Palenberg 2018). However, while outcomes and impact are distinct concepts, they are interconnected. Outcomes describe the objective changes resulting from a planned intervention. Impact, on the other hand, captures the stories, experiences, and feelings of people or society because of these changes. Table 1. displays the main differences.

Sustainable outcome means something that goes on for an extended amount of time, rather than peaking and then waning. Hence, for success to be sustainable, it must have a longer time horizon. A successful hackathon might be just hacking, just training, or both hacking and training (Tauberer, J. 2017). In this regard, success might refer to short-term goals, solely like the successful implementation of the hackathon. Of course, the completion of the event alone does not guarantee lasting impact of the outcomes generated within it. This is clear, since hackathons are not destined to provide complete solutions rather than test assumptions and quickly advance to conclusions (McIntosh and Hardin, 2021). Meanwhile, impact is a dynamic concept which presupposes a relationship of cause and effect. Impact can be measured through the evaluation of the outcomes of actions, be that an initiative, a set of initiatives forming a policy, or set of policies which form a strategy (Fedorciow L. and Bayley J., 2014).

Table 2: Distinction between event success and impact

Outcome	Success	Impact
Level	Event	Ecosystem
Effect	Short-term	Mid-and-Long-term
Scope	Focused	Broader
Measurement approach	Objectively and subjectively	Objectively and subjectively
Evaluation	Measures activity and satisfaction	Measures activity continuation and spin-off, new activity, and behavior

Source: Authors' elaboration

In measurement terms, outcomes are typically predefined and can be objectively measured using quantitative metrics. Impact, on the other hand, can be quantitative, qualitative, and subjective, often based on people's

feelings or experiences, making it more challenging to quantify. Impact can be measured for all activities and in its simplest terms refers to the long-term effects of an individual, organisation, or policy actions/interventions on stakeholders, such as customers, beneficiaries, sponsors and society at large. Therefore, measuring impact refers to the process of evaluating the effects of the activities/interventions of an individual/organisation on people, the environment, society or the economy (Fedorciow L. and Bayley J., 2014).

3.1 Hackathon Success

Hackathons are recognised as a strategy for open innovation and entrepreneurial intention, highlighting the importance of open data and investments for the success of hackathons, particularly in aiding startup development (Schaedler *et al.*, 2022). In a study conducted by Juell-Skielse *et al.* (2014), it was found that only one-third of developers who participated in open data hackathons reported completing their projects. To address this issue, open data hackathons should involve entrepreneurs and venture capital firms as jurors. These jurors would be aware of the motivations driving the participating developers. Consequently, at the end of digital competitions, developers could engage in open discussions about their apps, pitch them to investors, and potentially secure funding (Lee *et al.*, 2016).

According to Soltani *et al.* (2014), six critical factors contribute to the success of hackathon contests. Firstly, problem definition is crucial. A well-defined problem area ensures that participants understand the challenge they need to address. If organisers fail to explain the problem clearly, participants may struggle to develop the desired solutions. Secondly, the type of return offered to contest winners serves as a significant motivator. The rewards influence the types of participants who sign up and their commitment throughout the contest. Thirdly, team diversity is essential for success. Collaboration among team members with diverse competencies and skills enhances the development of appropriate digital solutions. Fourthly, effective mentorship plays a vital role. Clear communication of expertise from mentors to participants positively impacts project outcomes. Fifthly, jury knowledge is important for ensuring a fair evaluation process. Jurors with sufficient subject matter knowledge can provide informed assessments of the projects. Lastly, entry requirements need to be clearly defined. These requirements set the tone for the hackathon and help participants prepare adequately for the contest. Together, these factors create a structured and supportive environment that fosters innovation and effective problem-solving during hackathons.

Furthermore, interdisciplinary collaboration is essential for successful hackathons. Teams with members from different backgrounds have an advantage in developing innovative solutions, as explained by Yoo *et al.* (2009). Additionally, the success of the event depends on having a jury composed of individuals with strong academic and professional backgrounds. Organisers must carefully select the best solutions to achieve their desired outcomes.

Rosell *et al.* (2014) emphasised the importance of ideas and team formation in hackathons. They observed that teams were formed either before or during the hackathon, often using social media platforms like Facebook. Participants could post their hackathon ideas and connect with others to form teams. This collaborative approach ensured that everyone contributed to one or more ideas, forming teams around specific concepts. The flexibility to form teams even on the day of the event allowed for dynamic collaboration and idea exchange.

3.2 Key Factors Affecting Hackathon Impact

Nolte *et al.* (2018) conducted a detailed study focusing on the outcomes of corporate hackathons, which have unique characteristics compared to their collegiate or civic counterparts. The study investigated five teams from Microsoft's One Week hackathon, one of the largest corporate hackathons globally, involving over 18,000 employees and 4,700 projects. The researchers aimed to understand how activities before, during, and after the hackathon influenced the continuation of projects and the perceived impacts on participants' skills, careers, and networks. In their study, Nolte *et al.* (2018) identified several critical factors that influence the continuation of projects initiated during hackathons. These factors are essential for understanding how to sustain the momentum and ensure the long-term success of hackathon projects.

Firstly, meticulous preparation is crucial. Teams that engage in thorough preparation before the hackathon, such as defining clear goals, assembling the right team, and understanding the problem space, are more likely to continue their projects post-event. Pre-hackathon activities like team-building exercises, preliminary research, and stakeholder engagement contribute to a stronger foundation for the project. Secondly, having a clear and shared vision among team members ensures that everyone is aligned with the project’s goals and motivated to see it through. Projects with well-defined objectives that resonate with all team members are more likely to be pursued further. Effective leadership is another vital factor. Teams led by individuals who are committed to the

project and possess strong leadership skills tend to perform better. Effective leaders can inspire team members, delegate tasks efficiently, and navigate challenges. Leaders who see the hackathon as an opportunity for career advancement often invest more effort and resources into the project, increasing the likelihood of continuation. The composition of the team also plays a significant role. Recruiting team members who are passionate about the project and eager to learn new skills contributes significantly to the project's continuation. Teams with a diverse mix of skills and expertise are better equipped to handle the various aspects of project development and implementation.

Post-hackathon dissemination is critical. Actively promoting the project within and outside the organisation after the hackathon can attract additional support and resources, facilitating its continuation. Leveraging networks and connections made during the hackathon to secure further collaboration and investment is crucial. Aligning the project with existing product lines or the strategic goals of the organisation increases the likelihood of continued support. Ensuring that the project fits within the broader organisational context and addresses relevant business needs enhances its chances of being adopted and scaled. Engaging relevant stakeholders, such as potential users, customers, and internal champions, early in the process helps validate the project and secure buy-in. Establishing mechanisms for regular feedback from stakeholders ensures that the project remains relevant and adaptable to changing needs. Finally, structured follow-up activities, such as mentorship programs and incubation support, are vital for maintaining project momentum. Ensuring that teams have access to necessary resources, including technical infrastructure, financial support, and expert advice, is crucial for the project's continuation.

Hackathons also face several challenges. A significant issue is the disparity of intentions to continue projects after a hackathon and their actual continuation. Factors contributing to this gap include the lack of follow-up activities, insufficient stakeholder involvement, and the difficulty in maintaining momentum post-event. Ensuring the long-term sustainability of hackathon projects requires addressing these challenges through strategic planning and support from organisations hosting the events. Despite their growing popularity, the factors of projects continuality from the Hackathons organisation perspective receive limited attention from the research community.

In Table 3 we summarise the outcomes or success indicators on both event level and ecosystem level. We distinguish the most significant indicators to be considered in planning a hackathon (note that there is not a direct correspondence between factors in the two columns of Table 3).

Table 3: Outcomes/success indicators

Hackathon event	**Hackathon sustainability/impact**
Technical artifacts (Medina, 2020; Chau, 2023)	Projects continued (Kohne, 2019)
Non-technical artifacts (Medina, 2020; Chau, 2023)	Collaborations continued (Medina, 2020; Chau, 2023)
Number of participants (Kohne, 2019)	Teams continued (Kohne, 2019)
Number of teams (Kohne, 2019)	Number of jobs created (Kohne, 2019)
Number of Press mentions (Kohne, 2019)	Inquiries for solutions (Frey F.J., Luks M., 2016)
Money raised (Kohne, 2019)	Accelerated innovation process (Lifshitz- Assaf, 2020)
Participant satisfaction (Heller *et al.*, 2023)	VC investments (Kitsios and Kamariotou, 2023)
Entrepreneurship (Medina, 2020; Chau, 2023)	IP out licensing and Patent selling (Rexhepi *et al.* 2019)
Awareness about theme (Medina, 2020; Chau, 2023)	
Learning (Medina, 2020; Chau, 2023)	
Networking opportunities (Medina, 2020; Chau, 2023)	
Ideas generated (Medina, 2020; Chau, 2023)	
Fostering existing enterprise (Medina, 2020; Chau, 2023)	

Source: Elaborated from Kohne and Wehmeier (2019), Rexhepi *et al.* (2019), Medina and Nolte (2020), Chau (2023), Heller *et al.* (2023), Kitsios and Kamariotou (2023)

In Table 4 we provide a summarised depiction of factors contributing to events success or greater sustainability/impact. The factors are listed independently of stage of the event lifecycle, including planning, execution, and post-event follow-up, offering a comprehensive overview to guide future hackathon organisers

and researchers. The selection of factors accomplished by reviewing the most relevant papers discussing the deciding factors in a systematic approach.

Table 4: Success factors in literature

Factors	Hackathon event	Hackathon sustainability/impact
Dissemination	✓	
Entry requirements	✓	
Problem definition	✓	
Compensation/award	✓	
Team composition/Skills diversity	✓	✓
Organisers' support	✓	✓
Mentoring	✓	✓
Jury engagement	✓	
Stakeholders' engagement	✓	✓
Career-promoting ideas		✓
Project feasibility		✓
Post-event incentives		✓
Follow-up program		✓

Source: Elaborated from Soltani *et al.* (2014), Nolte *et al.* (2018), Kohne and Wehmeier (2019), Pe-Than *et al.* (2020), Heller *et al.* (2023)

In order to cater for these factors key decision must be taken at the appropriate time. In Table 5 we show when these decisions should be taken and how they relate to the success factors outlined above.

4. Discussion and Propositions

Building on the experience gained throughout the implementation of the three ENTREPRENEDU hackathons, we propose a framework that contributes significantly to the ongoing conversation on enhancing hackathon outcomes and sustaining their impact over time. This framework extends the success factors identified by Soltani *et al.* (2014), emphasising the critical importance of the follow-up period in maximising the impact of solutions generated during such events. By incorporating considerations for relevant criteria from the planning phase onwards, this updated classification aims to optimise both the immediate outcomes and the long-term viability of hackathon-generated innovations.

The findings of this study underscore the multifaceted role of hackathons in fostering innovation within entrepreneurial ecosystems. By integrating existing literature and analysing the outcomes of the ENTREPRENEDU project, we have identified critical factors that influence the sustainability and impact of hackathon-generated projects. Our study clearly delineates the distinction between immediate success and medium- to long-term impact, emphasising the necessity of considering both aspects in the planning and execution of hackathons.

The disparities between immediate success and long-term impact, as outlined in our study, call for a re-evaluation of how hackathons are perceived and organised. Success should not only be measured by the immediate outputs but also by the enduring impact on the broader ecosystem. This broader perspective encourages organisers to adopt a more holistic approach, integrating sustainability considerations throughout the hackathon lifecycle.

Our findings also contribute to the ongoing discourse on the role of temporary organisations, such as hackathons, in fostering innovation. By highlighting the importance of follow-up activities and sustained support, our study suggests that hackathons should be viewed not as isolated public relations, promotional or encouraging events but as integral components of the innovation ecosystem. This perspective is supported by recent studies that emphasise the need for ongoing engagement and support to ensure the long-term success of innovation initiatives (Adamczyk, Bullinger, and Möslein, 2012; Briscoe and Mulligan, 2014).

Table 5: Key decisions in designing a hackathon

Key Decisions	When and How (methods/tools)			Factors affected and level of impact	
	Before	During	After	Event	Ecosystem
Goal / Objectives	Pre-hackathon survey			Problem definition, Dissemination, Stakeholders' engagement	
Theme	Theme definition			Problem definition, Stakeholders' engagement	
Type and Approach	Competitive/ cooperative, Physical/ Virtual/ Hybrid, Open/ Closed/ Dedicated			Dissemination, Compensation/award	
Stakeholder involvement	Involve sponsors, speakers, coaches, mentors, jurors, co-organisers			Dissemination, Problem definition, Stakeholders' engagement, Project feasibility	
Specialised preparation	Warm-up sessions, tutorials, training, specialised hardware, access to licenses and team meetings			Dissemination, Entry requirements, Stakeholders' engagement	
Duration / breaks	Overall timeline including dates and times (start, end and potential overnight breaks) for each day.			Organisers' support	
Ideation	Brainstorming, targeted questions and idea clustering			Mentoring, Organisers' support, Project feasibility	
Recruitment and team formation	Website with basic information about the event. Pre-event registration form. Promotion and advertising carefully select participants.			Dissemination, Entry requirements, Career-promoting ideas, Team composition/Skills diversity	
Agenda	Agenda that outlines which activities will take place at which point in time.			Organisers' support, Mentoring, Stakeholders' engagement	
Judges and Mentors	Organisers create a mentoring strategy, recruit mentors and support them to execute the developed strategy. Mentors support participating teams based on this strategy.			Mentoring, Jury engagement, Project feasibility	
Continuity Planning	Provide an environment for participants that fosters the desired outcome.			Post-event incentives, Follow-up program, Career-promoting ideas, Project feasibility	

Source: Adapted from Kohne and Wehmeier (2019), Nolte, A., *et al.* (2020), Chau *et al.* (2023) and Heller *et al.* (2023)

4.1 Practical Implications

For practitioners, the proposed framework offers actionable insights into how hackathons can be designed and managed to maximise their impact. Hackathon organisers can use this framework as a guide to ensure that both immediate outcomes and long-term sustainability are considered from the outset. This approach can lead to more successful hackathons that not only generate innovative solutions but also contribute to the development of a vibrant entrepreneurial ecosystem.

Policymakers and funding bodies can also benefit from the insights provided by this study. The identified success factors and sustainability metrics offer a valuable tool for evaluating the potential impact of hackathon projects. By considering these factors, policymakers can make more informed decisions about which projects to support and how to allocate resources effectively.

Educators and academic institutions can leverage the findings of this study to enhance their curricula by incorporating hackathons as experiential learning opportunities. By doing so, they can foster entrepreneurial thinking and collaboration among students, preparing them for success in innovation-driven environments.

4.2 Future Research Directions

While this study offers valuable insights into the factors that influence the sustainability and impact of hackathon-generated projects, further research is needed to validate and refine the proposed framework. Future studies could focus on testing the framework in different contexts and with different types of hackathons to assess its generalisability. Additionally, research could explore the specific mechanisms through which post-hackathon support influences long-term outcomes, providing a deeper understanding of how to optimise these activities.

Another promising area for future research is the role of stakeholder involvement in hackathons. While our study highlights the importance of involving stakeholders early in the process, more research is needed to understand how different types of stakeholders contribute to the success of hackathons and how their involvement can be optimised. Finally, longitudinal studies that track the outcomes of hackathon projects over time would provide valuable insights into the factors that contribute to their long-term success.

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The Debt Dilemma: Driver or Brake of Innovation in the EU?

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Abstract: In the current economic environment, the issue of increasing indebtedness is receiving considerable attention. This article delves deeper into a comprehensive analysis of how different forms of debt – from households to corporations to governments – affect innovation performance within the European Union (EU). Since the EU includes 25 different countries, it provides a rich background for this analysis covering the period from 2013 to 2021. By applying regression analysis techniques on a large dataset, this study offers a new insight into the complex relationship between indebtedness and innovation performance. A key part of this analysis is the Global Innovation Index, widely recognized as a metric for evaluating innovation performance among nations. The empirical findings of this study reveal a subtle dynamic: while government debt appears to be a drag on innovation performance, private sector indebtedness, including both households and non-financial institutions, shows a positive effect. This dichotomy underlines the crucial importance of implementing responsible fiscal policies that prioritize the promotion of innovation without jeopardizing financial stability. In addition, the research highlights the importance of fostering collaboration between the public and private sectors, supporting university research, and developing innovation incubators to create a robust innovation environment. In addition, this study not only clarifies the current status, but also identifies areas requiring further research, such as research into other factors influencing the innovation environment. However, it is important to acknowledge the limitations associated with the current understanding of the relationship between debt and innovation. These limitations underscore the need for continued refinement of methodologies and investigation of other factors that may influence this interaction, thereby providing fertile ground for future research efforts. In conclusion, this study contributes to a deeper understanding of how debt dynamics shape innovation outcomes in the EU context.

Keywords: Debt dilemma, Innovation performance, European Union

1. Introduction

In the current global economy, innovations constitute a fundamental pillar of economic growth, sustainable development, resilience, and, notably, financial stability (Di Caro and Fratesi, 2018; Hysa et al., 2020; Shen et al., 2022). A country's ability to innovate and adapt to new technologies and market conditions not only determines its position in the international market but also significantly influences the quality of life of its citizens. Innovations bring benefits such as increased efficiency, the creation of new jobs, and the promotion of sustainable practices essential for addressing current economic, social, or environmental challenges.

Following the importance of innovation, many countries turn to financing research and development through debt (Croce et al., 2019; Fan et al., 2022). This trend raises the question of whether a higher level of debt truly benefits innovation performance or poses a potential risk to the country's economic stability. In the context of the European Union, where economic conditions and innovation capacities of individual member states vary significantly, this question is particularly relevant.

The aim of this article is to examine the relationships between debt indicators and innovation performance in EU countries, with the goal of identifying how household, non-financial institution, and government debt affect countries' ability to generate innovations. Previous research has only marginally addressed the issue of various forms of debt and innovation, leaving a significant gap in knowledge that we aim to fill. Specifically, we address the question of whether there is a connection between higher debt levels and better innovation performance, and if so, what type of debt has had the greatest impact on innovation in the EU in recent years.

Our research offers a new perspective on the so-called debt dilemma, i.e., the dilemma between further indebtedness in favor of innovation performance and the concurrent risk of financial collapse. We see our contribution in clarifying the impact of different forms of debt on innovation performance in EU countries, being among the few to include in the analysis the direct relationship between household debt and innovation performance. At the same time, we reveal a gap in current research – what is the impact of current restrictive fiscal policies on innovation performance? And finally, we discuss possible recommendations for policymakers regarding future forms of innovation support while considering the strengthening of fiscal sustainability due to growing global indebtedness.

This paper is structured as follows: Section 2 presents the latest findings from the known literature and hypothesis development, Section 3 briefly describes the methodology we used, Section 4 presents the results of

our research, which are then discussed in more detail in Section 5. Section 6 provides conclusions, including theoretical and practical implications, research limitations, as well as proposals for future research.

2. Literature Review and Hypothesis Development

Currently, we observe an unabated interest among regional policymakers in innovations, which significantly impact not only the economic but also the societal environment. Innovations are considered a significant factor in economic growth (e.g., Prokop and Stejskal, 2019; Hysa et al., 2020; Fan et al., 2022), sustainable development (e.g., Silvestre and Ţîrcă, 2019; Hysa et al., 2020), regional resilience (e.g., Di Caro and Fratesi, 2018; Bristow and Healy, 2020), and financial stability (Shen et al., 2022). It is important to note a certain synergy in the relationship between innovations and these key indicators – economies achieving higher levels of development, sustainability, resilience, and financial stability often excel in innovation (Lazaretti et al., 2019; Manzoor et al., 2023). Innovations not only contribute to strengthening these indicators but are also the result of their successful development.

The extensive positive effects associated with innovations necessitate the support of innovative activities. Considering current trends and policies within the EU (notably Horizon Europe and the European Fund for Strategic Investments), it is evident that innovation support is multifaceted and includes various initiatives aimed at digitalization, green transformation, and support for small and medium-sized enterprises (Henriques et al., 2022; Tabarés et al., 2022). Similarly, at the national level, there are various mechanisms for supporting innovation. Besides the, these include different forms of tax relief, national innovation strategies, support for university research, public-private partnerships, and in recent years, increasingly popular innovation incubators that provide startups and innovative firms with access to mentorship, networking, and funding (Cirule and Uvarova, 2022; Redondo et al., 2022). Their positive impact on innovation has been demonstrated in recent years, for example, in Spain and the Netherlands (Redondo et al., 2022) and in Latvia (Cirule and Uvarova, 2022).

In examining the dynamics between innovations and these indicators, it is legitimate to pay more attention to the area of financing. Justification for research in this area has been further reinforced in recent years by various crises that have had a significantly negative impact on the global economy and led to a dramatic increase in debt (Ellul et al., 2020; Wang et al., 2021). In terms of fiscal sustainability, it has been necessary in many countries to adopt restrictive fiscal policies. It has been shown that budget cuts in science and research, and especially the increasing taxation of corporations, hinder progress in this area, ultimately significantly limiting economic growth (Atanassov and Liu, 2020; Babina et al., 2023). Research in this area is currently highly relevant, particularly considering the global increase in public debt and the multifaceted effects of innovation. Despite this, there is still not enough scholarly resources that address this issue in detail. Moreover, it was not just public or government debt that increased; households and businesses also faced rising indebtedness. Alongside governments, examining the financial situation of households and businesses is entirely warranted – their improved financial situation enables the strengthening of innovative activity and supports the creation of new ideas and technologies (Poltorak et al., 2022). If households and businesses are less indebted and have stable incomes, they have more financial resources to invest in education, research, and the development of new products or services. Thus, while it might seem that there is a clear negative relationship between debt and innovations, this conclusion needs to be approached with necessary caution – it is one of many perspectives.

2.1 Innovation and Debt: Household Debt, Non-Financial Corporation Debt, General Government Debt

Household debt is currently a highly discussed topic in the economy, yet its direct relationship to innovations is scarcely explored in the current literature. Therefore, indirect exploration of the relationship, as indicated in the preceding section, seems appropriate. A generally accepted conclusion is the negative relationship between household debt and consumption, which is an integral part of aggregate demand and thus a significant source of economic growth. For example, Ji et al. (2019) in the context of Dutch households between 2006–2015, Du Caju (2022) in the Belgian economy between 2010–2014, and Wong et al. (2022) in a sample of 4730 households in Malaysia for the year 2019 reached this conclusion. As a result of lower consumption, it can then be expected that households will have lower demand for innovative products, effectively presenting a significant brake on innovative activity (Guiné et al., 2020). The direct relationship between household debt and innovations is approached by Bernstein et al. (2017), who, in the period of 2008–2012, highlighted a significant aspect in the American economy, where the negative impact of the financial crisis on households led to a fundamental influence on the productivity of innovative workers, resulting not only in a limitation of innovation performance but also in the exacerbation of economic decline. Thus, to some extent, we can indeed perceive a negative relationship between household debt and innovations. Based on these conclusions, we formulate the following hypothesis:

H1: Household debt has a negative impact on innovation performance.

In terms of innovation generation itself, the perspective from businesses appears most important. Recent empirical studies have shown that particularly innovative firms heavily rely on debt financing (e.g., Wu et al., 2016; Ernst, 2019; Geelen et al., 2022). Their innovation growth largely depends on whether and how broadly companies in each region have access to loans. In this regard, a positive relationship between the amount of corporate debt and innovation activity can be observed (Cumming et al., 2016; Geelen et al., 2022). These considerations are partially confirmed by Wu et al. (2016), who addressed the role of specific informal debt as an integral part of corporate debt. They demonstrated on a sample of 3,235 firms from 31 Chinese provinces that the relationship between informal debt and corporate innovations follows a reversed U shape, with an optimal level of informal debt. Concerning corporate debt, the dependence between its amount and potentially different impacts on innovations is often discussed. While excessive debt, often accompanied by a negative effect in the form of a rating downgrade, tends to limit corporate innovations, low debt, on the other hand, successfully stimulates them. This conclusion was demonstrated both in the EU context (Bonfatti and Pisano, 2020) and in China between 2016–2020 (Yao et al., 2022). However, it is not an entirely straightforward conclusion – there are studies that partially refute this belief – Geelen et al. (2022) for an extensive period from 1975–2010 in the American economy revealed that even with higher levels of corporate debt, innovation is supported. In this context, debt can stimulate innovations from new businesses, which outweighs the negative impact of debt overload on innovations in existing businesses (Geelen et al., 2022). Thus, while there may be some debate over the relationship between corporate debt and innovations, especially regarding the level of this debt, based on the findings, we establish the following hypothesis:

H2: Non-financial corporation debt has a positive impact on innovation performance.

Similarly to corporate debt, government debt may have an impact on innovations in the shape of a reversed U. Li and Zeng (2020) demonstrated that between 2011–2015, the increase in government debt had a negative impact on green innovations in Chinese industrial sectors. Similar conclusions were drawn by Zhang and Jin (2022) from 2011–2017, likewise in the context of the Chinese economy. The European perspective on this relationship, in turn, is offered by Coccia (2013), where in the environment of 27 European countries between 1995–2009, a significant negative impact of government debt was demonstrated not only on innovations but also on employment. Croce et al. (2019), in their research, additionally note that government debt significantly affects innovative companies compared to companies with low research and development activity. They confirmed this conclusion on quarterly macroeconomic data and data from selected American companies between 1975–2013. In fact, government debt through the growth of government expenditures can indeed effectively stimulate innovations, as it includes, among other things, expenditures on science and research; however, if there is insufficient revenue cover in the long term, government debt may represent a significant brake on innovation in the future (Coccia, 2013; Croce et al., 2019; Fan et al., 2022). The prevailing conclusions based on these findings lead us to formulate the following hypothesis:

H3: General government debt has a negative impact on innovation performance.

Drawing upon the findings of our comprehensive review of individual factors influencing innovation performance and the formulated hypotheses, we introduce a conceptual model for our study (see Figure 1)

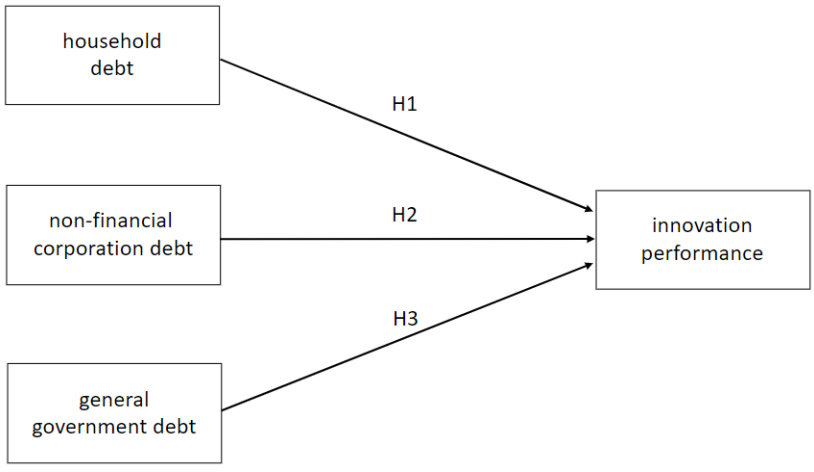


Figure 1: Research framework

3. Data and Methodology

To construct a linear regression model, we gathered data from 25 European countries. The data were collected from IMF and Eurostat databases for the years 2013-2021. Thus, we compiled a panel dataset spanning 9 calendar years, comprising a total of 225 observations. Specifically, our dataset includes the following countries: Austria, Belgium, Bulgaria, Croatia, Czechia, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

The dependent variable in our regression model is the Global Innovation Index (GII) score. This index, ranging from 0 to 100, reflects the innovation performance of individual countries (Svačinová, 2020; Oturakci, 2023). The independent variables in this model are household debt (HHD), non-financial corporation debt (NFD), and general government debt (GGD). The control variable in this model is unemployment (UNE).

An overview of the variables used is provided in the following table (see Table 1).

Table 1: Overview of Variables

Type	Variable	Description	Unit	Source	References
Dependent	GII	Global Innovation Index	Score (0-100)	GII	Oturakci (2023)
Independent	HHD	Household debt	% GDP	IMF	Bernstein et al. (2017)
	NFD	Non-financial corporation debt	% GDP		Ernst et al. (2019)
	GGD	General government debt	% GDP		Coccia (2013), Fan et al. (2022)
Control	UNE	Unemployment	% of the population in the labour force	EUROSTAT	Coccia (2013)

As the first step of the analysis, it was necessary to normalize the data. Normalization was performed using the min-max method. After normalization, we could proceed to construct the linear regression model. The linear regression model was built using the Gretl software. In addition to the results, the calculation also included the coefficient of determination, which helps determine the appropriateness of using the linear regression model for our dataset. For a detailed procedure of this statistical method, see, for example, Darlington and Hayes (2016).

4. Results

From the results of the regression model, it follows that all independent variables we tested within the hypotheses emerge as significant. Furthermore, the coefficient of determination, with a value of 0.662, indicates a relatively high suitability of using the linear regression model on the input dataset.

Table 2: Results of the regression analysis

Independent	Coeff. Estimate	Std. Error	*t*-value	*p*-value	significance
CONST	0.308	0.026	11.960	9.81E-26	***
HHD	0.798	0.050	15.950	1.39E-38	***
NFD	0.254	0.055	4.671	5.22E-06	***
GGD	-0.217	0.069	-3.161	0.002	***
UNE	-0.372	0.073	-5.060	8.82E-07	***
R-squared 0.662					

Signif. codes:‘***’ 0.01;‘**’ 0.05;‘*’ 0.1

Based on the results presented in Table 2, we reject hypothesis H1, as even though the household debt indicator emerges significantly at a 99% level of significance, it is important to note the positive coefficient value, indicating that household debt positively influences the innovation performance of the state. Non-financial

corporation debt also emerges significantly at a 99% level of significance, likewise with a positive coefficient. In this case, hypothesis H2 regarding the positive impact of the debt indicator on innovation performance is confirmed. Finally, we also confirm hypothesis H3 regarding the negative impact of government debt on innovation performance, as this relationship is significant in our model at a 99% level of significance and has a negative coefficient value.

5. Discussion

Based on the established hypotheses regarding the impact of selected debt indicators on innovation performance in EU countries between 2013-2021, we can draw the following conclusions. Firstly, hypothesis 1 concerning the negative influence of household debt on innovation performance is rejected. It is worth noting that establishing this hypothesis was challenging, mainly due to the limited number of studies that have directly addressed this relationship. The lack of interest in this relationship may stem from the difficulty in proving the actual impact of household debt on innovation performance, implying the need for further research and analysis. We emphasize that in our model, the strength of this relationship is the greatest. By rejecting this hypothesis, we contradict the results of the study by Bernstein et al. (2017), which focused on examining this relationship in the context of the American economy between 2008-2012. Given the differing conclusions between our study and theirs, several questions arise: could the difference in results be attributed to changing trends during these periods, or the distinct characteristics of the American economy compared to EU countries? While the period 2008-2012 may more prominently reflect the impacts of the global financial crisis and economic recession, since 2013, the effects of this crisis may have been increasingly less pronounced in the economic development of individual countries. Furthermore, global economic growth in recent years has increasingly relied on innovation as a key factor supporting competitiveness and productivity. Considering the different specifics, policies, regulations, and approaches of the American and European economies is also pertinent. However, for more specific conclusions, it would be appropriate to conduct further research that examines these and other factors in more detail and their impacts on the relationship between household debt and innovation performance in different periods and regions.

We hypothesized, beyond our chosen indicators, that household debt negatively affects consumption (Ji et al., 2019; Du Caju, 2022; Wong et al., 2022), which a decline in would result in innovation constraints. However, this effect did not occur in our case. One reason may be that our study includes 25 EU countries, whereas the selected studies exclusively examined this relationship in one country. In this context, it is necessary to consider that the economies of individual countries are highly diverse, with different socioeconomic conditions, policies, and market structures. Therefore, the impact of household debt on consumption and innovation may vary in each country.

On the other hand, we confirm hypothesis 2 regarding the positive impact of non-financial corporate debt on innovation performance. This aligns with the findings of studies by Cumming et al. (2016) and Geelen et al. (2022). Thus, we lean towards the view that non-financial corporate indebtedness plays a crucial role in supporting innovation and technological development in the economy, even despite higher corporate debt levels. It is pertinent to mention the economic context with low interest rates in the global economy during the analyzed period, which provided businesses with broader and cheaper access to credit, undoubtedly stimulating their innovation performance.

While we do not directly refute the conclusions of any of the mentioned studies, it is essential to note some debate regarding the size of non-financial corporate debt and innovation performance – excessively high debt may have significant negative impacts on financial and economic stability in the future, whether at the level of companies, regions, or individual countries (Bonfatti and Pisano, 2020; Yao et al., 2022). In extreme cases, excessive corporate debt at the expense of innovation may lead to increased vulnerability of companies, which may face financial distress or even insolvency due to worsened market conditions. As a result, negative impacts such as increased unemployment, lower product supply, and overall reduced competitiveness can be expected. In terms of optimization in this area, solutions are available both on the side of companies, particularly in active debt management, monitoring, evaluation, and control of credit risks, and on the side of the government – support through financial instruments and programs that enable (not only) companies to finance their innovation projects without excessive indebtedness.

Government programs to support innovation are reflected negatively in the growth of government debt; therefore, it was necessary within hypothesis 3 to also examine the relationship of this indicator to innovation performance. We confirmed the findings of Coccia (2013) that the growth of government debt significantly limits the innovation performance of European countries. Like our other hypotheses, this one was also confirmed at

the 99% significance level, albeit with the lowest coefficient, which may indicate some diversification of this relationship across EU countries. The results of our study suggest that excessive growth in government debt may have serious consequences for the innovation environment (Coccia, 2013; Croce et al., 2019; Fan et al., 2022). Excessive government debt can lead to a limitation of available financial resources for investment in research and development on one hand and increased uncertainty and distrust in economic stability on the other hand. This trend can be particularly problematic in the long term, as a lack of investment in innovation may jeopardize long-term economic growth and the country's competitiveness. It is therefore essential for governments to carefully manage their public finances and ensure a favorable environment for innovative activities. In this context, Ege and Ege (2019) point out that a favorable innovation environment is not only subject to appropriate economic conditions (financing) but also to legal regulation, the political system, and social influences. If these pillars are suitably stimulated by public policy, innovation outputs can be achieved with significantly lower financial resources. This idea is also confirmed by a study by Muscio et al. (2015), which arrives at the innovation paradox, where higher government spending on science and research does not necessarily mean higher innovation performance. A typical example of this paradox is the long-term situation in Eastern European countries. Based on these findings, the future direction of innovation support policies should increasingly focus on supporting the circulation of knowledge (innovation incubators, support for university research) and the collaboration between the private and public sectors (Cirule and Uvarova, 2022; Redondo et al., 2022). When these sectors cooperate and share resources and know-how, it can lead to synergistic effects and enhance the innovation potential of the economy while simultaneously reducing pressures on the growth of public debt. In relation to fiscal sustainability, public financial support should serve more as a complement in stimulating the innovation environment in the future, with the goal of policymakers being to make it targeted and maximally effective.

6. Conclusion

Our study provides important insights into the relationship between debt indicators and innovation performance in 25 EU countries during the period 2013-2021. From the perspective of the debt dilemma, that is, whether debt is more of a driver or a hindrance to innovation, we conclude that this question is not straight forward and its answer is intertwined with many variables. In our case, it was revealed that while private debt (households and non-financial corporations) positively influenced innovation performance in EU countries, government debt, on the contrary, represented a significant brake on innovation. However, in terms of the clarity of these conclusions, it is necessary to note their possibly overly categorical nature, which leads us to the limitations of this research.

It can be assumed that by extending the analyzed period, especially to include the financial crisis, the results of our study would differ, and it would also be possible to discuss the impacts when including the years 2022 and 2023. These years can also be perceived in relation to our analyzed period as very specific regarding debt - innovation (lingering energy crisis, war in Ukraine and its impacts, etc.). Furthermore, it is necessary to emphasize that our study has its limitations due to the inclusion of 25 different EU countries with diverse socio-economic conditions, different levels of debt, and varying capacities for successful innovation. This fact affects the accuracy of our conclusions and implications in individual countries. In terms of methodology, we must also mention that our regression model was able to explain roughly 66% of the variability in the original data.

Future research should focus more closely on the direct relationship between household debt and innovation performance, as this relationship cannot be considered sufficiently explored in the current literature. In relation to fiscal sustainability, government budget cuts and potential limitations on science and research will continue to be highly relevant and discussed. Therefore, it is important to pay increased attention to this research issue. Similarly, it is pertinent to examine to what extent private debt positively influences innovation performance and from what level negative effects begin to prevail. This level is very likely to differ across countries, so it is necessary to consider the division of countries into different groups, for example, according to the GII score used. Similarly, one can consider the analysis of other factors, such as institutional factors, that may influence the debt-innovation relationship. Their significance may vary from country to country and they have a significant impact on the creation of a high-quality innovation environment.

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The Evolution of Women Entrepreneurship in Turkey: Challenges, Opportunities, and Future Perspectives

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Abstract: This paper explores the dynamic landscape of women entrepreneurship in Turkey, highlighting its historical roots and the progress made over the decades, while also identifying persisting challenges and emerging opportunities. Women's entrepreneurship in Turkey, historically constrained by social and cultural barriers, has evolved significantly from the Ottoman era to the present day. This evolution has been influenced by major political and economic shifts, including the liberalization policies of the 1980s and recent digital transformations, which have expanded the scope for women's entrepreneurial ventures. Despite these advances, women entrepreneurs continue to face significant hurdles such as access to finance, societal gender roles, and limited networking opportunities. However, evolving government policies, international collaborations, and the increasing digitization of the economy present new opportunities for growth and integration into global markets. The study employs a comprehensive analysis of historical data, current statistics from the Turkish Statistical Institute, and literature reviews to offer a nuanced understanding of the trajectory of women's entrepreneurship. This paper aims to contribute to the discourse on gender equality and economic empowerment in Turkey, providing insights that could inform policy and entrepreneurial practice in the region.

Keywords: Women entrepreneurship, Economic development, Gender equality

1. Introduction

Women entrepreneurship in Turkey has a strategic importance in the economic and social structure. Entrepreneurship is not only limited to economic growth but also functions as an instrument of social transformation. Especially for women, entrepreneurship offers a great opportunity to gain economic independence, promote gender equality and build stronger social networks. However, in order to fully realise this potential, it is necessary to overcome the challenges faced by women entrepreneurs and to make effective use of the opportunities offered.

The history of women's entrepreneurship in Turkey dates back to the times of the Ottoman Empire, during which time there have been many changes. With the proclamation of the Republic, new doors were opened for women in education and working life, and the ground was prepared for women to take more active roles in social and economic life during the 1930s and 1940s. The wave of economic liberalisation and globalisation in the 1980s led to a significant increase in the number of women entrepreneurs. In the 2000s, digitalisation and technological developments have further strengthened women's presence in the business world.

In this entrepreneurial journey, women have had to contend not only with economic challenges but also with social and cultural barriers. Traditional gender roles, efforts to balance work and family life, and difficulties in accessing adequate financial resources are among the main barriers to women's entrepreneurship in Turkey. However, new opportunities offered through government support, international co-operation and digital platforms help women overcome these barriers and succeed in the business world.

This study aims to reveal the past, current situation and future perspective of women entrepreneurship in Turkey. In line with this purpose, the historical development of women entrepreneurship in Turkey is discussed in detail below. Today, the status of women entrepreneurship in Turkey is analysed in line with the reports published by the Turkish Statistical Institute. In addition, scientific research on women entrepreneurship in Turkey are discussed in the literature review section. Afterwards, obstacles and opportunities in front of women entrepreneurship in Turkey are discussed and various suggestions are made for the future in the conclusion part of the study.

2. Concepts of Entrepreneurship and Women Entrepreneurship

Entrepreneurship is the process of recognising and evaluating new business opportunities and transforming these opportunities into economic value. This process requires characteristics such as innovation, risk-taking and being proactive (Shane, 2003). Entrepreneurship is an important engine of economic growth and social welfare and promotes job creation, innovation and competition. Women entrepreneurship can be defined as entrepreneurial activities carried out by women. This field has received increasing attention in recent years and is of great importance for economic development and gender equality. Women entrepreneurs often face

more social and cultural barriers than male entrepreneurs. These include gender discrimination in access to finance, difficulties in balancing family and work life, and lack of adequate mentoring support (Brush, 1992; Carter, 2011). Research shows that women entrepreneurs' businesses significantly improve the well-being of their families as well as their contribution to society and the economy (Hughes, 2006). However, to fully realise this potential, the challenges faced by women entrepreneurs need to be overcome. Government-sponsored programmes, private sector initiatives and international collaborations have emerged as important tools to support women entrepreneurship (Jennings & Brush, 2013).

Explanations on the challenges faced by women entrepreneurs and the definition of the concept reveal that women face more and greater obstacles in starting and managing businesses than men. This situation necessitates defining women entrepreneurship as a special field and conducting detailed studies on this subject. Women entrepreneurs are defined as individuals who not only establish and manage their businesses, but are also innovative, creative and capable of gaining economic independence. Although this concept, which is interpreted in different ways by different authors, is often used synonymously with "businesswoman", women entrepreneurs do business on their own behalf and stand out as intelligent and independent individuals with high social awareness. While highlighting the unique challenges of women entrepreneurs in the business start-up process, it is emphasised that these women not only manage their businesses, but also stand out in the market with their innovative and creative approaches. These are women who are able to work independently under social security, who can take calculated risks by adapting to the market economy and offer products or services directly to the market. This definition shows that women's entrepreneurship has the potential to make a wide range of economic and social contributions and that women have the capacity to successfully manage personal, family and social roles (Keskin, 2014).

Promoting women's entrepreneurship is critical not only for economic but also for gender equality and social justice. In this context, supporting women entrepreneurship in developing countries such as Turkey plays an important role in achieving overall economic and social development goals.

3. Historical Development of Women Entrepreneurship In Turkey

Women entrepreneurship in Turkey has passed through important phases starting from the Ottoman Empire period. Women engaged in economic activities in the Ottoman Empire were generally involved in family businesses, but rarely engaged in independent entrepreneurship (Arat, 1994). With the establishment of the Republic, the post-1923 period initiated a transformation process that encouraged women to take more active roles in social and economic life. This process gained momentum when women were granted the right to vote and be elected in 1934 (Kandiyoti, 1987).

After the Second World War, women's participation in the labour force increased in Turkey, but this participation was generally limited to low-paid and low-status jobs (Acemoğlu & Ucer, 2015). The liberal economic policies and globalisation process of the 1980s brought a new perspective to women's entrepreneurship. During this period, there was a significant increase in the number of women entrepreneurs in Turkey and women-led enterprises were established in various industries, particularly in the textile and garment sectors (Güneş-Ayata, 2002).

While women entrepreneurship in Turkey has increased as a result of supportive policies of international organisations and export-oriented development strategies, women's participation in the labour force has increased especially after the 1980s. However, women's participation in economic activities has generally remained limited due to domestic roles and patriarchal relations. While economic difficulties and macroeconomic conditions have encouraged women to start their own businesses, these initiatives have generally been small-scale and family-supported. In recent years, policies and programmes supporting women's entrepreneurship have been implemented by various public and private sector organisations, thereby increasing the rate of women entrepreneurship (Soysal, 2010).

Studies conducted in the 1990s revealed that a large proportion of entrepreneurial women, who are mostly urban women, are in the trade sector and their education level generally remains at the high school level. While women entrepreneurs care more about social reputation compared to men, they are more cautious in taking risks. Studies on women's entrepreneurship in Turkey are ambiguous in terms of definition and scope, and no consensus has been reached on the definition of "entrepreneurial women". Moreover, when the educational attainment and employment status of women entrepreneurs in Turkey are taken into account, it is observed that while the educational attainment of self-employed women is generally low, the educational attainment of employers is higher. This situation emphasises the importance of educational opportunities for

the development of women's entrepreneurial skills (Yetim, 2002). Since the early 2000s, with the widespread use of technology and the internet, new business areas have opened up for women and paved the way for digital entrepreneurship. In this period, women entrepreneurs also found the opportunity to reach large masses by using social media platforms and established successful businesses in areas such as e-commerce (Ergene, 2020). In recent years, various incentives and loans have been offered by the state to support women's entrepreneurship, which has provided significant support to women in their business establishment and business development processes (Development and Investment Bank of Turkey, 2019).

4. Scientific Research On Women Entrepreneurship In Turkey

In this part of the study, some of the scientific research on women entrepreneurship in Turkey are included. In this context, summaries of the research in the literature and accessed within the scope of the research are given below in date order.

(Yetim, 2002) aimed to determine the qualifications and competences of women entrepreneurs as social capital. In the study, a questionnaire and face-to-face interviews with 224 women entrepreneurs in Mersin were used as a method. The scope of the study was determined as the socio-demographic characteristics of women, their knowledge and skill channels in the process of establishing and maintaining a business, and their tendency to co-operate. The results of the study show that women entrepreneurs are able to use social capital resources effectively and integrate them with their entrepreneurial qualities. Moreover, women's ability to use institutional information channels in particular supports organisation by increasing solidarity.

(Öğüt, 2006) aimed to examine the barriers to career advancement of women entrepreneurs and managers in Turkey, especially the glass ceiling syndrome. In the study, a comprehensive literature review and questionnaires on women entrepreneurs in Turkey were used as methods. As a result of the study, the existence of various social and institutional barriers that prevent women entrepreneurs and managers from rising to senior positions was revealed. In particular, the glass ceiling syndrome was found to be an important factor limiting women's career development.

(Soysal, 2010) aimed to address the obstacles faced by women entrepreneurs in Turkey and the opportunities created by them in a theoretical framework. The study emphasises that women entrepreneurs are potential forces that can make significant contributions to economic and social development and that policies and projects that will mobilise this potential should be prioritised. It is stated that encouraging women entrepreneurship, especially in developing economies, can pave the way for activating untapped potential and creating new jobs. However, it is stated that women face serious obstacles in their entrepreneurial activities and concrete steps should be taken to overcome these obstacles.

(Soyak, 2010) aimed to evaluate the access of women entrepreneurs in Turkey to microfinance services and the impact of these services. In the study, the activities of various non-governmental organisations in Turkey were examined and the socioeconomic results of these activities were analysed. The study analysed how poor and disadvantaged women entrepreneurs benefit from microfinance services and how these services affect women's participation in economic activities. The results of the study show that microfinance services increase the economic independence of women entrepreneurs and are an important tool for regional economic development. It was also found that these services strengthen social capital and co-operation among women.

(Sayın, 2011) aimed to describe the problems faced by women entrepreneurs in Aydın province and to offer solutions. As a method in the study, a survey was conducted for women entrepreneurs and the problems were analysed with descriptive statistics obtained from this survey. The scope of the study was determined to cover the difficulties of women entrepreneurs in business and social life and the micro and macro level effects of these difficulties. As a result of the study, the problems faced by women entrepreneurs were identified and suggestions were made for possible arrangements in business life. In particular, the recognition of Aydın Business Women's Association and its activities to support women entrepreneurs came to the fore.

(Güleç, 2011) aimed to determine the qualifications and competences of women entrepreneurs as social capital. In the study, a questionnaire and face-to-face interviews with 224 women entrepreneurs in Mersin were used as the methodology. The scope of the research focussed on women's socio-demographic characteristics, their knowledge and skill channels in the process of starting and sustaining a business, and their tendency to co-operate. The results of the study show that women entrepreneurs are able to utilise their social capital resources effectively and integrate them with their entrepreneurial qualities. Moreover, women's competence in using institutional information channels in particular supports organisation by increasing solidarity.

In her study (Keskin, 2014), she aimed to examine the situation of women entrepreneurs in Turkey and to reveal the current challenges and opportunities in this field. A detailed analysis of the existing literature and various data sources were utilised as methodology in the study. The study analyses the economic participation of women entrepreneurs and the obstacles they face. The study shows that women entrepreneurs make significant contributions to the economy but are unable to fully realise their potential due to gender-based barriers. The study emphasises that promoting women entrepreneurship is critical for social and economic development.

(Uluköy & Demireli, 2014) aimed to determine the effect of gender on entrepreneurship characteristics in their study. As a method in the study, a questionnaire form measuring the effect of gender on entrepreneurial characteristics was used and the data obtained were analysed. As a result of the study, it was found that some entrepreneurial characteristics such as risk-taking, vision, high achievement motive and communication skills did not differ between genders, but there were significant gender differences in self-confidence, tolerance to uncertainty, independence, opportunity evaluation, innovation, determination, leadership and internal control. These findings reveal the effect of gender on entrepreneurship and how this effect differs on various characteristics.

(Özyılmaz, 2016) aimed to determine the problems faced by women entrepreneurs who started to take a more active role in the business world with the increasing economic and social developments in the early 21st century and to produce solutions to these problems. Within the scope of the research, data were collected by conducting a questionnaire survey on 1,457 women entrepreneurs and face-to-face interviews with 32 women entrepreneurs across Turkey. As a result of the study, it was determined that the biggest motivation of women entrepreneurs was the desire to be the boss of their own business and to prove themselves. In addition, it was determined that family support is of great importance in the process of establishing a business, but they face financial and bureaucratic obstacles while running their businesses. When analysed regionally, it was found that women entrepreneurs in regions with low level of development faced more problems. As a result of the research, it was concluded that in order to develop women entrepreneurship, access to finance should be facilitated, social opportunities to support women in business life should be increased and regional support systems should be established.

(Aşkın & Barış, 2016) aimed to examine how women entrepreneurs benefit from social capital in Tokat province. Qualitative analyses and survey studies were used as methods in the study. The scope of the research was determined as evaluating the social networks of women entrepreneurs and the impact of these networks on business success. As a result of the study, it was determined that "strong ties" consisting of family and friends are important in the process of establishing and maintaining a business, but "weak ties" such as public institutions and non-governmental organisations are insufficient. In addition, as a result of the study, policy recommendations were presented for women entrepreneurs to increase business success by developing more social capital.

(Kutukız & Özden, 2018) aimed to measure the financial literacy levels of women entrepreneurs in Milas district of Muğla and to understand their financial knowledge, behaviours and attitudes. The study focused on the potential of financial literacy to increase individual and macro-level social welfare. In the study, the survey technique was utilised as a method and financial literacy levels and competencies were tried to be determined. As a result of the study, it was revealed that the participants showed various levels of competencies in financial knowledge and behaviours and how the economic participation of women entrepreneurs in particular was affected by this knowledge.

(Durukan, 2021) aimed to evaluate the role of KOSGEB in supporting women entrepreneurs in Turkey. In the study, compilation and document analysis were used as methods. The scope of the study was analysed within the framework of "Entrepreneurship Supports" provided by KOSGEB. As a result of the study, it was determined that KOSGEB offers various types of support for women entrepreneurs and that these supports make significant contributions to women's business establishment and maintenance processes. In particular, it has been determined that supports for women entrepreneurs contribute to economic development and increasing women's participation in the labour force.

5. Challenges to Women Entrepreneurship in Turkey

The challenges faced by women entrepreneurs in Turkey stem from social, economic and cultural factors. These challenges not only reflect the local specificities of the barriers that women face in the business world,

but also indicate wider gender inequalities. In this context, the challenges to women's entrepreneurship are discussed under four headings below.

5.1 Difficulties in Access to Finance

Women entrepreneurs in Turkey face serious obstacles in accessing financial resources for starting and sustaining their businesses. Research shows that banks and other financial institutions demand more assurance or collateral when providing loans to women (Aydın, 2018). In addition, the low rate of women owning property in their own name causes them to have difficulty in providing the necessary collateral to obtain loans.

5.2 Social and Cultural Barriers

Traditional roles of women in Turkish society function as a limiting factor for entrepreneurial activities. Stereotypical expectations about gender roles make it difficult for women to be active in business life and in some cases lead to social isolation in environments that support women's entrepreneurship (Koçer & Akgündüz, 2021).

5.3 Lack of Training and Support Services after Training

In Turkey, the number of training and mentoring programmes to ensure that women entrepreneurs have sufficient knowledge and skills to start and manage their businesses is insufficient. This situation prevents women from developing themselves in areas such as business management, marketing and digital skills and negatively affects business success (Demirer & İlhan, 2019).

5.4 Networking and Marketing Challenges

One of the important ways to succeed in business is to build strong professional networks. However, women entrepreneurs in Turkey have fewer networking opportunities than their male counterparts. This makes it difficult for them to expand the marketing and customer base of their businesses and limits their opportunities for sustainable growth (Günay, 2020).

6. Opportunities Offered by Women Entrepreneurship in Turkey

The opportunities and challenges faced by women entrepreneurs in Turkey are shaped by the country's unique socio-cultural and economic structure. A study by Kacar, Essers and Benschop (2023) emphasises that Turkey's location at the intersection of Western and Middle Eastern cultures creates a challenging and stimulating environment for women entrepreneurship. The study analysed how women entrepreneurs cope with social, political and institutional structures through mechanisms such as strategic distance and closed social positioning. Such strategies enable women to tackle the challenges they face in the entrepreneurial world and start their own businesses.

Regional differences further crystallise the barriers and opportunities for women's entrepreneurship. A study by Aslan and Gunes (2017) addresses the effects on economic growth of women entrepreneurs' insufficient participation in economic life in the Eastern and Southeastern regions of Turkey. Surveys of women entrepreneurs in provinces such as Bingöl and Diyarbakır who have benefited from state-supported KOSGEB and other incentive mechanisms show how these supports have helped women to start businesses. However, this study also highlights persistent problems such as access to finance, market recognition and high operating costs.

The perception of social support stands out as a critical success factor for women entrepreneurs. A study by Kapusuz, Çavuş, and Pekkan (2018) examines the gender perspective and dimensions of social support in social entrepreneurship in Turkey. The study documents how women and men assume different roles in both traditional and social entrepreneurship and how the perception of social support plays a determining role in entrepreneurial success. Understanding how gender roles and societal expectations are perceived by women in business and how this can affect their entrepreneurial potential has important implications for policy makers and community leaders. The opportunities available for women entrepreneurs in Turkey can be summarised as follows:

6.1 Government Support and Incentives

Government-sponsored organisations in Turkey offer various financial incentives and grants to support women entrepreneurs. Organisations such as KOSGEB provide special programmes for women starting new businesses.

6.2 Training and Mentoring Programmes

Entrepreneurship training and mentoring programmes offered by universities, NGOs and other organisations help women to increase their knowledge and skills in the business world.

6.3 Networking Opportunities

Various women entrepreneur networks and organisations provide platforms for women to share their experiences and build collaborations.

6.4 Digitalisation and Technology Access

The proliferation of the internet and social media platforms enables women entrepreneurs to reach a wide audience with their products and services.

6.5 Access to Global Markets

E-commerce platforms and international trade fairs make it easier for Turkish women entrepreneurs to present their products to global markets.

6.6 Social Change and Awareness

Increased awareness on gender equality leads to greater acceptance and support for women entrepreneurs.

6.7 Opportunities in Innovative Sectors

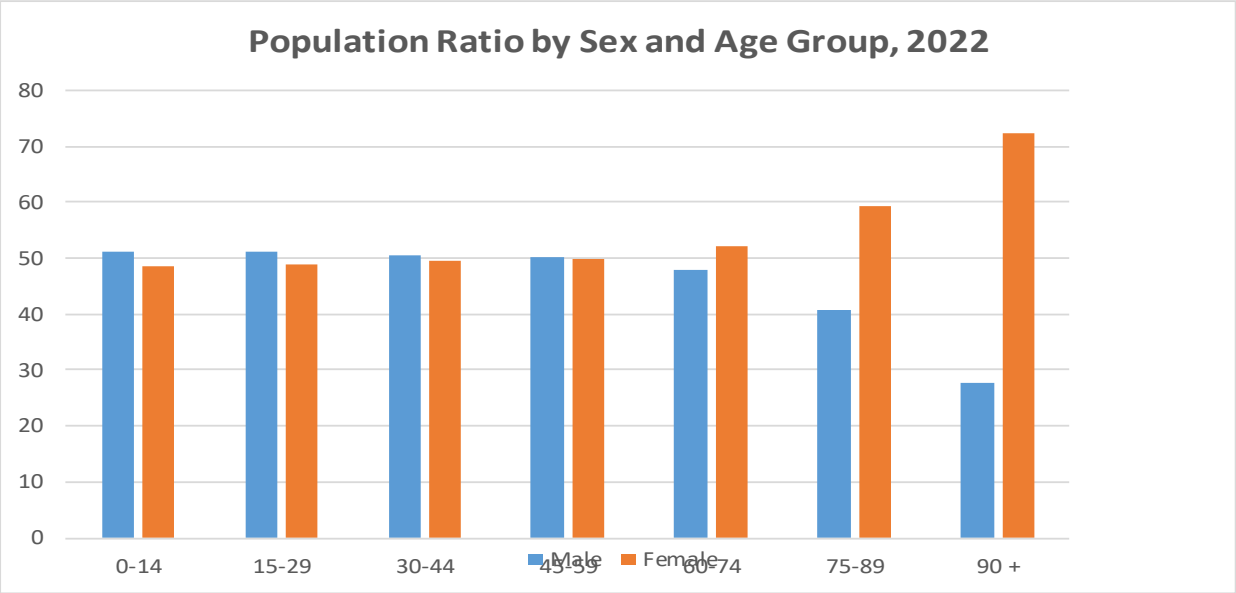
Rapidly developing sectors such as health, education and technology offer opportunities for women entrepreneurs to start new businesses and innovate.

7. "Women Entrepreneurship in Turkey with Statistics"

In this part of the study, the current status of female entrepreneurship in Turkey has been examined using statistical data published on the official website of the Turkish Statistical Institute.

7.1 Population Ratio by Gender and Age Group (2022)

According to the results of the Address-Based Population Registration System (ADNKS) for the year 2022, the female population was 42,575,441 while the male population was 42,704,112. In other words, women constituted 49.9% of the total population, and men 50.1%. This proportional balance between women and men shifts in favour of women starting from the age group of 60 and above, due to the longer life expectancy of women. The proportion of the female population was 52.2% in the 60-74 age group, and 72.4% in the 90 and above age group. Below is a graph showing the population ratio by gender and age group.



Source: Turkish Statistical Institute (2014) – https://www.tuik.gov.tr/

Figure 1: Population Ratio by Sex and Age Group, 2022

7.2 Selected Indicators by Gender

Table 1: Employment Data by Gender Between 2008 and 2021

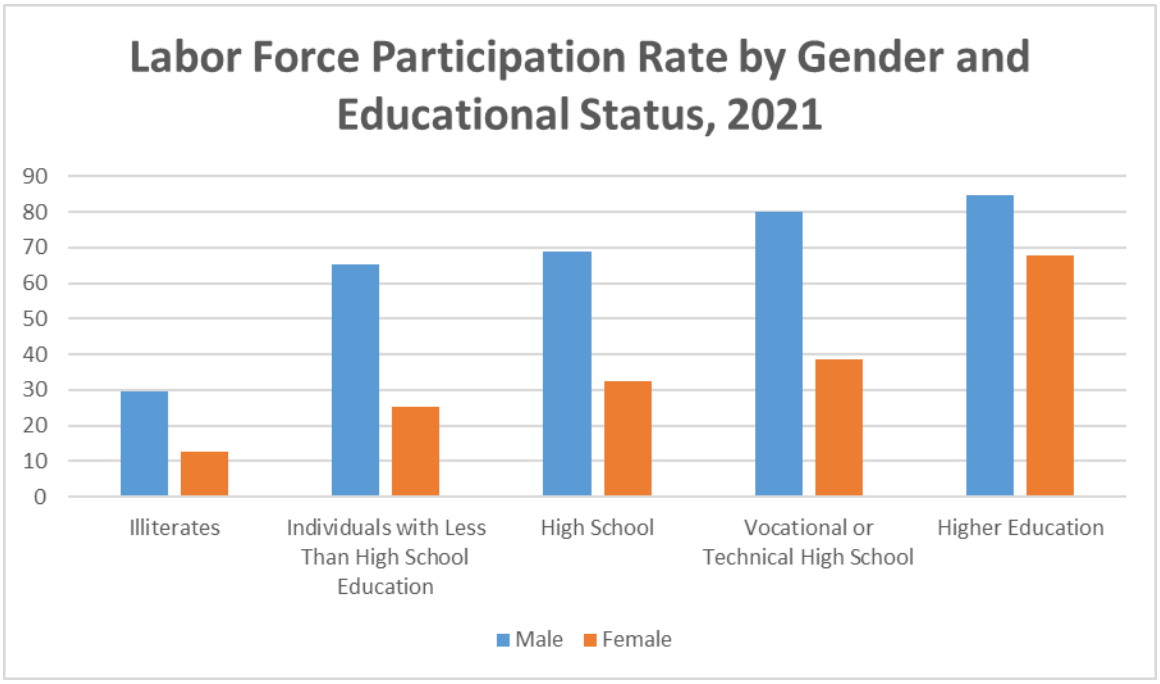
	Total	Male	Female
Illiteracy Rate Among the Population Aged 25 and Over	3,5	1	6,1
Higher Education Graduation Rate Among the Population Aged 25 and Over	23	25,1	20,9
Employment Rate (Aged 15 and Over)	45,2	62,8	28
Labor Force Participation Rate (Aged 15 and Over)	51,4	70,3	32,8
Unemployment Rate (Aged 15 and Over)	12	10,7	14,7

Source 1: Turkish Statistical Institute (2024)

The proportion of the population aged 25 and over with a higher education degree (college, master's, and doctorate) within the total population increased from 9.8% in 2008 to 23.0% in 2021. When this rate is examined by gender, in 2008, 7.6% of women and 12.1% of men aged 25 and over had a higher education degree. By 2021, this rate had risen to 20.9% for women and 25.1% for men.

7.3 Labor Force Participation Rate

The graph below shows the labour force participation rates in Turkey.

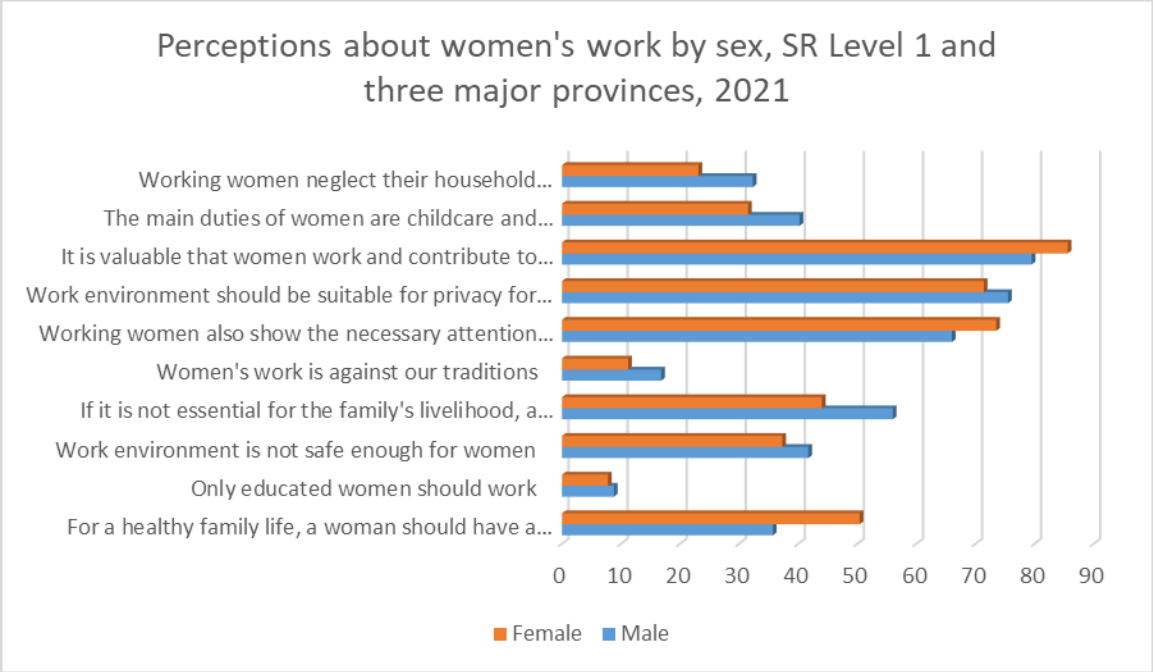


Source: Turkish Statistical Institute (2014) – https://www.tuik.gov.tr/

Figure 2: Labor Force Participation Rate by Gender and Educational Status, 2021

When examining the labour force participation rate by educational status, it is observed that women's participation in the labour force increases with higher levels of education. The labour force participation rates are as follows: illiterate women at 12.8%, women with less than high school education at 25.3%, high school graduates at 32.5%, vocational or technical high school graduates at 38.5%, and women with higher education at 67.6%.

According to the results of a family structure survey in 2021, when examining perceptions about women working, 82.6% of respondents believed that women's participation in work and social life is valuable. Breaking this down by gender, 85.6% of women agreed with this statement, compared to 79.5% of men.



Source: Turkish Statistical Institute (2014) – https://www.tuik.gov.tr/

Figure 3: Perceptions about women's work by sex, SR Level 1 and three major provinces, 2021

8. The Future of Women Entrepreneurship in Turkey

The future of women entrepreneurship in Turkey is shaped by various factors, including economic policies, technological advancements, educational opportunities, and progress in gender equality. Developments in these areas in the coming years could reduce the challenges faced by women entrepreneurs and encourage more women to join the entrepreneurship ecosystem.

8.1 Economic Policies and Incentives

It is anticipated that the government and private sector in Turkey will strengthen policies to support women entrepreneurs. These policies could include financial incentives, tax reductions, and special credit packages for women entrepreneurs. Additionally, investments aimed at facilitating women's ability to start and develop businesses will make entrepreneurship more appealing (Yıldırım, 2021).

8.2 Technological Advancements and Digitalization

The proliferation of digital technologies creates new business models and market access opportunities for women entrepreneurs. Women are expected to play a more active role in areas such as e-commerce, digital marketing, and social media management. These developments will enable women entrepreneurs to expand their businesses nationally and internationally (Demir, 2022).

8.3 Educational Opportunities and Business Skills Development

The number of educational programs available for women in Turkey to enhance their business skills needs to be increased, and the quality of these programs improved. Training in entrepreneurship, financial literacy, and technology usage can boost the competitive strength of women entrepreneurs (Özdemir, 2019).

8.4 Gender Equality and Cultural Change

Achieving gender equality in Turkey is critical for the future of women entrepreneurship. Modernizing perceptions of gender roles and the place of women in the business world will further encourage women to start and manage businesses (Aksoy, 2020).

These strategies are essential for empowering women in Turkey to engage more fully in entrepreneurship and for fostering a more inclusive economic environment.

9. Conclusion

This study has comprehensively examined the historical development of female entrepreneurship in Turkey, its challenges, and the opportunities it presents. Despite facing social and economic barriers, women entrepreneurs in Turkey have made significant progress in the areas of economic development and gender equality. The participation of women in the entrepreneurship ecosystem is increasing, especially due to advancements in technology and digitalization, which create new business models and opportunities for market expansion.

However, women entrepreneurs still face significant challenges, including access to financing, social and cultural barriers, and a lack of education and mentoring services. Overcoming these challenges is crucial and requires government-backed incentives, private sector initiatives, and international collaborations. Proposed solutions include providing more financial support for women entrepreneurs, expanding entrepreneurship training programs, and creating more opportunities for women to develop their professional networks.

The future of women entrepreneurship in Turkey depends not only on economic policies, educational opportunities, and technological advancements but also on progress in gender equality. These advancements will further encourage and support women in the processes of starting and managing businesses. Consequently, the role that women entrepreneurs will play in Turkey's economic and social development will depend not only on leveraging current opportunities but also on strategically and effectively addressing these challenges.

This study provides an understanding of the current state of women entrepreneurship in Turkey and lays a foundation for improvements in this field, also serving as a resource for future research. As in all studies conducted in the field of social sciences, this study has some limitations. First of all, the study was carried out in Turkey and taking into account the data of the Turkish Statistical Institute. Different results can be obtained by considering different data sets. Another limitation of the study is the time constraint. The study was carried out in line with the data available as of June 2024.

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The Impact of Artificial Intelligence for Advancement in Entrepreneurial Education

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Abstract: The changing technology has advanced into new advents like Artificial Intelligence. This technology has diffused into the classrooms through chatbots like ChatGPT, Claude, Google Bard, YouChat, KoalaChat, ChatOn, Microsoft Binge and many others. The conventional softwares are only updated by humans while Artificial Intelligence can correct and remodel itself. Artificial Intelligence is assisting the entrepreneurial organizations and students in data analysis, automation and Natural Language Processing (NLP). It also helps the entrepreneurial organizations in strategic decision making and managing operations and accounts. This research focuses on the opportunities and challenges posed by Artificial Intelligence in the entrepreneurial education across various business schools. It examines the benefits of chatbots for educational purposes. It also studies the limitations of chatbots. It enquires about the business advice sought from chatbots. For this purpose, a survey was applied amongst students of entrepreneurial courses to analyze the impact of Artificial Intelligence in our classrooms. It is a study performed on 103 students enrolled in entrepreneurship courses at two management institutes of India between August, 2023, and December, 2023. The study focuses on the benefits of AI in areas such as assisting in classroom activities like such as market research, competitor analysis and legal aspects. It also aids the students in getting feedback for their assignments, preparing for examinations and rapid access to information. The research suggests that Artificial Intelligence is significantly contributing right from idea generation, planning, forecasting and progress evaluation of business plans to entrepreneurial students. It is extensively helping the entrepreneurial students in developing the business model canvas which assists them in designing the blueprint of the project, strategic management, and development of innovative business models. It also assists in improving the productivity and efficiency of students. This research would facilitate students, teachers and business schools imparting entrepreneurial curriculum inculcate Artificial Intelligence into the classroom studies.

Keywords: Artificial Intelligence, Chatbots, Entrepreneurial education

1. Introduction

Implementing Artificial Intelligence in educational curricula has been highlighted as one of the significant evolutions of the decade. Along with education, these technologies are adopted across multiple industries. They comprise of blockchain, artificial intelligence, the internet of things (IoT), and genomics (Chalmers et al., 2021). AI assists human beings in completing complex tasks with the help of digital technologies (Haenlein & Kaplan, 2019). In the Industry 4.0, artificial intelligence is playing a major role. It can be described as the assessment of the performance of tasks by algorithms and digital computers (Giuggioli et al., 2022). AI assists human beings in completing complex tasks with the help of digital technologies (Haenlein & Kaplan, 2019).

AI not only assists the conventional organizations, but also supports the creation of new enterprise. It helps decipher opportunities and generate new business ideas (Chalmers et al., 2021). With the help of AI, entrepreneurs can take strategic decisions, manage operations and accounts, and aid in sales function (Figueras, A. et al., 2019). Entrepreneurship implies an individual or a group of people joining together for a new venture. An entrepreneur bears most of the risk of the new business and also gets the major profits from the project. Entrepreneurship pertains to combining several skills including an understanding of financial and operational outlook with an approach towards innovation (Bańka, M. et al, 2023). Entrepreneurial education is a pedagogical process assisting institutional teachings that educate scholars to inspire them towards the formation of a new venture. It can bring about innovation, creativity and knowledge of industry. It facilitates decision-making, problem-solving, leadership, social responsibility, and ethics (Ala, M. et al, 2022).

The role of AI is rising with the growth of digital technology. Considering this, the Business schools are introducing AI into their curriculum (Govindarajan & Sikka, 2020). The introduction of AI including chatbots in entrepreneurial education would support instructors in drafting new curricula, devising teaching materials, assignment grading, handling student queries, and performing research activities. Scholars can formulate project outlines, get feedback on their assignments, prepare for examinations, and accumulate relevant information easily (Cribben & Zeinali, 2023).

The rising significance of AI in the business environment has made it imperative to investigate and apprehend the application of AI technologies in entrepreneurial education. We attempted to assess the impact of AI for advancement in entrepreneurial education on a target sample of 103 students enrolled in postgraduate entrepreneurship courses at a management institute in India between August, 2023, and December, 2023. This study appraises the role of AI in supporting entrepreneurial scholars in devising business model canvases and other curriculum-related activities. It presents the opportunities that entrepreneurial students achieve from using AI chatbots. It also brings out the limitations of AI chatbots. It suggests the business advice a student can extract from these chatbots for drafting business plans. This paper is extremely significant as it showcases the effectiveness of implementing AI into education.

2. Literature Review

Artificial Intelligence is a term coined by Mc Carthy in 1956. A contemporary annotation of artificial intelligence is "registering frameworks that can take part in human-like procedures, including, learning, adjusting, blending, self-rectification and the utilization of information for complex procedures. (Crompton et al., 2023). The education system is the support point for the development of any country. Artificial Intelligence has plentiful potential for the education system. As innovation has dug, its manner into our everyday life, the education system has transformed. Besides, implementing innovations in the education system is challenging (Tilak, 2020). Advances in the field of Artificial Intelligence have significant ramifications for the economy as well as overall society. These advancements have the potential, to influence both the creation and the quality of products and services (Iain M. Cockburn et al., 2019). Among the different Artificial Intelligence frameworks, the capability of chatbots has been featured by scientists, attributable to the easy-to-understand interface created, utilizing natural language processing (NLP) (Chang et al., 2020). Eventually, Artificial Intelligence and ChatGPT will mechanize the whole innovative client revelation and approval process. Certain business sectors, like online business, will adopt and evolve way sooner than we naturally expect (Chakraborty, U. et al., 2023).

Entrepreneurship education foundations effectively drive change in the education system by teaming up, with enterprises and setting up incubators and mentorship plans. It assists in the reconciliation, of the scholarly community and industry (Qing Mu et al., 2024). Educators should utilize Artificial Intelligence and Big data to improve their instructive practices in the curriculum. Artificial intelligence frameworks could be employed, in entrepreneurial education to give customized feedback to scholars on their business strategies and presentations. Scholars could acquire quicker admittance to pertinent data, for example, intellectual property, entrepreneurial finance, licenses, permits, or market data. Artificial intelligence chatbots, like ChatGPT, Microsoft Bing, and others could help scholars distinguish and decipher designs, in huge datasets, for a more viable evaluation of business plans (Mavlutova et al., 2020). The Entrepreneurial students benefit by gaining the knowledge of Artificial Intelligence which assists them in establishing startups and generating funding from Venture Capitalists (Gofman et al., 2024).

Lopez, T. and Qamber, M. (2022), performed a study on the benefits and drawbacks of implementing chatbots in higher education. Results revealed that students can rapidly explore through numerous data pertinent to them using chatbots. The disadvantages of chatbots presented by this study include the absence of human support when the chatbot can't answer complex queries or conditions requiring human contact. Lidén, A. and Nilros, K. (2020), studied that it is desirable to start with simple usage of chatbots and then progressively get to the next level. It is more useful for students to adopt the basic functionality of chatbots rather than complex procedures.

The utilization of ChatGPT in educational curricula and logical creation has raised worries about its exactness and ethical concerns (Stokel-Walker, 2022). Chatbots likewise, have restricted logical comprehension, which can prompt insignificant reactions when the inquiry posed is uncertain or fragmented. Moreover, it needs the presence of mind, prompting the conceivable error of specific words, when the authors use ChatGPT (Choi et al., 2023).

There is also a concern that employing Chatbots in educational curricula are a hazard to scholastic honesty and the discussion on "AI plagiarism" is continuous. Some have additionally seen that the scholars depending too intensely on chatbots to finish their assignments could become dormant (Stokel-Walker, 2022). Chatbots likewise, add to the spread of fabrication and create erroneous or one-sided responses. Many countries have banned the usage of Chatbots due to the nature of the information they access (Dwivedi et al., 2023).

Despite the ongoing constraints, if carried out in a controlled manner and under the direction of teachers, a fraction of these difficulties can be addressed (Kasneci et al., 2023). Chatbots might help scholars pursuing

entrepreneurial education, and teachers across disciplines in large number of ways, as it is examined in the following sections. Ample debate around the impact of chatbots in educational curricula is continuous (Kuhail, M. A. et al.). It means that there is a lot to check out how this innovation could be utilized, which will assist entrepreneurial scholars with meeting their learning goals, and protecting scholar uprightness.

3. Research Methodology

This research is based on a study of students enrolled in entrepreneurial courses at 2 institutes in India. The study examines the benefits of chatbots for educational purposes. It also studies the limitations of chatbots. It investigates the benefits of chatbots to develop a business model canvas. It enquires about the business advice sought from chatbots. A survey has been applied to investigate the impact of Artificial Intelligence on advancements in entrepreneurial education on a target sample of 103 students (out of which 50.5% of the students were females and the rest were male) of 2 institutions offering entrepreneurial courses. A structured questionnaire was sent to the entrepreneurial students through e-mails, WhatsApp, and physically between August, 2023, and December, 2023. The entrepreneurial student's responses were documented, evaluated, and analyzed. We collected the data to examine the efficacy of AI Chatbots in the educational curriculum on a 5-point Likert scale. The data were measured using Microsoft Excel and IBM SPSS Statistics.

4. Results and Discussion

The majority of the respondents have a positive response toward the use of AI chatbots in the educational curriculum. Out of 103 entrepreneurial students, 95.1% of these have used AI chatbots like ChatGPT, Microsoft Binge, Google Bard, YouChat, etc to assist them in their studies 37.9% got knowledge about AI chatbots through social media, 29.1% from known people, 26.2% from college, and the remaining through news. The most frequently used AI chatbot for educational purposes is ChatGPT which is 86.4% followed by Google Bard. Further, 74.8% of students agreed that the instructors in their college discussed AI chatbots in the classroom. Enquiring about the favourability of AI chatbots, 95.1 % of entrepreneurial students found chatbots beneficial for their educational curriculum.

4.1 4.1 The Benefits of Using Chatbots for Educational Purposes

The entrepreneurial students were examined about the benefits of using Chatbots for educational purposes. The questionnaire required participants to rate their responses on a scale of 1 (very poor) to 5 (excellent). The findings revealed that 62 students are positive about getting feedback for their assignments through chatbots. 63 students responded that chatbots are effective in preparing for examinations. 63 students agreed that chatbots provide rapid access to information. Thus, entrepreneurial students have a positive approach toward chatbots and consider them beneficial for their education purposes. Students can utilize chatbots to get prompt input on their work and get insight before they submit the assignments to the educator. Chatbots can offer valuable support to students to prepare for exams. It can assist in making flashcards, creating personalized study plans, role-playing, mnemonic, and better concept understanding. It assists students with getting information rapidly. Data can be assembled swiftly from different sources. It could also help in acquiring data about other organizations.

Table1: The benefits of using Chatbots for educational purposes

The benefits of using Chatbots for educational purposes	No. of students rated themselves 1 on Likert scale	No. of students rated themselves 2 on Likert scale	No. of students rated themselves 3 on Likert scale	No. of students rated themselves 4 on Likert scale	No. of students rated themselves 5 on Likert scale
Getting feedback for the assignments	11	7	23	39	23
Preparing for examinations	9	8	23	35	28
Rapid access to information	12	8	20	33	30

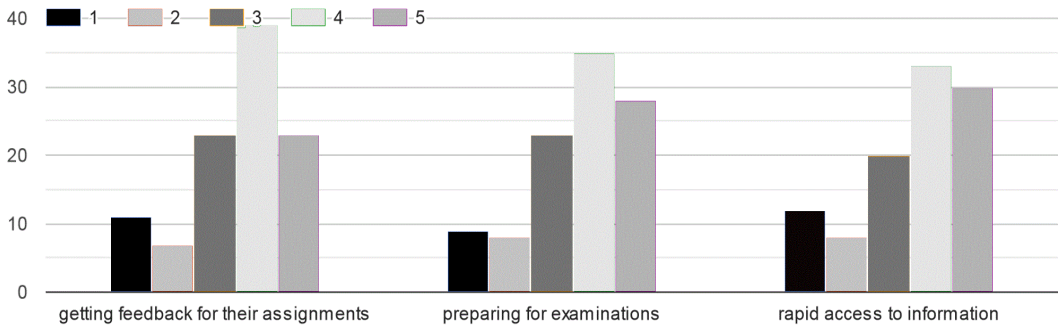


Figure 1: The benefits of using Chatbots for educational purposes

4.2 The Benefits of Using Chatbots to Develop a Business Model Canvas

The entrepreneurial students were investigated for the benefits of using chatbots to develop a business model canvas. The questionnaire required participants to rate their responses on a scale of 1 (very poor) to 5 (excellent). The findings revealed that 57 students responded positively to using the chatbots to generate new and creative ideas to develop a business model canvas. 54 students responded that chatbots assist in developing newer insights to identify and understand distinct variables. 64 students agreed that chatbots provide rapid access to information. 57 students believe that chatbots help in increasing student's productivity and efficiency. Thus, chatbots are of great help to entrepreneurial students in developing business model canvas. It helps think of ideas that will be innovative. It can be useful in the illustration of an existing business model that describes several concepts that made it successful. Chatbots assist in the creation of financial models, business plans, value propositions, SWOT analyses, and marketing plans.

Table 2: The benefits of using Chatbots to develop a business model canvas

The benefits of using Chatbots to develop a business model canvas	No. of students rated themselves 1 on Likert scale	No. of students rated themselves 2 on Likert scale	No. of students rated themselves 3 on Likert scale	No. of students rated themselves 4 on Likert scale	No. of students rated themselves 5 on Likert scale
Generate new ideas	15	8	21	40	17
Newer insights	11	10	27	37	17
Rapid access to information	11	8	17	40	24
Increase student's productivity and efficiency	12	6	28	37	20

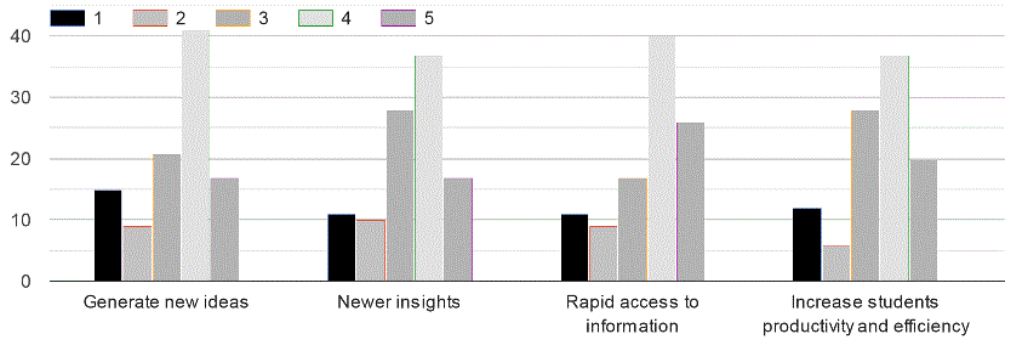


Figure2: The benefits of using Chatbots to develop a business model canvas

4.3 The Limitations of Chatbots to Improve Business Model

The entrepreneurial students were inquired about the limitations of using Chatbots to improve business models. The questionnaire required participants to rate their responses on a scale of 1 (very weak) to 5 (very strong). The findings revealed that the student's response to creativity as a limitation of chatbots scored a p-value of 0.485, which is insignificant. Thus, creativity is not a limitation of chatbots. As per, sources and accuracy of data as a limitation of chatbots, a p- p-value of 0.481, which is not significant, thus it is not a limitation. The student's response on getting specific and real-time data from chatbots, had a p-value of 0.488, which is not significant, thus it is not a limitation. Accordant with, wording a prompt correctly and asking specific questions, a p-value of 0.490, which is not significant, thus, it is not a limitation. Therefore, entrepreneurial students don't consider the variables that are discussed above as a limitation of AI chatbots to improve their business model. The students don't think chatbots lack creativity and provide standardized responses. It can provide real-time information about surveys/demand and statistics, which would aid in the customer development plans of a new venture. Chatbots recognize the wording of questions asked and respond accurately.

Table 3: The limitations of Chatbots to improve business model

Variables	N	Mean	Std. Dev.	t-test	p-value
Creativity	103	3.28	1.20	0.036	0.485
Sources and accuracy of data	103	3.24	1.10	0.046	0.481
Specific and real time data	103	3.22	1.20	0.028	0.488
Wording a prompt correctly	103	3.24	1.18	0.023	0.490

4.4 The Business Advice Usually Requested From Chatbots

The entrepreneurial students were inquired about the kind of business advice they usually request from Chatbots. The questionnaire required participants to rate their responses on a scale of 1 (Never) to 5 (Always). The findings revealed that 39 students are positive about getting suggestions on marketing for business advice. 46 students responded that chatbots help in competitor analysis. 47 students responded that chatbots assist in market research. 32 students agreed that chatbots facilitate legal aspects. 47 students responded that chatbots aid in social media and web design. Thus, entrepreneurial students are optimistic about getting distinct business advice from AI chatbots.

Table 4: The business advice usually requested from Chatbots

The overall benefits of using Chatbots in education	No. of students rated themselves on Likert scale	No. of students rated themselves 2 on Likert scale	No. of students rated themselves 3 on Likert scale	No. of students rated themselves 4 on Likert scale	No. of students rated themselves 5 on Likert scale
Suggestion on marketing	20	14	30	26	13
Competitor analysis	17	11	28	23	13
Market research	15	9	32	30	17
Legal aspects	18	15	32	21	12
Social media and web design	14	7	32	30	17

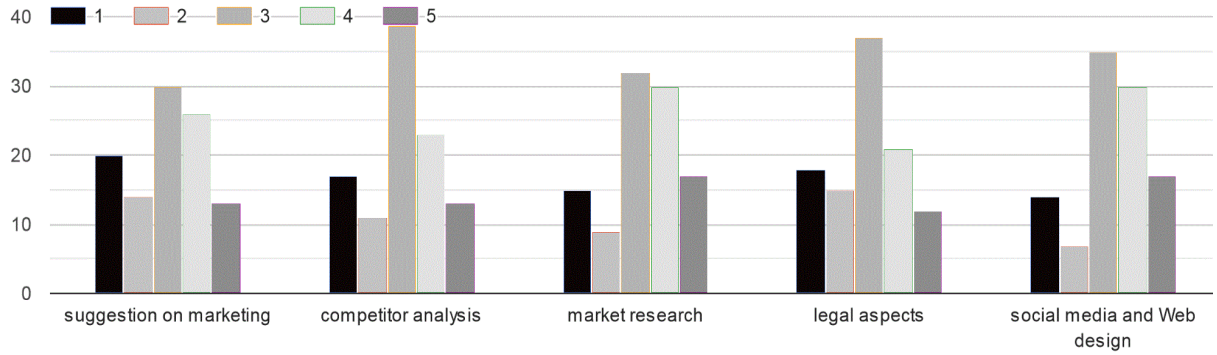


Figure 3: The business advice usually requested from Chatbots

5. Conclusion

The study established that the majority of entrepreneurial students are using AI chatbots for their educational purposes. Most of these students got information about these chatbots through social media platforms. Some students also got information about chatbots through people they know and from their college. Most of the students have accessed ChatGPT for their educational purposes.

The entrepreneurial students responded that getting feedback for their assignments, preparing for examinations and rapid access to information are major benefits of using Chatbots for educational purposes. It can assist in generating new ideas, developing newer insights, and getting rapid access to information to evolve a business model canvas. It also increases the productivity and efficiency of students. AI chatbots facilitate entrepreneurial students' business advice on marketing and competitor analysis. It also assists in market research and legal aspects. Chatbots provide valuable insights on social media and web design to develop business plans.

6. Limitations

Though our research studies the impact of Artificial Intelligence on advancement in entrepreneurial education, it is restricted to a small number of respondents. Secondly, it does not observe the impact of AI on entrepreneurial education from the point of view of the instructors in entrepreneurial institutions.

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Venture Clienting in Corporate Practice: What Type of Established Companies are Using the Venture Client Model?

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Abstract: Start-ups have become a pillar of EC' open innovation initiatives. With the aim of accessing start-up innovation, established companies (EC) use various corporate venturing modes. However, as established corporate venturing modes (e.g. corporate venture capital or accelerators) do not provide direct access to start-up innovation, the venture client model (VCLM) is receiving increasing attention in corporate practice. In the VCLM, ECs become paying customers of start-ups without taking equity - they become venture clients. In joint pilot projects, they apply start-up solutions to their products, processes or business models in order to solve relevant business problems and create strategic impact for increased competitiveness. The literature lists different EC using the VCLM such as BMW, Bosch, Continental, Daimler, Siemens, or ZF. This suggests that the VCLM is only used in EC with tens of thousands of employees, from Germany and in technology-intensive sectors such as automotive, mechanical engineering or telecommunications. On the other hand, GIMMY describes the suitability of the VCLM for any EC. However, in order to develop practical solutions to the challenges of the VCLM (e.g. slow purchasing, legal and IT processes or lack of acceptance of start-ups as collaboration partners), it is necessary to know the users (type of EC) of these solutions. Therefore, the aim of this paper is to characterize the EC using the VCLM with respect to industry, size and regionality.

Keywords: Venture client model, Corporate venturing, Start-up collaboration, Open innovation

1. Introduction

In times where rapid technology change and accelerated development cycles collide with limited resources established companies (EC) are seeking external sources of innovation to maintain competitive in global markets (Enkel & Sagmeister, 2021; Onetti, 2021). Therefore, "start-ups have become a pillar of […] [their] open innovation initiatives" (Moschner et al., 2019). Start-up ideas are not only more novel and beneficial to customers than those of EC, but they are also equipped with a substantial amount of venture capital to transform these ideas into innovations (Simon, 2019). In concrete terms, $285 billion of venture capital was invested in approximately 19,500 start-ups in 2023 (Teare, 2024). For EC these figures represent 19,500 innovations, which do not have to be developed in-house and $285 billion of R&D-budget which do not have to be spent. In the past EC have employed a variety of different corporate venturing modes such as hackathons, corporate incubators and accelerators or corporate venture capital to benefit from start-ups' significant innovation potential (Kurpjuweit & Wagner, 2020; Enkel & Sagmeister, 2021; Gutmann & Lang, 2022; Faria et al., 2018).

Nevertheless, as these modes are not ideally designed to integrate start-up innovation into the core business a growing number of EC started to adopt a new corporate venturing mode – the venture client model (VCLM) (Gimmy et al., 2017). Noteworthy examples of EC adopting the VCLM include such as BMW, Bosch, Continental, Daimler, Siemens, Telefonica, and ZF (Gimmy et al. 2017; Kurpjuweit und Wagner 2020; Mais et al. 2023). Applying the VCLM, they become paying customers of start-ups without taking equity - they become venture clients (Haarmann et al., 2023; Mais et al., 2023). In joint pilot projects, they apply start-up solutions to their products, processes, business models or IT-systems to solve relevant business problems and create strategic impact for increased competitiveness. Considering the recent emergence of the VCLM, EC are confronted with a multitude of challenges. These challenges encompass the design of a venture client strategy, process and organization; the creation of a start-up-friendly, open-minded corporate culture and internal awareness for the VCLM; and the implementation of the model itself (Gutmann et al., 2020; Kurpjuweit 2019; Corvello et al., 2021; Gimmy et al., 2017; Haarmann et al., 2023). The current state of literature provides a general overview about the model but does not offer comprehensive solutions to the mentioned challenges (Haarmann et al., 2023). To develop solutions that are relevant for EC, it is necessary to frame them in accordance with the EC' characteristics, such as company size, regionality or industry (Hevner et al., 2004). The literature indicates that

the VCLM is employed exclusively by EC with tens of thousands of employees, particularly those based in Germany and operating in technology-intensive sectors such as automotive, mechanical engineering or telecommunications. However, GIMMY states that the VCLM is suitable for any kind of EC (Gimmy, 2022). Consequently, the objective of this paper is to characterise users of the VCLM to create guidelines for future research. The research question that underlies this study is as follows:

What are the defining characteristics of established companies that use the venture client model?

The paper unfolds as follows: The second chapter commences with an overview of the VCLM and user companies as they have been described in the literature. Chapter three presents the underlying research design. The results are then presented and described in detail. Chapter 5 is concerned with the interpretation of findings from Chapter 4 and presents the limitations of the research and the implications for future studies in the field and for business practice. Chapter 6 provides a summary of the problem, procedure and results.

2. Theoretical Background

The VCLM was coined by Gregor Gimmy and Matthias Meyer at BMW (Gimmy et al., 2017; Gutmann et al., 2020; Haarmann et al. 2023). It distinguishes from other corporate venturing modes by three unique characteristics. Firstly, it contributes directly to an EC competitiveness and innovativeness by solving relevant business challenges (Mais et al, 2023). Secondly, to solve the business challenge, the EC purchases the start-ups product not its equity (Gimmy et al., 2017). Thirdly, to mitigate the risk associated with buying a less mature product from a less mature company (start-up) compared to established suppliers, the venture client and the start-up conduct a joint pilot project (Kurpjuweit & Wagner, 2020; Haarmann et al., 2023).

This results in manifold benefits for EC and start-ups. As the VCLM aims to solve challenges of business or corporate functions (venture clients) it ensures the integration of start-up solution into the core business (van der Meer et al., 2021). This is contrary to other corporate venturing modes such as incubators, where start-ups and corporate innovation managers develop ideas and prototypes together before approaching business unit managers (Kurpjuweit & Wagner, 2020). As these managers often do not have a useful application for the developed solution the integration into the core business fails (Kurpjuweit & Wagner, 2020). In addition, the connection to the core business results in another advantage. The VCLM is more scalable than other corporate venturing modes as the majority of the required resources (e.g. budget or staff to conduct the pilot project) are provided by the venture client rather than the venture client unit and are therefore less limited (Gimmy et al., 2017; Kurpjuweit & Wagner, 2020; Weiblen & Chesbrough, 2015). Furthermore, EC benefit from purchasing the start-up's product rather than its equity as well as the limited scope of the pilot project. This requires less capital and is consequently accompanied by a lower risk (Gimmy et al., 2017). Additionally, the pilot project offers EC the possibility to test start-up solutions quickly and adopt them to their specific needs (Kurpjuweit & Wagner, 2020, Veit et al., 2021; Gutmann & Lang 2022). Start-ups benefit especially from the pilot projects. They gain access to the extensive industry and technical expertise of the EC, get feedback on their product, improve their credibility through reference customers and receive renumeration for conducting the pilot project (Gimmy et al., 2017; Gutmann et al., 2020; Enkel & Sagmeister, 2021; Corvello et al., 2021; Gutmann & Lang 2022; Onetti, 2021). In addition, the start-ups preserve their autonomy as the venture client does not purchase its' equity (Mais et al., 2023; Faria et al., 2018). To solve relevant business challenges using the VCLM, EC follow a distinct venture client process. This process is divided in six process steps (see Figure 1).



Figure 1: Venture client process (Haarmann et al., 2023)

The process starts with the identification, detailing and selection of relevant challenges for the VCLM (Corvello et al. 2023; Haarmann et al., 2023). Based on the previously defined problem and the venture client unit scouts start-ups, pre-evaluates them and creates a longlist (Haarmann et al., 2023). In the "match" process the longlist gets evaluated by the venture client to create a shortlist. The start-ups included present their solution in form of a use case demo, which forms the basis for the final start-up selection by the venture client (Kurpjuweit et al., 2020, Corvello et al. 2023). Subsequently, the EC "buys" the start-up solution. This process step includes different legal, IT and purchasing processes (Haarmann et al., 2023). Thereafter, the pilot project is conducted, where the EC and the start-up build test and evaluate the developed prototype (Kurpjuweit & Wagner, 2020). In the final process step the EC has the option of continuing the collaboration in several ways. This includes development projects, (in-)direct purchasing, a venture capital investment or acquisition (Haarmann et al., 2023).

The literature on the VCLM is scarce. Systematic literature reviews by HAARMANN ET AL. and MAIS ET AL. identified only five dedicated publications on this topic (Haarmann et al., 2023, Mais et al., 2023). Other publications devote small sections to the VCLM without analysing it in detail. Consequently, there is a paucity of information in the literature about companies using the VCLM. There are only 15 companies in the literature that are described as users of the VCLM. However, a precise characterisation of the users of the VCLM is necessary to develop relevant solutions for corporate practice (Hevner et al., 2004). Figure 2 provides an overview of those EC mentioned in the literature. They are characterised by their industry, size in terms of revenue and employees as well as their affiliation to a venture client cluster (VCLC)[1].

Company	Industry sector	Revenue (in bn €)	Employees	VCL cluster affiliation	Source
Börse Stuttgart	Banks	8.9	700	No	Mais et al., 2023
Bosch	Industrial Goods & Services	88.2	134,000	Yes	Mais et al., 2023
BSH	Consumer Products & Services	14.8	60,000	No	Mais et al., 2023
BMW	Automotive	111.2	154,900	No	Gimmy et al., 2017
Continental	Automotive	37.7	199,000	No	Gimmy et al., 2017
Daimler	Automotive	133.9	166,000	Yes	Gimmy et al., 2017
DB Schenker	Industrial Goods & Services	23.4	72,700	No	Mais et al., 2023
Lafarge Holcim	Construction & Materials	27.2	115,000	No	Gimmy et al., 2017
Lufthansa	Travel & Leisure	32.8	96,600	No	Mais et al., 2023
Miele	Consumer Products & Services	4.5	23,300	Yes	Machon et al., 2023
Nexa Resources	Metal Mining	2.5	5,800	No	Faria et al., 2017
Siemens Mobility	Industrial Goods & Services	9.7	38,200	No	Mais et al., 2023
Telefonica Germany	Telecommuications	7.5	7,100	No	Gutmann et al., 2020
Viessmann	Industrial Goods & Services	4	14,500	No	Gimmy et al., 2017
WAGO	Industrial Goods & Services	1.3	9,000	Yes	Machon et al., 2023

Figure 2: Established companies using the venture client model

Characterising a typical venture client based on the current literature allows the following conclusion: A typical venture client is a German company operating in the automotive or mechanical engineering industry with more than 10.000 employees making 10 bn € in revenue, without an affiliation to a VCLC. However, the small data basis limits the validity of this statement. Furthermore, GIMMY states that the VCLM is suitable for all companies (Gimmy, 2022). Consequently, it is necessary to identify additional users of the VCLM and characterise them in order to tailor future research work specifically to the needs of these companies.

3. Research Design

A four-step research design is employed to characterise users of the VCLM (see Figure 3). This approach orientated towards the procedure for a systematic literature review, as outlined by Xiao & Watson (Xiao & Watson, 2017). While scientific publications are not the primary focus of this research and analysis, this transparent approach provides a comprehensive overview, establishes the foundation for the repeatability of the study, and minimises the potential for bias (Pati & Lorusso, 2018). The outcome of this research is the

[1] A VCLC is a collective of several EC, who decided to join forces and practice venture clienting cooperatively. Prominent examples are Stratosfare, BIND 4.0, Startup Autobahn or Combient Foundry. (Haarmann et al. 2023)

identification of 195 companies, which have been characterised according to their regionality, sector, size and affiliation to a VCLC.

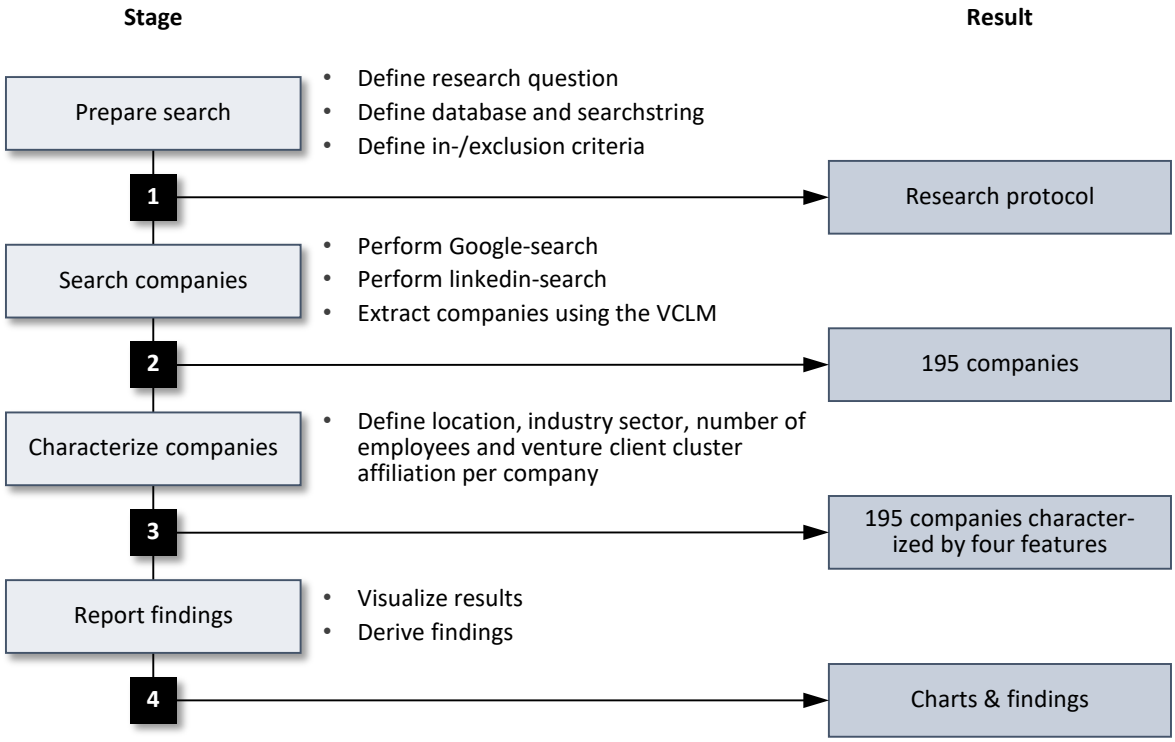


Figure 3: Research design

The initial phase of the research design concerns the formulation of the search strategy. To this end, the problem is first delineated and a corresponding research question is defined. Based on this, the database and the search string are defined. Given that only 15 user companies of the VCLM can be identified from the analysis of the scientific literature (see Figure 2), the more practically oriented databases "Google" and "Linkedin" are defined for the present analysis. Google can be employed to identify company websites, websites of venture client units (e.g. OTTO Dock6) or popular scientific or newspaper articles. Linkedin is suitable for identifying user companies via Linkedin posts or profiles of company employees who describe venture clienting as part of their field of activity. Similar search strings are defined for the two different databases. Results containing the terms "venture client" or "venture clienting" should be included. Indirect searches using terms such as 'corporate venturing' or 'start-up unit' are excluded due to the large number of results unrelated to the VCLM. Only when searching Linkedin posts the search string is supplemented by the hashtags "#ventureclient" and "#ventureclienting". The adjustment is made iteratively due to the high number of unspecific search results when using the initial search string. The inclusion criteria are defined as including all companies that explicitly describe the application of the VCLM. EC that are not to be understood as users of start-up technology are excluded. These include management consultancies, universities or VCLC.

In a second step, two people independently search for user companies of the VCLM according to the framework described above. Any discrepancies are discussed until a clear result is achieved. Figure 4 shows the procedure in the form of a flow chart. The Google search results in 9880 hits for articles after 01/01/2014 (year of invention of the VCLM) (Gimmy, 2017). However, only the first 200 hits are accessible via Google. All other results are not displayed. To include more results in the search, the search is split into two different queries with different time periods (period of the first query with 1970 hits: 01.01.2014 - 31.12.2018; period of the second query with 7910 hits: 01.01.2019 - 01.04.2024). As a result, 400 search results are included in the analysis. The search on Linkedin for relevant personal profiles yields 612 hits and 327 hits for relevant posts. However, similar to Google, Linkedin limits the accessibility of posts. Only posts from the last nine months are accessible. This gives a total of 1354 relevant articles, Linkedin profiles and posts. Using the inclusion and exclusion criteria, 195 companies can be identified as users of the VCLM.

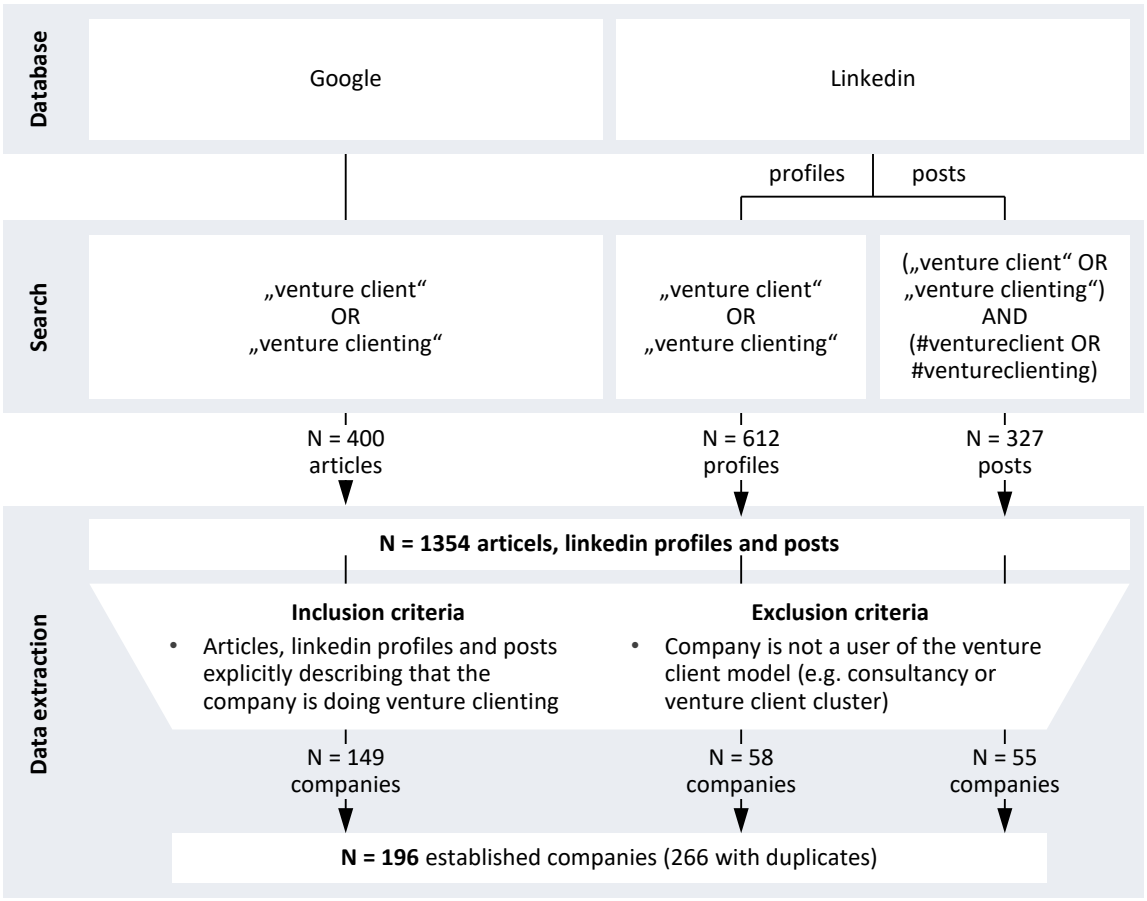


Figure 4: Flow chart of search and data extraction

In the third step, the identified companies are characterised according to the criteria of region, industry, size and affiliation to a VCLC. The companies' websites are used as a source of information. The Industry Classification Benchmark is used for industry characterisation at the supersector level (London Stock Exchange, 2024). No suitable schemes are available to classify companies by size. The OECD and other organisations classify companies according to the number of persons employed in categories 1-9, 10-19, 20-49, 50-249 and ≥250. However, since 98 % of the companies identified fall into the last category, this classification is not very useful. The same applies to the categorisation according to the annual turnover of the companies. Therefore, a categorisation according to Figure 7 is used.

In the fourth step, the results are visualised and implications are derived. The latter is done in a discussion between three scientists.

4. Results

A total of 195 companies with different characteristics were identified as users of the VCLM. This section presents and describes the distribution of the different characteristics of the regionality, sector affiliation and size in terms of number of employees. The last four dimensions are also evaluated in relation to cluster affiliation.

4.1 Regionality

Figure 5 shows the regional distribution of Venture Client users. The 20 countries shown are grouped on the x-axis into the three groups 'Europe', America' and 'Asia'. Within each group, they are shown in descending order of frequency. In addition, the companies' affiliation to a VCLC is shown in colour.

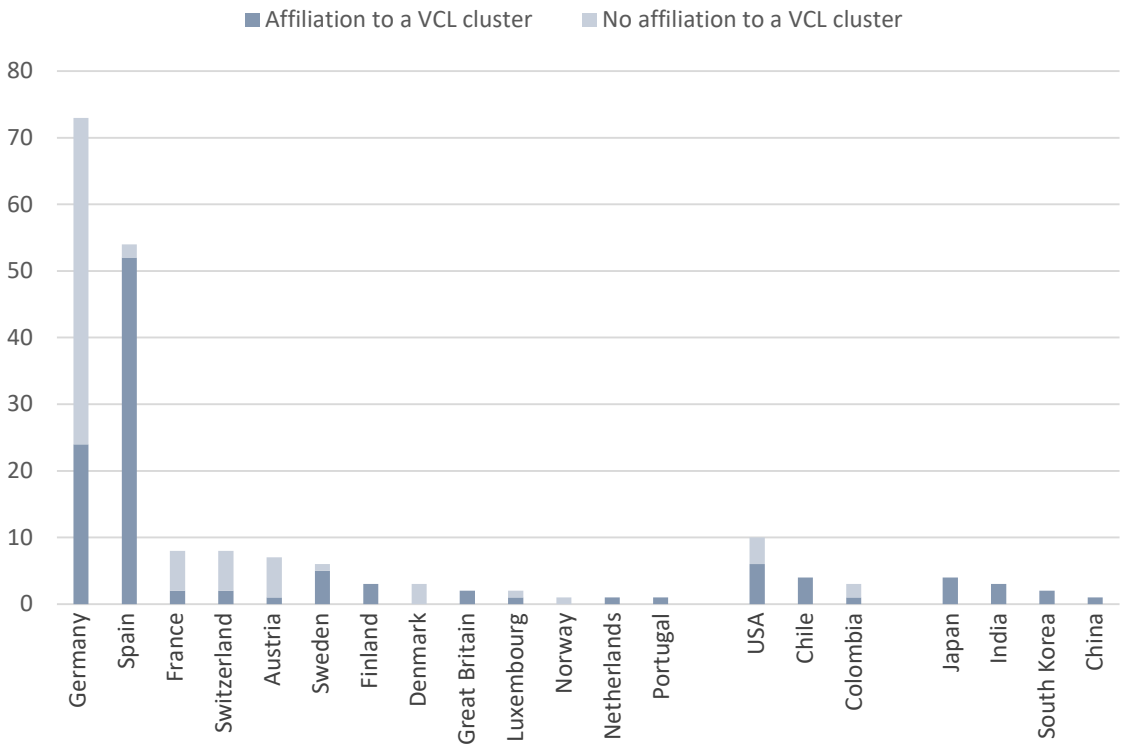


Figure 5: EC using the VCLM characterized by location of the headquarter

- Most user companies are from Europe (86%). The North and South America account for 9% and Asia for 5%.
- Within Europe and globally, most user companies are located in Germany (37%[2]) and Spain (28%[2]). In America, most user companies are located in the USA (5%[2]), while in Asia this position is held by Japan (2%[2]).
- In terms of affiliation to a VCLC, 46% are located in Spain and 21 % in Germany.
- Looking at the affiliation to a VCLC country-by-country it can be observed that 100% of the EC from Finland, UK, Colombia, Japan, India, South Korea and China as well as 96% from Spain and 86% from Sweden are affiliated to a VCLC.

4.2 Industry Sector

Figure 6 shows the distribution of Venture Client users by industry. The x-axis shows 18 different industry sectors.

- 27% of the user companies of the VCLM belong to the "Industrial goods & services" sector. This includes companies in the aerospace, electronics and, above all, mechanical engineering sectors. A further 20% can be assigned to the automotive sector and 9% to the "Basic Resources" sector. These include mining companies or manufacturers of paper, metal products or steel.
- Most companies belonging to a VCLC can be found in the “Industrial Goods & Services" (32) and "Automotive" (27) sectors. A further 14 companies belong to the "Basic Resources" sector, 9 to the "Food & Beverage" sector and 7 to the "Health Care" sector.
- The sectors in which the majority of companies belong to a VCLC are as follows: Health Care (100%), Food & Beverage (90%), Basic Resources (78%) and Automotive (71%).

[2]On a global level

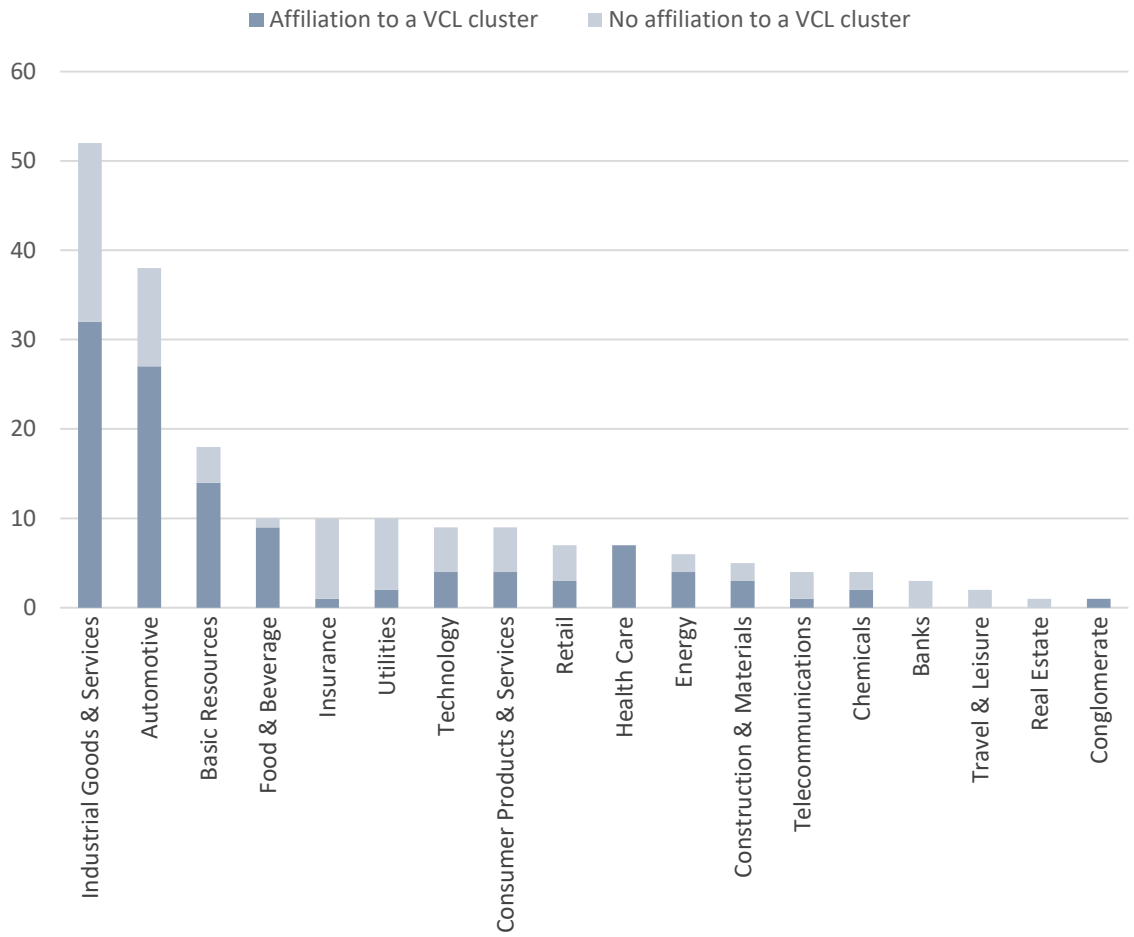


Figure 6: EC using the VCLM characterized by industry sector

4.3 Size

Figure 7 shows the distribution of user companies of the VCLM in terms of number of employees.

- 90% of user companies are almost equally distributed between the categories 1,000-9,999, 10,000-49,999 and ≥50,000 employees. 8% of user companies have 250-999 employees and 2% have less than 250 employees.
- Most of the companies (41) belonging to a VCLC fall into the category of companies with 1,000-9,999 employees. There are 31 companies with 10,000-49,999 employees and 25 of the companies with ≥50,000 employees belong to a VCLC.
- The proportion of companies belonging to a cluster per category shows that small user companies are most likely to be part of a cluster. 75% of companies with less than 250 persons employed and 88% of companies with 250-999 persons employed belong to a VCLC.

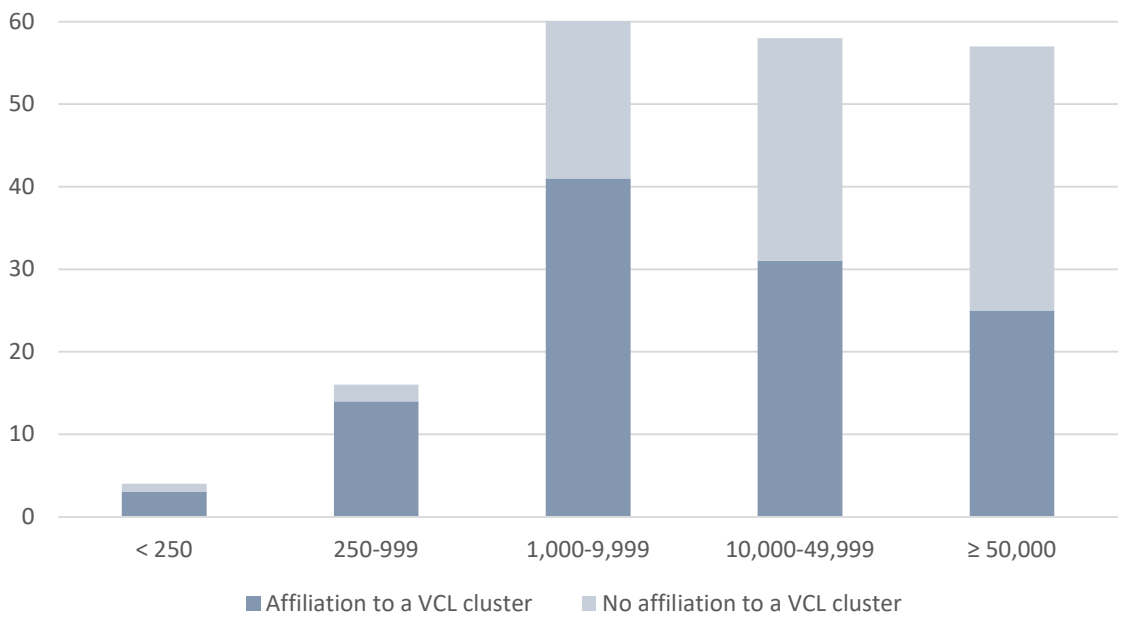


Figure 7: EC using the VCLM characterized by the number of employees

5. Discussion

Based on the literature, a typical user company of the VCLM can be characterized as follows: It comes from Germany, operates in the automotive or mechanical engineering sectors, does not belong to a VCLC and generates more than €10 billion in revenue with more than 10,000 employees. In contrast, the results of this study demonstrate that venture clienting is used in all companies regardless of their origin, industry or size. Nevertheless, various trends can be identified from the identified data. These trends and the hypotheses based on them are discussed below. Based on this, limitation as well as implications for research and business practice are derived.

There are various potential reasons for the regional concentration of user companies in Europe, particularly in Germany and Spain. First and foremost is the origin of the VCLM in Germany. The VCLM was invented at BMW and subsequently disseminated by the German consulting firm 27pilots. As the third largest economy in the world, Germany also boasts a considerable number of companies that are potential users of the VCLM and start-up technologies. Additionally, various VCLC are active in Germany, including Stratosfare, Startup Autobahn and TechFounders (Haarmann et al., 2023). These provide EC with knowledge for setting up the VCLM, take over individual steps of the venture client process (e.g. scouting) or the entire process, enable exchange between the cluster companies and thus help to lower the entry barriers to the application of the VCLM. Similar trends can also be noticed in Spain, Sweden and Finland, where approximately 90% of the user companies are part of BIND 4.0 (Spain) and Combient Foundry (Sweden and Finland) (Haarmann et al., 2023).

In addition to the strikingly high concentration in the countries already described the low number of user companies outside of Europe, and especially in the USA, is particularly noteworthy. The United States, with Silicon Valley as the world's leading start-up ecosystem, offers a wide range of start-up solutions and is also the world's largest economy, with many potential user companies. It is therefore reasonable to conclude that outside Europe and in the USA, the VCLM is not referred to by that name or that the use of the model is not communicated to the same extent as in Europe.

With regard to sector affiliation, there is a discernible increase in the utilisation of the VCLM in the industrial goods and services and automotive sectors. One possible explanation for this discrepancy is the industry structure in Germany, Spain, and other countries with a high prevalence of VCLM users. Conversely, it is possible that this accumulation results from the high application potential for start-up technologies in these sectors. Although all companies have a similarly strong potential in terms of their processes or IT systems, they differ in terms of the potential of their products. For instance, a car manufacturer may install a diverse array of sensors, software, or displays from start-ups within its vehicle. However, for a paper manufacturer, the possibilities are considerably more constrained. A review of the size of user companies based on the number of employees reveals a comparatively low prevalence among companies with fewer than 1,000 employees. This observation

allows for the drawing of several conclusions. Firstly, dedicated innovation management often plays a subordinate role in small companies. Secondly, small companies are equipped with limited resources, often having little or no dedicated innovation management staff with specific venture client knowledge. Furthermore, the costs associated with a pilot project of approximately 25.000 €, represent a significantly greater financial risk for smaller companies than for larger ones (Gutmann et al., 2020). Thirdly, smaller companies are less attractive to start-ups than larger ones, as they have less appeal as reference customers and potentially commission a lower volume. If smaller companies use the VCLM, they usually do so as part of a VCLC. The clusters address the aforementioned entry barriers by providing personnel capacities and knowledge on the subject of venture clienting, as well as through the increased appeal resulting from the collaboration of many companies.

This discussion of the results reveals three limitations: The search string, the database selection and the fact that EC do not necessarily disclose and promote their venture clienting activities on the internet. The online search was conducted with a focus on the search term “venture clienting”, as this is the predominant description of the corporate venturing mode in the researchers' region. The results show a low number of venture client users outside of Europe which may lead to the assumption that some user companies were not covered using this search string. This is also supported by the fact that for example the number of start-ups and large technology companies in the USA, offers great potential for venture clienting. The inability to find these companies practicing venture clienting outside Europe may be due to the different names are used for this corporate venturing mode in these regions. The second limitation is the selection of the databases for this search. Additional databases may lead to additional results. Moreover, the selected search engines limit their search results. Google limits the search results displayed to 200 per search query and LinkedIn only displayed the first 327 results when searching through the posts. Lastly, the willingness of EC to disclose their venture clienting activities displays a limitation. Although this can lead to a decrease in visibility for leading start-ups, EC may hide venture clienting activities due to their low maturity as the VCLM is comparatively new or to give competitors little insight into their innovation activities.

From a research perspective, three main areas of focus can be identified. Firstly, the spread of the VCLM outside Europe needs to be analysed more closely. Due to its role in the global start-up ecosystem and the global economy, the USA is of particular interest. It is important to examine whether other approaches of solving business challenges with start-up technology exist or whether this approach is not practised. Secondly, the existing challenges in the implementation and operation of the VCLM in EC must be addressed. When applying the VCLM, EC typically rely on the institutionalisation of the VCLM in the form of venture client units with dedicated strategies, processes and organisational structures. The systematic literature review by Haarmann et al. reveals a paucity of literature on the implementation of the VCLM. While the strategy for venture clienting is not addressed, there are some process descriptions at a high level of abstraction (Haarmann et al., 2023). MAIS ET AL. and MACHON ET AL. also provide a number of tools (e.g. criteria for start-up evaluation) for the application of the venture client process (Mais et al., 2023; Machon et al., 2023). The design of the organisational structure in the form of a venture client unit is described in only isolated observations from corporate practice (Kurpjuweit & Wagner, 2020; Enkel & Sagmeister, 2021). Thirdly, further research should focus on the establishment and operation of VCLC. In addition, solutions must be developed for the successful interaction of these clusters, especially with smaller companies. Here too, hardly any preliminary work exists. Only MACHON ET AL. provide a cursory overview of the functionality, advantages and challenges of the VCLC "Stratosfare" in their case study (Machon et al., 2023). Although this is a theoretical paper, two statements can be derived for practical application. Firstly, the VCLM is relevant across industries, countries and company sizes. In combination with the advantages discussed in section 2, managers of EC are encouraged to consider the potential of start-up solutions and the VCLM. Secondly, these managers, but especially the managers of smaller EC, should consider joining VCLC or seeking allies to form such a cluster. Consequently, the barriers to entry in the context of venture clienting can be reduced.

6. Conclusion

The objective of this paper is to provide guidelines for future research in the field of venture clienting. In order to identify the user companies of the VCLM and associated research, it is necessary to characterise them. A four-step research design was employed to identify 195 user companies. The results show that the VCLM is used by EC across all industries, countries and sizes. However, an analysis of the size of venture client user companies in conjunction with their affiliation to a VCLC provides a significant insight. Companies with fewer than 1,000 employees engage in venture clienting in collaboration with clusters. Potential drivers include the utilisation of external knowledge, human resources necessary for successful venture clienting and greater visibility and attractiveness for start-ups. Consequently, it is vital to investigate how smaller companies with limited resources

and a lack of familiarity with the VCLM can benefit from the model in collaboration with VCLC, and how these clusters should be structured. Companies with 10,000 employees or more are increasingly utilising the VCLM independently, establishing their own venture client units with dedicated strategies, processes and structures. It is similarly crucial to devise practical solutions to the challenges faced by these companies.

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From Bonds to Bridges: Exploring Social Capital's Role on Migrant Entrepreneurs' Identity Construction

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Abstract: This paper contributes to the entrepreneurship literature by illustrating the significance of social capital in shaping the identity of migrant entrepreneurs throughout various stages of the entrepreneurial process. The novelty of this research lies in highlighting the adaptability of the social capital role in constructing the migrant entrepreneurs' identities, enabling them to overcome challenges encountered in emerging contexts. By employing a thematic-content analysis method strengthened by narratives, we gain a comprehensive understanding of how migrant entrepreneurs interpret and enact their social capital in constructing their entrepreneurial identities. Our results reveal that EI construction is a dynamic process that ME navigate through the strategic use of SC. This involves the cultivation of both bonding and bridging social networks that provide crucial resources, emotional support, and access to diverse opportunities. Our results highlight that ME are engaged in a complex process of identity negotiation, where they must balance the preservation of their origin's cultural identity with the necessity to adapt to the entrepreneurial identity valued in the host country. This process involves a sophisticated interplay of adopting, adapting, and sometimes resisting the norms and expectations that define the entrepreneurial landscape they are operating within.

Keywords: Social capital, Immigrant entrepreneurs, Entrepreneurial identity, Identity construction, Emergent context

1. Introduction

Although the entrepreneurship literature has already embraced the role of social capital (SC) in investing and embedding valuable resources for entrepreneurs, meanwhile the association between identity construction (IC) and SC remains largely unexamined, particularly in studies of migrant self-employment. Indeed, entrepreneurial identity (EI) research acknowledges the centrality of context for both constructing and enacting EI. As Radu-Lefebvre et *al*., (2021) noticed, EI research should revolve around two overreaching themes: the interplay of EI and temporal context; and the mechanisms for (re)constructing and losing EI. Drawing on these insights, this paper aims to explore the role of SC in shaping the IC of ME throughout the different stages of their adventure abroad. The following question guide our study: How does SC structure the IC of ME during the different phases of the entrepreneurial process?

Current research into the EI construction of ME has revealed several gaps that offer opportunities for further exploration. There is a notable lack of longitudinal studies that track the evolution of EI over time, which could provide deeper insights into the dynamic changes these identities undergo in response to varying economic and social conditions (Eimermann and Kordel, 2018). Thus, we aim to investigate the migrant entrepreneurial trajectory regarding the relevance of SC, on one hand and the EI construction, on the other hand. To do so, we deploy a qualitative design through in-deep interviews with 32 ME who made career transitions from developed and developing contexts to an emergent one. We draw upon narratives that synthesize the migrant entrepreneurial story with regard to SC and IC. Our aim is to capture the temporal evolution of ME' EI with conjunction of the SC accumulated over time by embracing a longitudinal approach that is appropriate for understanding "who entrepreneurs are? And "who they might want to be?".

The study begins by establishing the theoretical foundation, discussing key concepts of SC and identity within the framework of migration and entrepreneurship. A comprehensive literature review will then synthesize existing research, highlighting the gaps that this study intends to address. Our methodology section outlines the data collection methods employed, as well as the sample description and the research design. Following this, we present and interpret our findings, which reveal how ME leverage SC for their IC. The discussion section contextualizes these findings within broader theoretical and practical implications, emphasizing the dynamic interplay between SC and migrant EI in an emergent context. Concluding remarks summarize the key insights, acknowledge the limitations of the current study, and propose directions for future research.

2. Literature Review

2.1 Entrepreneurial Identity Construction Among Migrant Entrepreneurs

ME often reconstruct their identities to align with the host country's entrepreneurial norms and expectations, a transformation that is crucial for both their business success and social integration. This identity reconstruction is viewed as a dynamic process, heavily influenced by continuous interactions within their networks, which facilitate their integration into new economic and social environments. Eimermann and Kordel (2018) discuss how international lifestyle ME in new migration destinations utilize their transnational networks to negotiate identity and entrepreneurial practices in response to local conditions. Similarly, McKeever et al., (2015) highlight how these interactions help ME navigate and integrate into new settings by leveraging SC in ways that reshape their EI. Radu-Lefebvre et al., (2022) further enrich this understanding by highlighting EI as either a "Property" or a "Process". In the "Property" perspective, EI is seen as a stable set of characteristics that entrepreneurs bring into their new ventures, influencing decision-making and resource acquisition. Conversely, the "Process" perspective views EI as continuously negotiated and evolving through social interactions and contextual engagements. This perspective underscores the fluid nature of identity among ME as they adapt to new cultural and business environments, actively shaping and reshaping their identities in response to changing circumstances.

The construction of EI is significantly influenced by intersectionality, where gender, ethnicity, and class converge to shape the individual experiences of ME. Ozasir Kacar and Esser (2019) highlight how Turkish migrant women in the Netherlands experience their entrepreneurial journeys through the lens of these intersecting identities, influenced by the broader socio-political tensions and policies of the host country. These external factors create complex opportunity structures that either enable or restrict the entrepreneurial activities and identity construction processes of migrants. Empirical studies such as those by Smith et al., (2023) and Giazitzoglu and Korede (2023) provide insights into how ME navigate identity conflicts and manage the dual pressures of aligning with cultural norms of their communities while also adapting to the mainstream market expectations. These studies highlight the role of adaptive identity strategies in overcoming the challenges posed by dual cultural expectations. Furthermore, the entrepreneurial environment of the host country, including market conditions, societal norms, and regulatory frameworks, plays a pivotal role in shaping the entrepreneurial identities of migrants.

2.2 Social Capital Role in Constructing Migrant Entrepreneurs' Identities

SC is pivotal in entrepreneurship, especially for migrants who navigate unfamiliar and new economic landscapes. Putnam (2000) defines SC as the aspects of social organization, like trust, norms, and networks, which enhance the efficiency of society by facilitating coordinated actions. SC for ME refers to the cumulative assets derived from networks of relationships that these entrepreneurs can mobilize to access various resources, information, and support systems necessary for business initiation and growth in a new environment. SC for ME includes two dimensions:

- Bonding SC: Strong ties within one's own ethnic or cultural community, providing emotional support, trust, and cooperative norms that facilitate mutual assistance among community members (Putnam, 2000; Light & Dana, 2013; Kleinhempel et al., 2022);
- Bridging SC: Weaker, more diverse ties that extend beyond one's immediate community to include a broader range of contacts across different social, ethnic, or economic groups. These ties are crucial for accessing new opportunities, broader markets, and resources outside the ethnic enclave (Putnam, 2000; Kleinhempel et al., 2022).

Explaining how SC influences the entrepreneurial activities of migrants was the subject of recent studies that focus on different aspects of migrant entrepreneurship, converging on the importance of both intra-community (bonding) and inter-community (bridging) SC and addressing various contexts from forced migration to diverse migrant experiences in different geographical settings. For example, Williams and Krasniqi (2018) explored how forced migrants utilize both human and SC to engage in entrepreneurial activities, particularly focusing on Kosovan migrants. Their findings suggest that SC, especially from host country networks, plays a pivotal role in enabling entrepreneurial endeavors among migrants. Moreover, Ljungkvist et al., (2023) noticed that transnational entrepreneurs often rely on complex networks that span multiple countries to access resources, information, and markets. This transnational SC not only facilitates business operations in the host country but also strengthens connections with the country of origin, supporting bi-directional flows of capital, goods, and information. Yet arguably, the research conducted by Kleinhempel et al., (2022) critically examines the role of

SC at various stages of the entrepreneurial journey, focusing on its impact on venture creation across different European regions. Their findings reveal that SC significantly influences the formal establishment of ventures, indicating its crucial role in mobilizing external resources and accessing necessary networks during the early stages of business setup.

3. Methodology

This study employs a qualitative design to comprehensively explore how SC shapes the EI of ME throughout the entrepreneurial process. Bruner's (1991) approach to understanding human cognition and behavior through narratives provides a powerful methodological framework for investigating our research question. Bruner emphasizes that narratives are essential tools through which individuals interpret their experiences and the world around them. In the following paragraphs, we will describe how we implemented the narrative method to collect data and outline the characteristics of our sample.

3.1 Data Collection: Selecting Narrative Methods

Bruner's seminal paper "*The narrative construction of reality.* Critical inquiry (1991)", discusses how individuals use narratives not just to tell stories but to make sense of their lives and construct their reality. Bruner argues that narratives are an essential part of human thought and are fundamental in how people understand the world and themselves. Using Bruner's framework, we explored how entrepreneurs narrate their journey, which in turn can reveal the underlying values, beliefs, and experiences that drive their business actions. To do so, collecting data through narratives involves several key principles, three of them were used in this research that we summarize as follows:

- Narrative interviews: Before conducting our narrative interviews, an initial contact with our participants was made via email or phone, followed by a detailed information sheet about the study's objectives. We conducted 32 in-depth semi-structured interviews in order to encourage ME to tell their stories in a natural, unrestricted manner. This format helps to capture the richness of their experiences and the personal significance they ascribe to those experiences. We asked open-ended questions to elicit detailed responses, enabling participants to construct and reconstruct their narratives during the conversation.

We begin the interview with a broad, open-ended question designed to encourage the participant to start telling her/his story. We asked her/him to describe how she/he started her/his business and to recount a significant event in her/his life that push her/him to launch her/his business outside her/his home country. After the initial step, the participant narrates her/his story with minimal interruption, we listened actively and intervened only sparingly, mainly to encourage the participant to elaborate or clarify points.

- Storytelling sessions: We organized three storytelling sessions where some of our ME (19) shared their experiences in a more informal or communal setting. Our objective was to provide insights into the collective narrative and shared meanings within the community of ME established in an emergent context.
- Document analysis: We collected personal documents such as letters, diaries, autobiographies, or even social media posts that contain narrative content. These sources can provide authentic, unsolicited expressions of personal narratives (Bruner, 1991). Analyzing such documents helped us understand how ME represent their identities and experiences over time.

3.2 Sample Description: A Panel of 32 Migrant Entrepreneurs

This study targets ME who have launched their businesses outside their home country, establishing themselves in Tunisia, within the last ten years. This population is chosen because of the unique challenges and opportunities they face in integrating into a new business environment, making them ideal candidates for studying the impact of SC on EI construction. We excluded from our sample the entrepreneurs who have not started a business but are only in the planning stages, the migrants who have lived in the host country for more than ten years, as their experiences might differ significantly from more recent migrants in terms of SC integration and businesses that are not independently owned and operated by the migrant (e.g., franchises, branch of a family business not directly managed by the migrant).

We have approached the Agency for the Promotion of Industry and Innovation (APII) as well as the International Organization for Migration (IOM) to recruit our participants. Additionally, we utilized the Facebook social media platform, including the Expats in Tunisia page, and consulted associations like Terre d'Asile in Tunisia to broaden

our sample. As a consequence, our sample contains 32 ME, this number is determined based on the principles of qualitative research, where the aim is to reach data saturation (Miles and Huberman, 2003).

3.3 Research Design: The Thematic-Content Analysis Method

Narrative interviews were audio-recorded and subsequently transcribed verbatim to capture the full detail and nuances of the narratives. The analysis of these interviews can be done through various methods, including thematic analysis, structural analysis, or a narrative inquiry approach. We utilized the thematic content analysis method to generate themes and sub-themes, aiding our understanding of the specificities of each story and how ME enact their SC in constructing their entrepreneurial identities. To do so, we relied on the methodology developed by Miles and Huberman (2003) to identify, analyze, and report patterns (themes) within data.

4. Results

After exploring the typologies of SC involved in the migrant entrepreneurship experience in an emerging context, and the various initial and emerging identity profiles of the ME, we selected themes that correspond to the components of our coding grid, which are derived from the literature review. Ultimately, three general themes were identified:

- Contextualization of the use of SC by ME;
- The typologies of SC present in the entrepreneurial trajectory of ME;
- The initial and emerging identity profiles of ME.

According to Bertaux (2016), this process involves identifying the logic of the trajectory, therefore, we opt for sequential analysis of syntheses, described as "a processive approach that shows how to group individual trajectories by examining the flow of events and states specific to the life of each individual" (Miles and Huberman, 2003: 315-316). The entrepreneurial trajectory of the ME in our sample can be structured around three essential stages: the pre-project stage, launch, and operationalization.

Table 1: Social capital and entrepreneurial creation stages by migrant entrepreneurs

Stages	Description
Pre-project stage	19 out of 32 interviewed ME decided to start a business in Tunisia following a meeting or an invitation from a trusted person, or a business opportunity. The others (13) moved to Tunisia due to political instability in their home countries. Once there, they took advantage of entrepreneurial opportunities that arose.
Project startup phase	All 32 ME succeed to start their projects, despite initial difficulties in the migrant entrepreneurship experience in Tunisia. This was possible thanks to the help provided by and through the SC they solicited or already had. This phase lasts on average one year and culminates in the project's implementation. All 32 ME managed to launch their projects thanks to the contribution of existing (28 ME) or solicited (4 ME) SC.
Operationalization of the project	After the project startup, ME envisage three scenarios: The first involves minor crises or recurring daily difficulties. The second involves a major crisis that may hinder project development. The third scenario sees no crises at all. During this stage, 18 ME had an easy start due to their SC, using various relationships to navigate challenges.

As outlined in the table 1, the stages of the migrant entrepreneurship process in Tunisia highlight the importance of SC from the first phase of the process to an end that results in either the creation of a sustainable business or the abandonment of the project. In order to better understand how SC shapes the identities of ME, we will begin our results' analysis by contextualizing the use of SC by the ME of our sample.

4.1 Contextualizing the use of Social Capital by Migrant Entrepreneurs

The entrepreneurial experience of the interviewed ME appears to be divided into several parts. The contribution of SC as an assistant in the majority of cases is validated, but it varies from one case to another; it turns out that there is sometimes a strong representative of this variable that significantly influences the progress of the creation process and even its realization and sustainability. In other cases, we notice that SC consists of networks of strong and weak, acquired or solicited relationships that extend a helping hand to ME in their entrepreneurial journeys within an emergent context.

The recourse to SC stems from a specific context unique to each ME. Generally, encountering a problem or difficulty spurs the development of a network of relationships or the search for a resource through held or acquired SC. 26 narratives have revealed that difficulties related to business creation (mainly access to information), are one of the main reasons for resorting to SC. Furthermore, it is observed that the language

barrier, particularly the lack of knowledge of the Tunisian dialect, has caused numerous problems for the majority of participants. Finally, we note that negative emotions are very frequently mentioned by ME. These difficulties act as primary triggers pushing ME in Tunisia to pay particular attention to SC; without it, the business creation process in Tunisia could be seriously hindered.

Table 2: Data structure for the contextualization of social capital for migrant entrepreneurs

First-order concepts	Second-order themes	Verbatims
Project execution difficulties	-Institutional complexities and obstacles	"*When you are in your own country, you know the rules; in Tunisia, if you don't know the rules, the risks increase. This is compounded by the language issue and cultural differences*"
		"*It took me 8 months to establish myself, it's very complicated in Tunisia*"
		"*Administrative paperwork is extensive in Tunisia, with many procedures to fulfill, and it takes a considerable amount of time to complete everything that is needed. Sometimes, I was tempted to abandon the process*"
		"*We know little about the Tunisian market for renting an office, for fitting out, and for furnishing and acquiring office equipment*"
	-Access to information - Lack of proficiency in Arabic language and Tunisian dialect	"*The prerequisites are first of all the language... the Tunisian dialect*"
Emotional regulation	Negative emotions (fear, loneliness and isolation)	"*When you come to Tunisia and you don't have SC, you feel you don't have a pillar, you don't have a relay, you can't move forward with your project. It's a loneliness mixed with excessive uncertainty and anxiety*"
		"*I come with French beekeeping experience and the first thing I hear here is: 'it's not like that here!' and it's depressing!"*

4.2 Typologies of Social Capital in the Entrepreneurial Trajectories of Migrant Entrepreneurs

In order to identify the extent of SC in the evolution of the ME' identity, we focus on the intervention of different forms of SC, as specified by Putnam (2000), during the various phases of the business creation process. Our findings indicate that ME predominantly utilize bridging SC while overlooking the bonding aspect. In the following table, we summarize the data structure related to the use of bonding and bridging SC by ME.

Table 3: Data structure of the typologies of social capital used by migrant entrepreneurs during their entrepreneurial trajectories

First-order concepts	Second-order themes	Verbatims
Bonding social capital	- Strong ties with own's community (family, friends; foreigners and other ME);	"*I followed my husband, trusting him and also his partner. I left everything behind: my job, my family, and I came to a country that was unknown to me*"
		"*There is also a young person who comes from France and who has studied management here and who also helps to organize all this*" noticed a French ME who adds "*My French migrant friend who was a beekeeper provides us with wax, propolis, and other products from the hive, and in return, I give him my essential oils*"
		"*I can say this very clearly: I believe that without my wife, I would not have been able to endure. When you arrive as a migrant, there is a welcoming environment, but you do not arrive alone; you arrive with who you are, and she is an integral part of who I am. I cannot imagine achieving anything here without her by my side. It is evident. She provides emotional support, but not only that...*"
Bridging social capital	- Getting the support of local communities in terms of procedures, norms, *etc.*;	"*Local contacts are a prerequisite for the success of project initiation*"
		"*Our local partner prepared a workspace suited to our activities and provided us with equipment at the best quality-price ratio*"
		"*Initially, when I arrived, I had no particular idea about taking care of all this, but there were two young women at that time... it was my first Tunisian acquaintance; they are still with me in this lab*"

First-order concepts	Second-order themes	Verbatims
	- Cultural convergence	"*Our Tunisian partner prepared the ground, gave us information, introduced us, and explained the culture, language, and knowledge, this is was particularly insightful for us*" "*A wonderful partnership with a dynamic, ambitious, and competent Tunisian who understands your approach and can easily adapt and communicate with you. Just the relationship we needed!*" "*The intellectual level, their training in biology in Tunisia and my studies in pharmacy in France only brings us closer and facilitates communication between us. We speak the same language and use the same codes*" "*At our first meeting, I was impressed by 'D's vision and the quality of his work. I felt that we had many common goals and values. We exchanged ideas, discussed challenges in our fields, and realized that we could achieve much more together*" "*For me, it's very important that there's reciprocity in mutual enrichment: she brings as much to me as I bring to her*" "*In addition to commercial success, 'D' and I form a sincere friendship, and we support each other in our personal and professional challenges. Our collaboration inspires other entrepreneurs in Tunisia and beyond, demonstrating the benefits of a successful partnership based on complementarity and shared values*" "*She brought a local touch and a deep understanding of the Tunisian market, and we brought our French expertise*" "*SC is about meeting, working together, and enriching exchanges with one another, where we can count on each other. When it's time to get to work, the group gets going and we achieve something*"
	- Reciprocity and trust	

4.3 Initial and Emerging Identity Profiles of Migrant Entrepreneurs

The conceptual generation of the theme "identity profiles" primarily allows us to discern an initial identity for ME, reflecting their identity traits at the time they decide to migrate and engage in entrepreneurship in Tunisia, that is, at the beginning of the experience. Subsequently, various emerging identities appear throughout the entrepreneurial journey, displaying characteristics that vary according to individuals and contexts.

Table 4: Data structure of the identity profiles (initial and emergent) of migrant entrepreneurs

First-order concepts	Second-order themes	Verbatims
Initial identity characteristics	- Name change; -Professional trajectory;	"*I was called (a French name)*" "*I chose pharmacy because it's a liberal profession. I did not want to work within a hierarchy; I want to take risks, but not too many*" "*I had succeeded in creating and developing several successful businesses in France*" "*I resigned from my job as a journalist*"
Emerging identity characteristics	- New first name; -Mastery of the Tunisian dialect; - Behavioral change.	"*I am now called 'A' an Arabic name very much appreciated in Tunisia, and I am proud of it. I adore my new name*" "*Today I am called (a Tunisian name) and I am happy with it; it allows me to feel Tunisian*" "*The language, Tunisian, was not a big obstacle for me; socializing allowed me to improve the Tunisian dialect day by day*" "*I make myself very small and let 'D' handle things*" "*I become a chameleon and adapt*" "*Certainly, I feel that I have changed because it does shape you to be here, to also be confronted*"

5. Discussion: How Migrant Entrepreneurs Construct Their Identities With the Help of Social Capital?

Our findings indicate that throughout the entrepreneurial journey in Tunisia, the identity of ME is in continuous flux, this notion is supported by Smith et al., (2023, p.1), who suggest that an entrepreneur's identity, in general, is closely tied to, and even shaped by, the unpredictable entrepreneurial journey with its ups and downs. Three categories of emerging identities arise from our analysis:

- Personal identity, which is "the person's unique sense of the self" (Postmes and Jetten, 2006: 260);
- Relational identity, which evolves over a prolonged series of interactions between the individual and their environment, thus presenting itself as a dynamic system (Kunnen and Bosma, 2006);
- Entrepreneurial identity, which comprises the behaviors and elements that characterize individuals when they perform entrepreneurial functions (Wagenschwanz, 2020). This identity is crucial for entrepreneurs throughout their journey, confronting them with the persistent question of "who am I" and it forms a strong bond between the entrepreneurs and their business, establishing a profound connection between the entrepreneur's identity and the often-unpredictable fluctuations of the business (Karagozoglu, and Wincent, 2019).

These three identities are in constant change, and the research results allow for a better understanding of their evolution throughout the three stages of the migrant entrepreneurship process in Tunisia. Each type of identity is composed of a set of components. Following the comparative analysis, we have identified for personal identity components such as first name, profession, and religion. For entrepreneurial identity, we have emphasized entrepreneurial skills. Given that entrepreneurial identity addresses the question of what the entrepreneur does rather than who they are (Smith et al., 2023: 2), we have attributed to the initial state of the 32 ME the notion of "initial identity," which encompasses the three aforementioned forms of identity: personal, entrepreneurial, and relational. This framework helps illuminate the existing dynamics throughout the migrant entrepreneurship process in Tunisia.

A significant element in the IC of ME appears to be the desire for continuity, this element consistently emerges in the discourse of our interviewees, who often mention their origins (family, first name, initial entrepreneurial skills, former profession), indicating that a connection to one's origins marks the beginning of the ME' identity formation process and that there is a willingness of ME to maintain continuity with their previous identity. Indeed, this idea is also shared by Christensen and Newman (2024), who emphasize in their research the importance of the initial identity associated with the migrant entrepreneur's previous life. They rely on acculturation psychology and the foundational identity theory to suggest that newly arrived migrants reflect on prioritizing their identity linked to their past and the level of connection they wish to establish in their new community.

Thus, the IC among the interviewed ME gains momentum from this "initial identity" and follows a surge of negative emotions such as fear, loneliness, and anxiety, as expressed in the collected narratives. Indeed, while crises and challenges related to creation are triggering events, it is also important to consider the concerning psychological state and negative emotions identified in the thematic analysis and confirmed during the comparative analysis. Thus, each time ME encounter a difficulty during the entrepreneurial process, they are plunged into an identity crisis that particularly affects their initial entrepreneurial identity. Subsequently, throughout their entrepreneurial journey in Tunisia, the encounter with inherent obstacles and challenges to the project, both during the project launch phase and during its operationalization, compels ME to rely on others, thus immersing them in a continuous process of identification. It is through this dynamic that the identities of ME are constructed and distinguished, and new ME' identities emerge. In this vein, we highlight the effort made by ME to preserve or develop the initial EI, of which the initial entrepreneurial skills represent the indicative characteristics of the ME identity change. Therefore, if these factors evolve negatively, ME must react in association with their network to address this imbalance. This idea aligns with the findings of Urban et al., (2022) on the importance of professional and entrepreneurial experience in predicting entrepreneurial success and thus the importance of preserving the EI in case of imbalance during a crisis. Thus, if the EI is threatened by the onset of crises and difficulties related to the entrepreneurial project or difficult access to information, or managing negative emotions following these issues, it is important to understand how ME manage these difficulties, as identity threats can harm the progress of their entrepreneurship, or even lead to the total abandonment of their business. To overcome these challenges, ME resort to or solicit adequate SC for the situation, they undertake a process of identity work that triggers the process of their IC.

Identity work, being the process by which the individual construct her/his own identity over time and through various contexts (Rostron, 2022), implies that humans are capable of consciously engaging in self-doubt and are consequently able to shape and redefine their own identity. We find that various variables of personal identity have been adjusted to facilitate integration and connection to Tunisians or migrants in Tunisia within the framework of a self-defined identification. Among these variables, we mention:

- The language;
- First name;
- Family;
- and behavior change.

6. Conclusion

The results of the sequential synthesis analysis conducted on the ME in Tunisia and its relationship with SC show that the role of SC in this experience begins very early in most cases, serving as a motivational factor, whether Tunisian or foreign, for migration and entrepreneurship during the pre-project stage. This corresponds to a migrant entrepreneurship of opportunity. This idea aligns with that of Foroozesh et al., (2018), who emphasize the importance of certain factors related to the migrant, such as SC, during all the stages of business creation in the host country through the guarantee of a presence and long-term support of family members, their relational network, and the resources at their disposal. This is the principle of "bounded solidarity" as described by Parsons (1949). We also identify some ME who are compelled to migrate to Tunisia due to the political, social, and economic instability caused by war in their country of origin (Syria, Lybia). In this case, the ME does not require SC to be motivated to migrate.

When ME encounter few or no obstacles in their entrepreneurial journey, they do not need to mobilize SC. These entrepreneurs do not show affinity towards local actors (self-referential identification) and do not seek to associate with them (self-defined identification). This is disidentification, which is associated with negative evaluations (Pratt, 2000). Furthermore, having a minimum of SC in the absence of crises during the operationalization of the entrepreneurial project results from ambivalent identification characterized by simultaneous positive and negative evaluations (Pratt, 2000), where ME choose to exploit their network of relationships and identify only with the positive elements while rejecting the negative aspects of SC.

In this study, we have elucidated the significant role that SC plays in shaping the EI of ME. Our findings reveal that both bonding and bridging social capital are indispensable in providing emotional support and practical business advantages, which are crucial for the integration of migrants into new market environments. This dual aspect of SC not only fosters personal growth but also facilitates access to vital resources and networks that enhance business operations and market reach.

Despite its contributions, this research has limitations, primarily related to its specific context. A comparative analysis across various emerging contexts would be more informative. We recommend expanding the analysis to include other emerging contexts by examining additional dimensions of SC that may differently influence the EI of ME. Additionally, future research could benefit from a quantitative design that integrates personality traits as a moderating variable between SC and IC among ME.

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Technology Audit: Results of the Assessment of the Technological Maturity of Brazilian Innovation Institutes

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Abstract: The *technology audit* enables the assessment of the technological capability and thus the technological maturity of an RTO. It focuses on the analysis of the research activities in the R&D service areas of the RTO. This allows for a comprehensive understanding of the technologies used, the research competencies, the technologies developed, and the established technology partnerships of the RTO. Since 2017, technology audits have been conducted to evaluate the technological maturity of Brazilian SENAI innovation institutes (ISI). In the last seven years, 41 audits have been completed, providing ample opportunity to extensively test and refine the methodology. As experts 46 technology auditors from 17 different institutions participated. The extended duration and involvement of numerous experts facilitated continuous improvement of the methodology, necessary processes, and roles as well as needed materials. Two rounds of technology audits were conducted between 2017 and 2023. In the first round until the end of 2019, all 23 operational ISIs were audited, with 15 undergoing re-audits in the second round by the end of 2023. In this paper, the results of the application of the technology audit to assess the technological maturity of Brazilian Innovation Institutes is described. The objective of this evaluation of the application, which this paper undertakes, is to exemplify and verify the methodology of the technology audit. To this end, the background of 26 Brazilian SENAI innovation institutes is outlined to contextualize the use of the technology audit in these RTOs. Subsequently, aggregated results from 41 conducted technology audits are described, and concluding implications for the method are derived.

Keywords: Technology audit, Technological maturity, Technology assessment, Technological capability, Technological resources, Technological competences, Technology evaluation, Strategic technology management, Research and technology organizations

1. Introduction

Around the world, developed nations have found a way to strengthen their national innovation ecosystems over time with a variety of complementary entities playing important roles together, in order to foster economic growth. Among those players, RTOs (Research and Technology Organizations) have taken a very important role of creating bridges among those entities that create knowledge (e.g. universities), those entities that apply knowledge to innovate (e.g. companies) and those entities interested in promoting the efficient use of knowledge for impacting societal and economic development (e.g. governments). (Hecklau et al. 2020)

For accomplishing that difficult intermediation role, RTOs must learn and professionalize their businesses to integrate and deal with scientific discoveries and developments from universities, translate such knowledge into viable applications for client companies, and sensibilize government and decision-makers about important and strategic business opportunities, interpreting their impact on society and economy. Therefore, the proper strategic positioning and execution of such a role in the innovation ecosystem requires continuous development of technological and management competences by multidisciplinary teams, as well as deep networking capabilities with partners and clients. (BMBF 2022; Arnold et al. 2010; Breznik 2015; Kröll 2007; Figueiredo 2014; Zehnder 1997)

Within the Brazilian innovation ecosystem, SENAI decided in 2012 to launch an ambitious program for fostering the increase of national industrial competitiveness, by planning and implementing new RTO structures under its broad set of unities spread all over Brazil. Since its creation in 1942, as a private entity guided by industry, but with non-profit orientation, SENAI has always served the Brazilian industry with high quality technical and technological educational services. The extension to further technological businesses (e.g. metrology and

consultancy services) came along time (around the 80s) with the industrial need for precise quality control in production environments. With the development of global innovation chains and strategies in this new century, it was time for SENAI to also expand its portfolio of "applied technological services" to the Brazilian industry with dedicated applied research centers, thus creating the SENAI Innovation Institutes (ISI) in direct cooperation and governance with CNI (National Confederation of Industry), with the Brazilian government and supported by investments from BNDES (National Development Bank).

The initial creation of 26 new applied research institutes by SENAI in 2012 had a deep inspiration in the well-known German Fraunhofer model and counted with the direct partnership of Fraunhofer IPK for such a challenging implementation. This successful partnership supported the expansion of the network to 27 current operating SENAI Innovation Institutes, which are guided and frequently evaluated with global best practices for R&D management. Among such practices, technology audits have been structured, conducted and evolved over time, in order to assess the technological capabilities of SENAI innovation institutes from the point of view from external experts, who are regularly dealing with, or have already become known global references in their technological fields. (Kohl et al. 2020; Kohl et al. 2015)

This paper intends to provide further information on the methodology behind such technology audits, as well as the results and impact for SENAI over time with its application among its innovation institutes as a guiding instrument for continuous improvement within a challenging and dynamic innovation ecosystem. For this purpose, a methodological approach was chosen that focuses on the description of the theoretical orientation and the extensive practical application of the technology audit as well as on a comparative analysis of the quantitative results. The research contribution of the paper lies in transparently documenting the development of a fit-for-purpose and application-oriented method for the technological assessment of RTOs and testing its suitability in application in order to improve the method based on the research results.

2. Technology Audit for Research and Technology Organizations

The Technology Audit represents a systematic methodology designed to analyze and evaluate the technological maturity of Research and Technology Organizations (RTOs), identifying opportunities for enhancement and initiating optimization processes. This audit employs a standardized procedure incorporating various models, such as the maturity model and assessment dimension model, alongside tools and templates, to facilitate a structured evaluation of the RTO being audited. (Hecklau et al. 2022b)

To obtain the necessary insights for assessing the technological maturity, all technological areas within the RTO are examined. A targeted approach involves selecting and discussing specific, representative research activities conducted in these areas. This approach provides a comprehensive overview of the organization's research activities through the analysis of a limited number of research and development projects, focusing on both past and current research endeavors. The analysis emphasizes the technologies and competencies utilized and the technological outcomes, such as prototypes, which are crucial for evaluating technological maturity based on predefined assessment dimensions. (Hecklau et al. 2023; Hecklau et al. 2022b, 2022a) To assess the technological maturity, an appropriate benchmark is selected for comparison (Werner und Sourder 1997). The auditor's expertise and the organization's research activities form the basis for the evaluation. The auditor outlines the international state-of-the-art in the relevant technological areas and employs the organization's research achievements, such as tangible results from internal projects, as a benchmark. (Hecklau et al. 2022b)

For the assessment of the dimensions, a technological maturity model was developed, comprising different levels. This model serves as the foundation for evaluating an RTO within the scope of the technology audit. The spectrum includes various gradations. Each level is described individually and specifically for each of the assessment dimensions to ensure a high degree of standardization and comparability between different RTOs. To this end, a technological maturity model has been created, consisting of five levels. It starts with maturity level 1, representing insufficient technological maturity, and culminates at maturity level 5, representing very high technological maturity. The technological maturity model is visualized in the following figure 1. (Hecklau et al. 2022b; Hecklau et al. 2023)

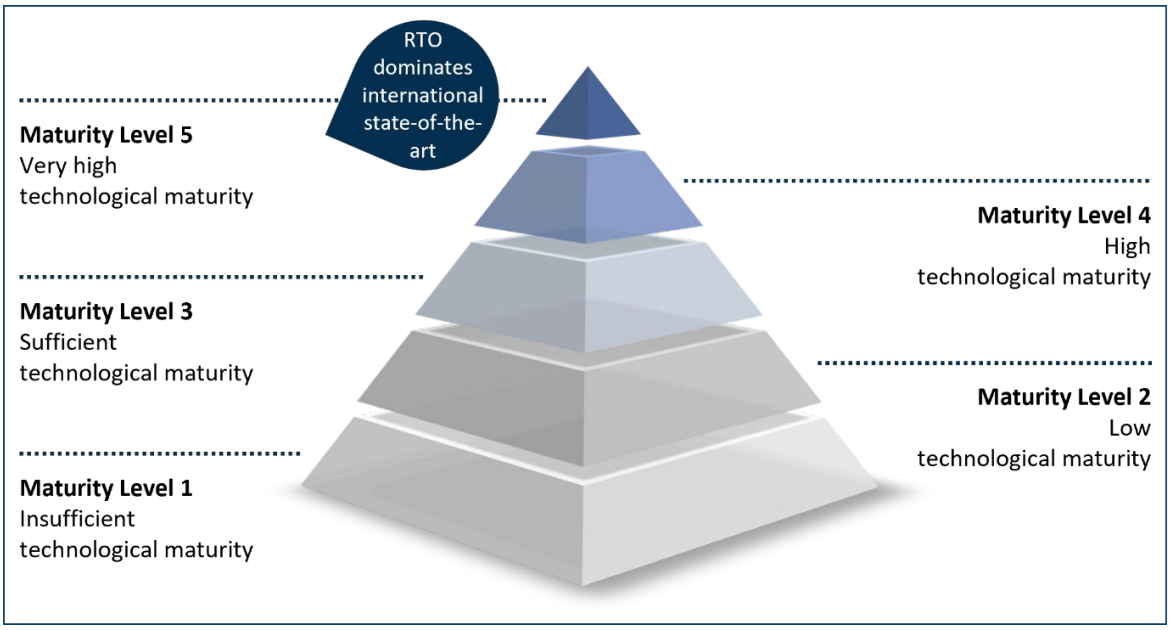


Figure 1: Technological Maturity Model for RTOs

3. Results of 41 Technology Audits at Brazilian SENAI Innovation Institutes

Since 2012, the Brazilian national training service SENAI has been setting up 26 innovation institutes. Under the umbrella organization of Brazilian industry CNI, SENAI is pursuing a network strategy in the development of these applied research institutes, which envisages the establishment of nationally operating institutes with different focus areas in different regions. Figure 1 below provides an overview of all operational SENAI innovation institutes and their respective research focuses.

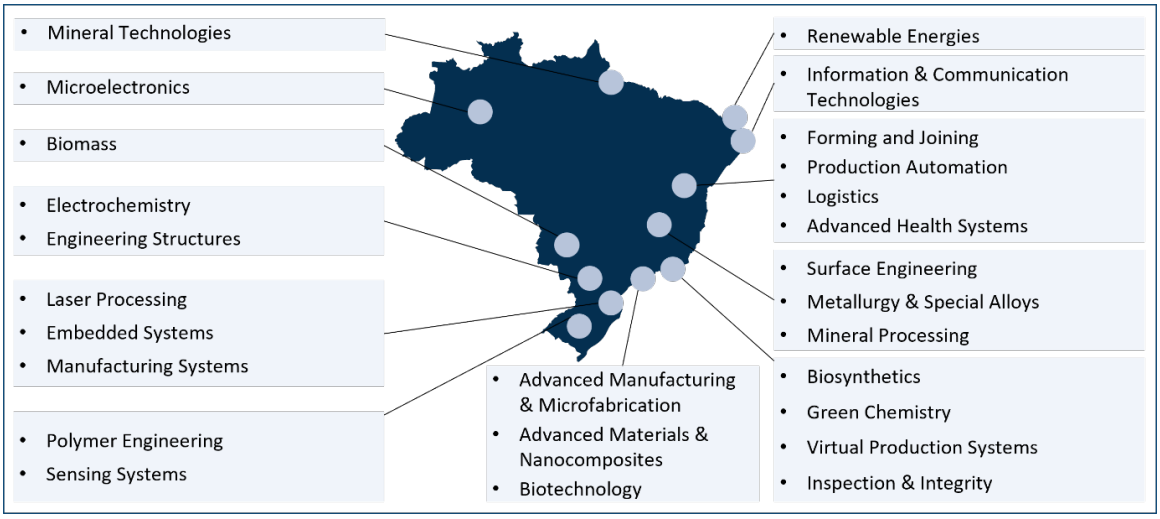


Figure 2: Overview of 26 SENAI Innovation Institutes in Brazil

The institutes offer research and development for Brazilian industry and have a broad thematic and technological focus. They are already an integral part of the Brazilian innovation system. The network is growing steadily and can be seen as a successful example of a large-scale initiative to establish an innovation structure.

All of the 26 operational ISIs were initially technologically audited for the first time between 2017 and 2022. Two rounds of technology audits were conducted between 2017 and 2023. (Hecklau et al. 2019) Due to the Covid-19 pandemic, no audits were performed in 2020, and all audits in 2021 were conducted entirely digitally. In the first round, which concluded at the end of 2019, all 23 operational ISIs at that time underwent technological audits. Of these, 15 ISIs underwent the technology audit again in the second round, which concluded at the end of 2023. Additionally, three new ISIs were audited for the first time in 2022. Figure 3 below provides an overview of the timeline of all technology audits conducted on the Brazilian Innovation Institutes since 2017.

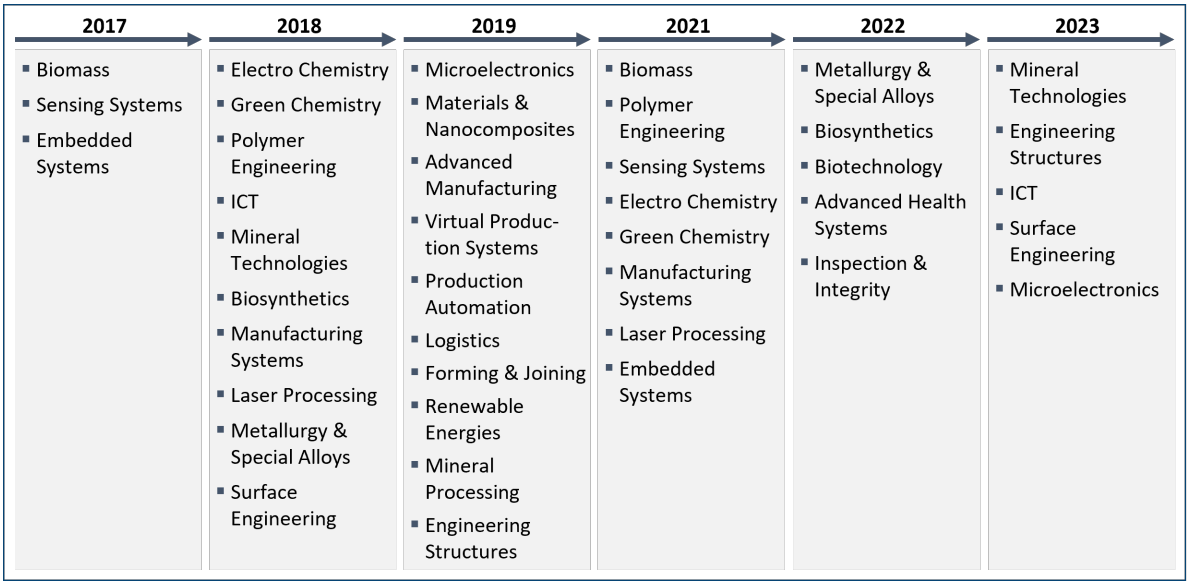


Figure 3: Timeline of 41 Technology Audits at the Brazilian SENAI Innovation Institutes

Valuable insights were gained during the application of the method in this first run. In addition to the method's potential for improvement, results on technological maturity were identified that illustrate the strengths of the methodology and are briefly described below.

3.1 Overall Results

During the first audit round, the assessments of the technological maturity levels by dimension were on average below the threshold value of 3. The technology base was assessed with an average of 2.85, the dimension of products and services with 2.75 and the collaborations with 2.5. A rating of 3 indicates that an institute has sufficient technological maturity to carry out all the research activities it aims for and offers. It has been shown that many ISIs are not able to offer all the intended services and products in all the planned research areas. As a result, the defined research portfolio of the network of ISIs could not be offered to Brazilian industry in its entirety. The audit also revealed that the technology base and products & services were better developed overall than the technological maturity in the area of cooperation. This can be explained by the fact that, particularly in the first years of the network's development, high investments were made to build up the necessary infrastructure and technical resources. The technology base was therefore the best developed compared to the other two dimensions, as the results of the audits show. It is also evident that the ISIs were not yet able to fully translate the inputs available to them into innovative research results at this early stage.

From 2021, the ISIs audited for the first time were subjected to a further technological audit in order to better understand developments at the institutes. To this end, a total of 15 selected ISIs were audited again by 2023. In order to ensure the highest possible degree of comparability, an attempt was made to use the same auditors as in the first round almost across the board. This reapplication of the method has also enabled continuous improvement of the method. One of the most important revisions to the method took place in 2022 in the form of the further specification of the assessment aspects and the introduction of a weighting and an assessment of the dimensions with decimal digits in order to enable even more precise gradations in the assessment.

The evaluation and comparison of the results of the 15 double-audited ISIs revealed significant improvements in all three dimensions. For the first time, these re-audited institutes were able to achieve an average rating of at least 3 in all dimensions, which proves that the network of ISIs as a whole has sufficient technological maturity to carry out research activities. The best rated dimension continues to be the technology base (3.6). The improvement compared to the first round is +0.7 points. The increase in the technology base can be explained by further major investments in the equipment and infrastructure of many ISIs. The products & services dimension (3.2) also improved (+0.5 points), which indicates the improved outputs of the ISIs. Despite these optimizations in the output dimension, it is clear that the now solid technology base (3.6) does not yet result in innovative solutions to a comparable extent (3.2). The lowest rated dimension is still cooperation (3.0), which nevertheless also shows a high improvement rate of +0.6 points. Due to the Covid-19 pandemic in particular, the ISI network cooperated more closely in order to build up joint capacities and knowledge, e.g. for corona tests. Figure 4 below shows the results of both rounds of technology audits for the 15 ISIs audited twice.

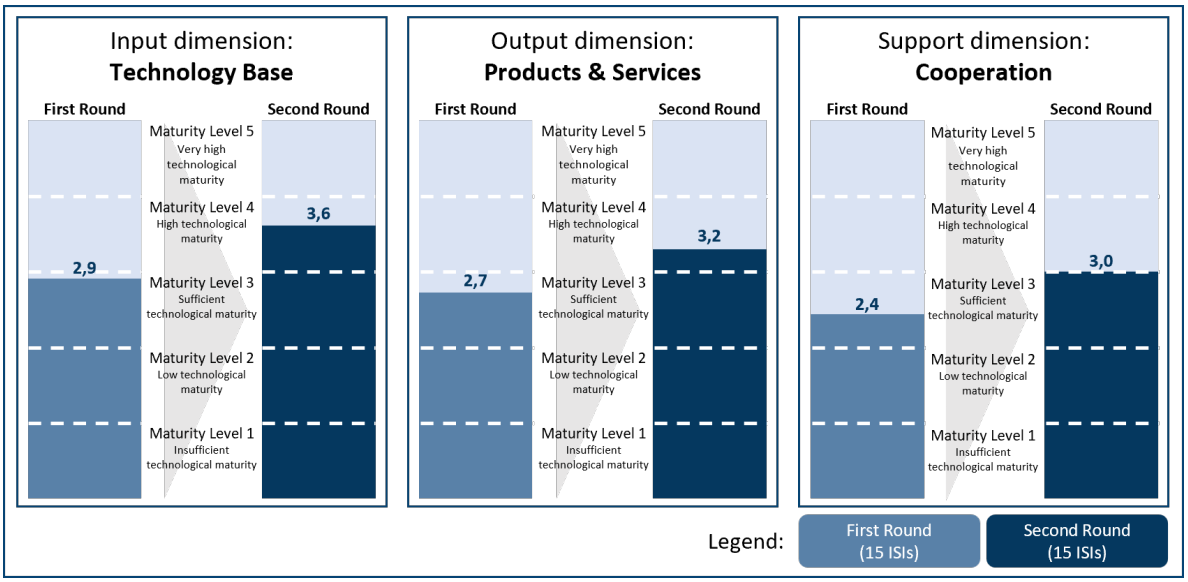


Figure 4: Comparison of Results of Technology Audits

The results of the three dimensions of Technology Base, Products & Services and Cooperation are explained in more detail below.

3.2 Results in Dimension "Technology Base"

The good overall assessment of the technology base can be explained by the high investments made by the Brazilian development bank (BNDES). The reasons for the significant average improvement in the technology base from the first (2.9) to the second round (3.6) at the 15 ISIs where both audit rounds were carried out are that further basic and specific technologies were introduced in the years between the audits. In addition, the skills of employees were stabilized and further improved, e.g. through training or by hiring new employees. Finally, the evaluation of the audits has also shown that the ISIs are aware of future technological developments and that they have a strategy in place to further develop skills, equipment and infrastructure accordingly.

Basic strategies and measures that have proven to be effective in optimizing the technology base in the course of the two audits are

- the installation and commissioning of all technologies already acquired and the search for potential innovative products and services based on unused equipment;
- the strategic purchase of specific equipment if required;
- focusing on the maintenance of existing technologies, laboratories and infrastructure;
- developing effective retention strategies to ensure that the required skills and experience remain within the ISI network;
- further developing the technological skills of ISI staff;
- and the recruitment of a highly skilled, innovative workforce capable of developing cutting-edge technological solutions.

3.3 Results in Dimension "Products & Services"

With regard to the products & services dimension, the results show that the ISIs are able to develop innovative research results to a certain extent. The ISIs were able to improve in the output dimension from the first (2.7) to the second audit round (3.2) and, as of 2021, had a sufficient level of technological maturity on average to transfer state-of-the-art technologies into new and customized products and services. However, there is still room for improvement in the degree of innovation of the products developed. Furthermore, although the ISIs are able to anticipate potential new technological solutions, the successful implementation and realization of the technological roadmaps are not consistently pursued.

Here, too, basic target-oriented strategies and general measures for improving the products & services dimension were identified:

- focusing on the acquisition of large and complex research projects in order to create the opportunity to develop innovative technological solutions by providing sufficient funding and time;

- improving the level of innovation of technological products and services, e.g. by
- *integrating knowledge, ideas and solutions from partners such as ISIs, universities and industry partners;*
- *increasing efforts to carry out pre-competitive applied research activities (from market pull to technology push);*
- the follow-up of technological roadmaps to ensure successful implementation and realization.

3.4 Results in Dimension "Cooperation"

Cooperation was assessed as sufficient at network level. Its maturity level has improved on average from the first (2.4) to the second audit round (3.0). Internal cooperation between the ISIs is at an expandable level, but is sufficient to jointly develop ideas for new technological products and services. In particular, cooperation to combat the covid-19 pandemic has significantly improved this dimension.

Cooperation with external R&D partners and service and technology providers for the integration and use of external technologies takes place to a limited extent. At an international level, there are only a few partners for the joint implementation of research activities and the development of innovative technical solutions.

Strategies and general measures to optimize cooperation that have proven effective in the double audit are

- the search for valuable win-win partnerships with other ISIs, universities, industrial partners, etc. in order to incorporate their knowledge, competencies, ideas, technologies, etc. and thus
- *increase the degree of innovation of its own technological solutions;*
- *close own technological gaps;*
- *close gaps in the skills and experience of its own employees;*
- *jointly develop innovative technological ideas;*
- take advantage of local cooperation between ISIs in the same city/campus and build on their own local strategies without neglecting the overarching guidelines and goals of the entire ISI network;
- to strengthen international cooperation for the joint implementation of research activities in order to become more visible within the international innovation system.

4. Conclusion and Implications Improvement of the Technology Audit

The application of the technology audit method to assess the technological maturity of Research and Technology Organizations in Brazil has shown important implications. Over a period of seven years, the method was applied intensively and comprehensively in 41 audits, providing valuable insights and experience on its effectiveness.

Based on the results of the 15 ISIs audited twice, it can be concluded that technological maturity has fundamentally improved in all dimensions. In addition to the general further development of the ISIs, the strong result is also attributable to the recommendations of the technology auditors from the first round. The recommended measures were largely taken into account and implemented, thus supporting the systematic development of the ISIs' technological maturity.

This broad application of the technology audit methodology has demonstrated that the technology audit is an effective tool for assessing the technological maturity of Research and Technology Organizations. Based on the findings, several directions for further development of this method can be identified to enhance its applicability and validity.

A central aspect for future development lies in further detailing the existing maturity model. This could involve incorporating significant Key Performance Indicators (KPIs) that measure specific aspects of technological and organizational maturity, thus providing a more nuanced picture of an RTO's technological maturity. The technology audit was specifically developed and tested for Research and Technology Organizations. A potential extension could involve adapting and validating the method for other organizations (e.g., universities) engaged in research and development. This would not only increase the scope and relevance of the method but also test its robustness and flexibility in different institutional contexts. Another important development perspective involves adding further evaluation elements and aspects. The dynamics of the national innovation system, in which RTOs operate, are subject to continuous changes. These changes could impose new requirements on the evaluation criteria. Therefore, it is essential that the evaluation elements and aspects consider specific developments in the innovation system to ensure the relevance and timeliness of the assessments.

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Action or Reaction? Entrepreneurial and Market Orientation for Implementing Circular Economy Practices in German SMEs

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Abstract: Circular Economy (CE) is one of the most promising practices in sustainable business development and achieving climate targets. Small and medium-sized enterprises (SMEs) play a significant role in this context due to their predominance in many countries and their associated ecological impact. Although studies indicate that CE offers various environmental and economic benefits, its implementation within SMEs remains relatively low. While SMEs face multiple challenges and barriers, there remains a lack of insights into the factors that can accelerate CE practices. A promising approach to overcoming these challenges involves strategic orientations. This study examines two specific strategic orientations, market orientation and entrepreneurial orientation, and their relationship with CE implementation in SMEs. Therefore, survey data from 757 German SMEs were analysed using multiple linear regression, which resulted in multifaceted insights. Both market orientation and entrepreneurial orientation positively influence CE implementation. Market orientation and entrepreneurial orientation demonstrate varying joint relationships, with entrepreneurial orientation acting as an enabler in the mediation between market orientation and CE. This study contributes to a deeper understanding of the relationships between various factors influencing the implementation of CE practices in SMEs. In particular, it provides the basis for further research into the interplay between market orientation and entrepreneurial orientation and their joint influence on CE. Practitioners in SMEs should not only integrate market orientation and entrepreneurial orientation as a holistic approach but, more specifically, seek to establish a culture that encourages innovativeness and risk-taking and deepen further marketing efforts throughout the organization to facilitate CE implementation. This ultimately leads to ecological sustainability and financial improvements in SMEs.

Keywords: Circular economy, Strategic orientation, Marketing orientation, Entrepreneurial orientation, Small and medium-sized enterprises

1. Introduction

Circular economy (CE) is regarded as one of the most relevant approaches in transitioning businesses towards sustainable practices (Murray, Skene, & Haynes, 2017). It is increasingly recognized as a transformative approach to sustainable development, changing the traditional linear economic model of "take, make, dispose" into a regenerative system that aims to minimize waste and use resources efficiently (Ellen MacArthur Foundation, 2013, p. 2). The Ellen MacArthur Foundation further emphasizes that CE can significantly address climate change, reduce biodiversity loss, and curb environmental pollution. Despite the numerous benefits a CE is purported to offer, its implementation remains relatively low (De Pascale et al., 2023). While previous literature mainly examined the reasons for the lack of implementation of CE in larger companies, there is a clear gap in the effects of small and medium-sized enterprises (SMEs) on CE implementation (Madrid-Guijarro & Duréndez, 2024). SMEs are regarded as one of the most promising contexts for applying CE practices (Al-Awlaqi & Aamer, 2022).

Prieto-Sandoval, Jaca, and Ormazabal (2018) indicate that SMEs can achieve several benefits and opportunities by embracing CE practices, such as enhancing brand reputation, reducing operation costs, business expansion, increasing productivity, environmental recovery through lower CO2 emissions, and gaining a competitive edge. But the researchers also reveal that the primary motivation of SMEs to adopt CE is the potential to save costs, rather than build brand reputation or respond to regulatory pressure. However, SMEs are lagging behind in the development of sustainable measures (Álvarez Jaramillo, Zartha Sossa, & Orozco Mendoza, 2019). Effective implementation of CE relies on various internal and external organizational elements (Prieto-Sandoval et al., 2018). Strategic orientations play a promising role in overcoming these challenges and facilitating the implementation of the CE in SMEs (Kirchherr, Reike, & Hekkert, 2017; Schmidt et al., 2021). Specifically, market orientation (MO) and entrepreneurial orientation (EO) are regarded as positive influencers on CE implementation in SMEs (Saari et al., 2024; Schmidt et al., 2021). MO thereby reflects the degree to which strategic market planning is influenced by customers, competitors, suppliers, and governmental agencies, while EO refers to the priorities that companies set for identifying and leveraging market opportunities (Shane & Venkataraman, 2000). Although several studies have already suggested a positive relationship between these two strategic orientations and CE implementation, it is nonetheless observed that strategic moves

towards CE by SMEs remain an under-researched topic (Cullen & De Angelis, 2021), which this study aims to further illuminate. This paper contributes to the literature by answering the following research questions: *Do MO and EO facilitate CE implementation in SMEs?*

2. Theoretical Background and Hypotheses

While CE gained prominence in the 1970s, academic interest in the field has intensified recently with numerous reviews, concepts, and practical guidelines (Geissdoerfer et al., 2017). The probably best-known definition in recent years is by the Ellen MacArthur Foundation (2013, p. 7), which defines CE as „an industrial system that is restorative or regenerative by intention and design." The Ellen MacArthur Foundation further argues that CE promotes the use of renewable energy and shifts the focus from a buy-and-consume model to a user-centric approach that emphasizes durable products, embraces modularity, and eliminates waste through products optimized for disassembly and reuse. A popular concept for implementing CE was developed by Bocken et al. (2016); Konietzko, Bocken, and Hultink (2020), who created a framework to guide designers and business strategists in transforming from a linear economy to a CE. The authors refer to four types of the cycling of resources: slowing resource loops aims to extend the life of products and resources, thus reducing the total number of products made and disposed of over time; narrowing resource loops involves using less material and energy throughout a product's lifecycle; closing resource loops focuses on creating a cycle where materials are reused, remanufactured, or recycled at the end of their life, transforming waste into a resource for new products; regenerate comprises the use of non-toxic materials and renewable energies, as well as the regeneration of natural ecosystems. Overall, CE offers enormous potential for SMEs, but they still face many challenges that must be addressed. It is, therefore, essential to examine factors that can positively influence the implementation of CE in SMEs. As outlined in the introduction, the strategic orientations of EO and MO are regarded as possible enablers in the implementation of CE in SMEs (Al-Awlaqi & Aamer, 2022; Saari et al., 2024; Schmidt et al., 2021).

2.1 Market Orientation and Circular Economy

Theoretical origins primarily go back to the 1990s, when Kohli and Jaworski (1990, p. 1) initially presented MO as a construct to implement a marketing concept and argued that "a market-oriented organization is one whose actions are consistent with the marketing concept". While this model primarily focuses on the behavioural aspects of MO, Narver and Slater (1990) it focuses on the cultural approach within the organization and points out that a lived MO culture reflects that of the customer and the market. SMEs tend to develop closer relationships with their customers Coviello, Brodie, and Munro (2000), which makes the dimension of customer focus even more pronounced in SMEs. The regionality of the companies could explain this and since SMEs have an economic incentive to align their actions with their customers (Raju, Lonial, & Crum, 2011). MO is identified as a precursor to commitment to sustainability (Jansson et al., 2017), which in turn can be seen as a predictor of CE implementation (Hoffmann & Kühnhold, 2023). Regarding the impact of MO on CE implementation in SMEs, besides the mentioned study by Schmidt et al. (2021), the research investigated that MO can positively impact corporate social responsibility in SMEs (Raza, Liu, & Usman, 2019). Given the positive relationship between corporate social sustainability measures and CE implementation (Rondinelli & Berry, 2000), it is plausible to assume that MO similarly influences CE implementation in SMEs.

Overall, the literature provides a comprehensive overview of the influence of MO on CE implementation in SMEs, from which we derive the following:

Hypothesis 1. MO positively influences CE implementation in SMEs.

2.2 Entrepreneurial Orientation and Circular Economy

EO refers to the priorities that companies set for identifying and leveraging market opportunities (Shane & Venkataraman, 2000). Its roots trace back to the 1970s when Mintzberg (1973) observed that entrepreneurial firms were more inclined to take risks and were more proactive in the marketplace. Studies found that a strong EO significantly influences innovation and the creativity of new products in SMEs rather than in larger organizations (Yi, Amenuvor, & Boateng, 2021). Saari et al. (2024) indicate that EO can assist companies in implementing new CE-oriented business models and deriving a competitive advantage from them. Furthermore, research points out that CE-related challenges and EO can work together (E. A. Khan et al., 2022), and human resources-related aspects, such as EO, are crucial for adapting business models in the transition towards CE (Bertassini et al., 2021). Although various studies indicate a positive relationship between EO and CE implementation, there is a lack of research on the direct relationship in SMEs (Ferreira & Ferreira, 2023). However, the literature suggests a positive relationship between EO and sustainable practices

in general in SMEs. For instance, EO positively influences sustainable environmental development (Ayuso & Navarrete-Báez, 2018), commitment to sustainability (Jansson et al., 2017), and investment in sustainability initiatives (Mullens, 2018). Consequently, EO promotes sustainable practices in SMEs, which may also include CE. As a result of this assumption and given the amount of literature linking EO with successful CE implementation, SMEs with a distinct EO should be more likely to implement CE. Hence, we posit that:

Hypothesis 2. EO positively influences CE implementation in SMEs.

2.3 The Mediating Effect

Jansson et al. (2017) raised the question of the extent to which EO and MO might significantly impact each other. The literature suggests that MO could be an antecedent to EO in SMEs (Morgan & Strong, 1998). In particular, identifying customer needs and observing competitors' activities can facilitate a strong EO and promote proactive action in the market environment (Seilov, 2015). This aligns with other research highlighting that companies develop a strong EO when they are already market-oriented, enabling them to implement innovative projects that are not only inspired by the market environment (González-Benito, González-Benito, & Muñoz-Gallego, 2009). While empirical studies point towards a mediation effect of EO in relation to MO (Acar et al., 2013), there is still no empirical research that provides evidence for the positive influence within the context of CE and SMEs. To fill this gap and under the assumptions established in the previous chapters that MO and EO have a positive impact on CE in SMEs, that MO acts as an antecedent of EO, and that EO can further act as an enabler for MO, the following hypothesis is proposed (see Figure 1):

Hypothesis 3. EO mediates the positive relationship between Mo and CE implementation in SMEs.

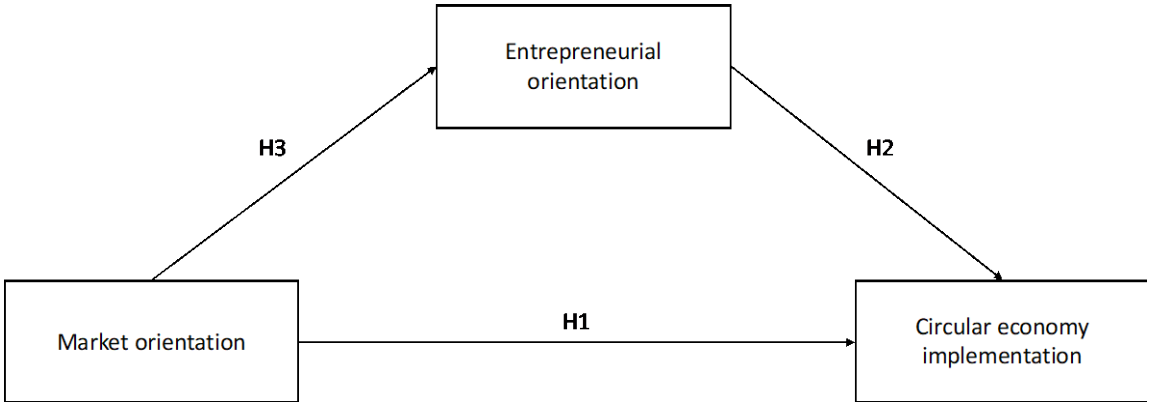


Figure 1: Research model

3. Methodology

3.1 Sample and Data Collection

We focused on German SMEs since they are well-suited for investigating CE (Schmidt et al., 2021). After certain pre-testing, a self-administered online survey was distributed via email to contact 15,034 German SMEs. The data collection took place between August 2022 and September 2022. A total of 820 surveys were completed and returned from SME managers. In this study, only survey results that provided a valid response to all CE, MO, and EO items were considered for analysis. This reduced the number of valid and usable results to 757. Table 1 contains descriptive statistics of the sample.

Table 1: Descriptive statistics

Segment	**Frequency**	**%**		**Sales**	**Frequency**	**%**
Production	171	22.7		< €22,000	39	5.2
Services	344	45.6		€22,000 - < €50,000	52	7.0
Both	240	31.8		€50,000 - < €125,000	95	12.7
Total	**755**			€125,000 - < €250,000	105	14.0
				€250,000 - < €500,000	179	23.9

Gender	**Frequency**	**%**		€500,000 - < €2,500,000	225	30.1
Female	60	8.0		€2,500,000 - < €5,000,000	32	4.3
Men	688	91.4		> €5,000,000	21	2.8
Diverse	5	0.7		**Total**	**748**	
Total	**753**					
Firm age	**Frequency**	**%**		**Firm size (number of employees)**	**Frequency**	**%**
<= 5 years	66	8.7		1	149	19.7
6 - 20 years	222	29.4		2 - 4	210	27.8
21 - 35 years	233	30.9		5 - 9	217	28.7
>= 36 years	234	31.0		10 - 19	110	14.6
Total	**755**			20 - 49	54	7.2
				>= 50	15	2.0
				Total	**755**	

3.2 Measurement

CE, MO, and EO were illustrated in the theoretical foundation as constructs that also consist of sub-dimensions. This poses the challenge that dimensions of constructs are not directly observable, which means they are latent. Thus, it is necessary to operationalize them (Hair et al., 2019). In the following, the variables are introduced. Table 2 presents the study's variable measures.

Table 2: Item survey questions

Variable	**Item**	**Question**
CE	ce1_1	Do you design and develop products that can be easily repaired? (Spare parts and repair possibilities available, economic efficiency of repair given).
	ce2_1	Do you design and develop products that are easy to maintain (e.g., easy monitoring and control of functionality)?
	ce3_1	Do you design and develop products that are recyclable (e.g. easily separable)?
	ce4_1	Do you use products (not packaging) made from recycled material?
	ce5_1	Do you design and develop products that are biodegradable (e.g. no hazardous substances, fast decomposition)?
	ce6_1	Do you use products (not packaging) that are biodegradable?
	ce7_1	Do you use packaging that is biodegradable and/or reusable?
	ce8_1	Are there closed loops in production (e.g. return/recycling of product residues into production, waste as raw material)?
	ce9_1	Do you increase the material and energy efficiency of your business by achieving the same result with less material and energy input?
	ce10_1	Do you reduce your waste by passing on by-products (e.g. products resulting from a manufacturing process whose main purpose is to produce another product; production residues)?
	ce11_1	Do you procure by-products from other companies/organizations?
	ce12_1	Do you provide repair services for customers?

Variable	Item	Question
	ce13_1	Do you provide maintenance services for customers? (e.g. monitoring and control of product functionality)
	ce14_1	Do you use materials that have been used before (e.g. old products)?
	ce15_1	Do you rent and share tools, machines, or facilities/rooms?
MO	mo1_1	We periodically review our product development efforts to ensure that they are in line with what customers want.
	mo1_2	In our organization, marketing personnel spend time discussing customers' future needs with different functional departments.
	mo1_3	Data on customer satisfaction are disseminated at all levels of the organization on a regular basis.
	mo2_1	We are slow to detect fundamental shifts in our market (competition, technology, etc.).
	mo2_2	We are slow to detect changes in our customers' preferences.
	mo3_1	The customers' interests always come first, ahead of the level of profitability.
	mo3_2	This organization exists primarily to serve customers.
	mo3_3	The business objectives of our organization are driven by customer satisfaction.
EO	eo1_1	I introduced and favored many product or service innovations in my company
	eo1_2	I marketed very many new lines of products or services in my company
	eo1_3	I made minor changes in product or service lines offered by my company.
	eo2_1	I tend to strongly favor high-risky projects (with chances of very high returns).
	eo2_2	Owing to the nature of the environment, I favor bold and wide-ranging acts to achieve the company's objectives.
	eo2_3	I typically adopt a bold and aggressive posture in order to maximize the probability of exploiting potential opportunities.
	eo3_1	I am very seldom the first business to introduce new products/services, management techniques or operating technologies in my company.
	eo3_2	I typically respond to actions which competitors initiate rather than preceding them.
	eo3_3	I typically have a tendency to follow up competitors to adapt to the market rather than anticipating it.

Dependent variable – CE. The dependent variable CE was measured using 15 items on a 5-point Likert scale (1 = "currently not planned", 5 = "successfully implemented"). The items were based on O. Khan, Daddi, and Iraldo (2021) and were slightly adapted to reflect the specific conditions of the German SME market. In addition, the option "not possible in my company" was integrated to identify companies unable to implement CE practices. The holistic construct of CE (α = .79) showed a satisfactory value for Cronbach's alpha.

Independent – MO. MO consists of 8 items based on the scale by Jansson et al. (2017). The items were measured on a 4-point Likert scale (1 = "Does not apply", 4 = "Applies"). The holistic construct had a Cronbach's alpha slightly below the threshold of .7 (α = .64).

Independent – EO. EO was measured using nine items based on the scale by Khedhaouria, Gurău, and Torrès (2015). These items were rated on a four-point Likert scale (1 = "strongly disagree", 4 = "strongly agree"). The resulting holistic construct showed satisfactory internal consistency, which was supported by a sufficient Cronbach's alpha (α = .78).

Control variables. Following earlier research in the field of SMEs, we control for segment, sales, firm age, the number of employees, and gender (Saari et al., 2024; Schmidt et al., 2021).

4. Analysis and Results

4.1 Multiple Linear Regression Assumptions

Verifying certain model assumptions is essential to ensure an unbiased estimation of the regression models. The models were first checked for fulfilment with the four basic assumptions of the Gauss-Markov theorem, as set out by Urban and Mayerl (2018) (see Table 3).

Firstly, homoscedasticity states that the variance of the error terms must be constant across all observations. To test this assumption, the White-Test was used, which applies the squared residuals to test the null hypothesis, confirming the absence of heteroscedasticity (White, 1980). If the null hypothesis is rejected and heteroscedasticity is present, the use of robust standard errors is indicated (Long & Ervin, 2000). Most of the hypothesis models showed a p-value of less than .05, which indicates heteroscedasticity. To correct this assumption violation and achieve consistent results throughout the hypothesis models, robust standard errors were used, which are contained as a standard function in STATA. The second assumption, that the expected value of the error terms is zero, cannot be tested directly in practice. However, violating this assumption would not pose a significant problem for the quality of a hypothesis model (Urban & Mayerl, 2018). According to the third assumption, there should be no autocorrelation of the error terms, as they must be independent. The Durbin-Watson test (Durbin & Watson, 1950) was used to measure the autocorrelation of the error terms, whereby a value range of 1.5 to 2.5 is interpreted as an indicator of the absence of autocorrelation (Urban & Mayerl, 2018). The test results of all hypothesis models were within the prescribed range. Therefore, no corrections were necessary (see Table 3). The fourth and final basic assumption concerns the absence of multicollinearity, which is the perfect linear independence of the dependent variables. The Variance Inflation Factor (VIF) was used as a metric for verification, as a bivariate correlation test between two variables in a model with several independent variables might not provide sufficient information about multicollinearity (Urban & Mayerl, 2018). A VIF value of 1.0 implies the absence of multicollinearity, whereas a threshold value of 4.0 is considered good (Urban & Mayerl, 2018).

Table 3: Assumption tests of regression analysis

Hypothesis	Description	White-Test	Durbin-Watson-Test	VIF
H1	MO → CE	.00	1.86	2.19
H2	EO → CE	.00	1.82	2.20
H3	MO → CE	.00	1.86	2.19
	MO → EO	.00	1.97	2.19
	MO + EO → CE	.00	1.82	2.16

4.2 Regression Analysis

The results of the hypothesis tests with the multiple linear regression analysis are presented below. In a model containing only control variables and the independent variable CE, the segment has a statistically significant effect on CE implementation. SMEs exclusively offering services have a lower average level of CE implementation (ß = -.62, p = .00), whereas companies offering both products and services exhibit a higher level of CE implementation (ß = .43, p = .00). Sales and company age do not show a statistically significant influence on CE implementation, while the logarithmic calculus of employees indicates a negative, yet marginally non-significant influence at the 5% level on the dependent variable CE (β = -.10, p = .07). Male CEOs are associated with a higher average level of CE implementation compared to female CEOs (ß = .32, p = .01), whereas the effect for CEOs identifying as diverse is not statistically significant (model 1).

Hypothesis 1 addresses the influence of MO as a holistic construct on CE as a holistic construct. MO has a positive statistically significant effect on CE implementation in SMEs (ß = .32, p = .00), confirming hypothesis 1 (model 2). Hypothesis 2 relates to the influence of EO as a holistic construct on CE as a holistic construct. EO has a positive, significant influence on CE implementation (ß = .54, p = .00), thus confirming hypothesis 2 (model 3). The results are shown in Table 4.

Table 4: Results of regression analysis

CE (dependent variable)	**Model 1**	**Model 2**	**Model 3**	**Model 4**
Constant	ß	ß	ß	ß
MO		.32***		.32
EO			.54***	.79*
Segment (Production as base)				
Services	-.62***	-.59***	-.60***	-.59***
Both (Production & Services)	.43***	.42***	.40***	.40***
Sales (< €22,000 as base)				
€22,000 - < €50,000€	-.09	-.11	-.08	-.09
€50,000 - < €125,000€	-.07	-.09	-.06	-.07
€125,000 - < €250,000€	-.04	-.10	-.07	-.09
€250,000 - < € 500,000€	-.07	-.14	-.11	-.13
€500,000 - < € 2,5 mil.	.02	.01	.03	.02
€2.5 mil. - < €5 mil.	.12	.11	.05	.06
> €5 mil.	.07	.06	-.00	.01
Firm age (log)	-.03	-.02	-.03	-.02
Employees (log)	-.10*	-.13**	-.18***	-.18***
Gender (Female as base)				
Male	.32**	.33***	.14	.16
Diverse	.78	.77	.59	.59
Observations	740	740	740	740
R-squared	.21	.23	.28	.28
F	16.2***	17.6***	22.8***	2.6***

Note. *p < .10 **p < .05 ***p < .01; N = 757.

Hypothesis 3 states that EO mediates the relationship between MO and CE implementation. When testing the first step (total effect), the influence of MO on CE is positive and significant (ß = .32, p = .00). The second step, testing the indirect effect using bootstrapping, further indicates that the relationship between MO and CE implementation is mediated by EO (ß = .22, CI[.14, .29], p = .00). The third step, testing the direct effect, confirms a full mediation, due to a non-significant direct effect (ß = .10, p = .24), thus hypothesis 3 can be accepted. Detailed results are presented in Table 5.

Table 5: Results of mediation analysis

CE	**H6**
a coefficient (MO → EO)	.43***
b coefficient (EO + MO → CE)	.51***
Step 1: Total effect	.32***

CE	H6
Step 2: Indirect effect	.22***
95% conf. interval	[.14, .29]
Step 3: Direct effect	.10
Note: *** p<.01, ** p<.05, * p<.1	

5. Discussion and Conclusion

The focus of this study lies in the relationship between MO, EO, and CE implementation in SMEs. MO and EO positively relate to CE implementation (hypotheses 1-2). Furthermore, EO mediates the positive relationship between MO and CE implementation (hypothesis 3).

5.1 Theoretical Implications

5.1.1 Influence of MO on CE

The positive and statistically significant effect of MO on the implementation of CE in SMEs confirms hypothesis 1. This emphasizes the assumption that a high level of MO within an SME, which encompasses an integration of marketing within the whole organization and a comprehensive understanding of customer needs, competitor actions, and market trends, is helpful to implementing CE in SMEs. The results of this study further confirm those of the existing literature (Schmidt et al., 2021) and provide a more comprehensive understanding of the influence of MO on CE in SMEs. Furthermore, the results support the findings by Wasim et al. (2024) and thus extend this from the Scottish to the German context. Hence, This study bridges the research gap on whether a pronounced MO can facilitate the implementation of CE in SMEs.

5.1.2 Influence of EO on CE

The empirical findings in this study provide robust support for the proposed hypothesis 2 that EO has a positive and significant impact on the implementation of CE practices in SMEs. This outcome aligns with recent research and emphasizes the positive relationship between EO and CE-oriented practices (Bertassini et al., 2021; E. A. Khan et al., 2022; Saari et al., 2024). This underlines EO's role in encouraging an organizational culture that is open to innovation, taking risks, and the proactive pursuit of new business opportunities, which are essential for the successful implementation of CE. Furthermore, this study contributes to the understanding of the relationship between EO and CE implementation and extends the current literature by focusing on the context of SMEs, which has not yet been sufficiently examined (Ferreira & Ferreira, 2023).

A pronounced EO positively affects the implementation of CE, thereby empirically confirming the previous findings of the literature (Saari et al., 2024). This study provides significant value as it empirically demonstrates the positive relationship within the context of SMEs for the first time, responding to prior calls from the literature (Ferreira & Ferreira, 2023) and accordingly expanding the body of knowledge.

5.1.3 Mediating effect of EO

The confirmation of hypothesis 3 demonstrates that EO acts as a mediator in the relationship between MO and the implementation of CE in SMEs. The findings indicate that the positive influence of MO on the implementation of CE in SMEs depends on the presence of a pronounced EO. Thus, EO also serves as an enabler for MO (Acar et al., 2013). An explanation for this positive effect might be that the characteristics of EO ensure the insights gained from MO about the market and consumers are transformed into concrete entrepreneurial actions, thereby practically advancing the implementation of CE. This is in line with further research that indicated that a strong MO without a strong EO may focus on the customer but might not have the capabilities to meet their demands (Baker & Sinkula, 2009), which could be sustainability aspects such as the need for CE implementation.

This study makes a novel contribution to the understanding of the interplay between MO and EO in the context of CE implementation in SMEs. Thereby, it addresses the call from Jansson et al. (2017), who questioned whether EO and MO act jointly or if one variable influences the other. EO acts as a mediator in the relationship between MO and CE. This confirms the assumptions from studies in a similar environment (Acar et al., 2013) and extends the current literature by providing empirical evidence in the context of SMEs in the German market. It further indicates that MO acts as an antecedent for EO. In addition, insights into the complex relationship between EO and MO are obtained, providing a basis for future researchers to investigate.

5.2 Managerial and Practical Implications

In addition to a theoretical contribution, practical implications can also be drawn. Firstly, a pronounced MO within a SME is conducive to the implementation of CE. Accordingly, practitioners should strive to deepen their MO by integrating marketing efforts across the organization and developing a thorough understanding of customer needs, competitor actions, and market trends to adopt CE practices more effectively. SMEs should focus on creating and enhancing internal processes that promote cross-functional collaboration and strategic alignment towards sustainability objectives within the organization and not just by individual areas or departments.

Secondly, practitioners should strive to establish a strong EO culture within the organization, which is essential for implementing CE practices in SMEs. This entrepreneurial approach can lead to the development of new products, services, and processes that support environmental sustainability. In particular, practitioners should seek to foster a culture that encourages innovativeness and risk-taking to create the best possible environment for sustainability-driven practices, such as CE implementation. EO demonstrates a unique ability to positively impact all areas of the cycle, which will further support practitioners in reaching sustainability.

Thirdly, the combined focus on MO and EO should be carefully considered. The mediating role of EO suggests that a synergistic approach to integrating market insights with entrepreneurial actions is beneficial for SMEs. Practitioners should, therefore, strive to implement both strategic orientations within their companies to enhance CE implementation. In this context, it may be particularly valuable for practitioners to leverage their market and customer knowledge gained through a strong MO to promote these insights within a pronounced EO culture, thereby developing sustainable measures for CE practices.

6. Conclusion

This study expands the existing literature concerning factors that positively influence CE implementation in SMEs. Using linear regression, it specifically highlights the impact of MO and EO on CE implementation and the mediating effect. The findings reveal a positive relationship between MO and EO with CE implementation in SMEs. Besides making a significant contribution to the literature, this study also provides subjects for future research. It encourages future researchers to investigate the relationship between MO and EO further by focusing more on the sub-dimensions. Furthermore, this study provides practitioners with recommendations to facilitate the implementation of CE in SMEs. Besides integrating a distinct MO and EO, it encourages creating a culture that promotes innovativeness and risk-taking and deepens marketing efforts across the entire organization to advance the implementation process.

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The Role of Cognitive Style in Influencing Entrepreneurial Self-Efficacy and Subsequent Entrepreneurial Intention

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Abstract: Cognitive style has been largely acknowledged to highly contribute to explaining variances in individuals' behavior. However, very few researchers studied the role of cognitive style in influencing entrepreneurial self-efficacy along the entrepreneurial intention process. Therefore, the purpose of this research is to study how differences in preferences towards linear, non-linear and balanced thinking style would affect individuals' self-perceptions towards entrepreneurial self-efficacy and subsequent intentions to create a new business. This study's findings reported that non-linear thinking style is negatively correlated to entrepreneurial self-efficacy which subsequently affects entrepreneurial intentions negatively. While linear thinking style was positively correlated to entrepreneurial self-efficacy which in return affects entrepreneurial intentions positively. Moreover, thinking style balance was found to be positively correlated to entrepreneurial self-efficacy that exceeds the magnitude of the Linear-Entrepreneurial Self-Efficacy relationship which subsequently affects intentions positively. Furthermore, the relationship between entrepreneurial self-efficacy and entrepreneurial intentions had higher significance and was stronger in effect for individuals with balanced thinking style than for those with linear and non-linear thinking style.

Keywords: Cognitive style, Entrepreneurial self-efficacy, Entrepreneurial intention

1. Introduction

Cognitive Style is one of the main variables that was derived from the individual differences psychology discipline. It has been given significant attention among researchers and practitioners specifically in the innovation and entrepreneurship field (Armstrong and Hird, 2009). This is because cognitive style is considered a main determinant of individual behavior as it affects the way people gather and process information, solve problems and make decisions. Thus, it affects people's choices. Accordingly, this clarifies the significance of cognitive style within the entrepreneurship context as it may affect many key behaviors that entrepreneurs face on a daily basis (Kickul, Gundry, Barbosa and Whitcanack, 2009; Barbosa, Kickul and Smith, 2008**,** Armstrong and Hird, 2009; and Krueger and Day, 2010). Despite the fact that cognitive style has been a very popular research domain in business and management during the past 40 years, it is still considered under-researched as more empirical research is (Armstrong et al, 2012).

In 1988, pioneers in research introduced the concept of Intentions to cognition research which played a very important role in managerial literature (Bird, 1988). Consequently, past researchers have been widely adopting the intentions variable in their empirical studies to predict subsequent behavior. This is because measuring actual behavior is considered difficult and requires long time intervals (Hattab, 2014; Barbosa et al., 2007; Ajzen, 1991). Accordingly, in the entrepreneurship field various entrepreneurial intention models emerged to explain the factors that spur people to become entrepreneurs as this would help in fostering entrepreneurship (Linan, Rodríguez-Cohard and Rueda-Cantuche, 2011).

Over the past years, many entrepreneurship researchers have given considerable attention to examine the relationship between entrepreneurial self-efficacy and entrepreneurial intentions to start their own business. This is because entrepreneurial self-efficacy is believed to be a strong predictor of entrepreneurial intentions (Schlaegel and Koenig, 2014; Chen et al., 1998; Boyd and Vozikis,1994). Yet very few researchers studied the role of cognitive style in influencing entrepreneurial self-efficacy along the entrepreneurial intention process (e.g., Kickul et al., 2009; Barbosa et al, 2007). Although, the relationship between cognitive style and entrepreneurial self-efficacy is initially supported in the literature (Kickul et al, 2009; Vance, Groves, Gale and Hess, 2012), very little knowledge exists regarding how cognitive style would impact an individual's entrepreneurial self-efficacy and subsequent entrepreneurial intentions (Vanevenhoven and Liguori, 2013; Kickul et al, 2009). Therefore, this research effort stands to advance and contribute to the field of entrepreneurial cognition by initially studying the impact of cognitive style on entrepreneurial self-efficacy and subsequent entrepreneurial intentions. Moreover, this research aims to study how differences in individuals' cognitive styles either favouring linear, non-linear or balanced style would affect the relationship between entrepreneurial self-efficacy and entrepreneurial intentions to have a more vibrant picture of the processes that may lead to entrepreneurial behavior.

2. Literature Review

2.1 Cognitive Style

Allinson, Chell and Hayes, (2000, p.33) define cognitive style as *"a person's preferred way of gathering, processing and evaluating information"* that relates to creativity, problem-solving and decision making. Groves et al, (2011) classified individuals' cognitive style into three types, the first type is the non-linear "intuitive" cognitive style which embraces holistic thinking, creativity, experimentation, uncertainty, and freedom. The second type is Linear "analytical" cognitive style which is being driven by facts, data, rationality and being task oriented. The third type is a balanced cognitive style which is described as one being versatile in using either linear or non-linear thinking style depending on the situation at hand. It is worth noting that an individual's cognitive style may intentionally vary according to the unique constraints and conditions of a given situation (Groves et al, 2011; Allinson and Hayes, 1996).

Even though entrepreneurs were believed to have an intuitive thinking style as they are perceived to be creative and have high tolerance for ambiguity, it is suggested that both intuitive and analytical ways of thinking are needed to cultivate and stimulate the entrepreneurial capability. Olson and Bosserman, (1984) implied that in the early stage of the entrepreneurial process, entrepreneurs are more likely to employ the intuitive style as creativity and innovation are needed in identifying and capitalizing on the opportunity. While in later stages of the entrepreneurial process; planning, implementation and management phase, analytical thinking will be more prevalent. Therefore, it is proposed that entrepreneurs adopt both thinking styles when it comes to starting their own business. This means they have a great versatility in demonstrating either intuitive or analytical thinking style depending on the situation at hand and the various functional requirements needed for venture creation (Vance, Groves, Gale and Hess, 2012; Groves, Vance and Choi, 2011). Accordingly, this emphasizes the importance of balanced thinking style throughout the entrepreneurial process.

2.2 Entrepreneurial Self-Efficacy and Entrepreneurial Intention

Entrepreneurial self-efficacy (ESE) is defined as "the strength of confidence individuals have in their own abilities to successfully execute and perform various entrepreneurial roles and tasks" (Chen, Greene & Crick, 1998). Bandura, (1986) was the first to define self-efficacy as a task-specific construct meaning that it should be developed and evaluated with respect to specific tasks to enhance its predictive validity. The entrepreneurial process entails several tasks related to creating a new business such as searching for opportunities, planning for the new venture, marshaling resources, and implementing and creating the business (Vance et al, 2012; Kickul et al, 2009; McGee et al, 2009).

Entrepreneurial Intention is defined as "the conscious state of mind that precedes action and directs attention, experience and behavior toward a goal such as creating a new business" (Bird, 1988 as cited in Moriano, Laguna, Gorgievski and Stephan, 2012, p.5). It is worth mentioning that the prevailing intention models in literature employ self-efficacy as one of the critical antecedents of intentions (McGee et al, 2009; and Barbosa et al, 2007). Most of the widely adopted intention models are based on the most two popular theories in the literature. These two theories include a variable of self-efficacy; perceived behavioral control and perceived feasibility which were empirically found to positively predict entrepreneurial intentions in various studies. The first one is the theory of planned Behaviour developed by Ajzen, (1991) which has been extensively applied empirically (e.g., Ozaralli and Rivenburgh, 2016; Rauch and Hulsink, 2015). The second one is the theory of entrepreneurial event developed by Shapero and Sokol, (1982) which has been widely applied empirically as well (e.g., Walter and Block, 2016; Peterman and Kennedy, 2003). Furthermore, Entrepreneurial self-efficacy has been reported by various empirical studies to be a strong predictor of intentions and behavior as it is found to affect entrepreneurial intentions positively (Schlaegel and Koenig, 2014; McGee et al, 2009**;** Barbosa et al., 2007; Zhao et al., 2005; and Kickul et al, 2009). Based on the above discussion, the first research question and hypothesis are as follows:

"RQ1: What is the impact of entrepreneurial self-efficacy on entrepreneurial intentions?"

Hypothesis 1*: Entrepreneurial Self-efficacy positively correlates to entrepreneurial intentions.*

2.3 The Role of Cognitive Style in Influencing Entrepreneurial Self-Efficacy (ESE) and Subsequent Intentions

Cognitive style is believed to play an important role in influencing individual's entrepreneurial self-efficacy in the road to entrepreneurial intentions (Boyd and Vozikis, 1994; and Barbosa et al, 2008). More specifically, when individuals start to consider entrepreneurship as a viable career option, their cognitive styles may play

an important role in influencing individuals' self-perceptions regarding various skills required to create a new venture by nurturing some perceptions and hindering others. Barbosa et al., (2007) studied the impact of cognitive style on entrepreneurial self-efficacy. It was proposed that intuitive individuals will score higher than analytical individuals on the tasks of self-efficacy that reflects the early phase of the entrepreneurial process which is opportunity identification efficacy. On the contrary, the former will score lower than the later on the task of self-efficacy that occurs in later phases of the entrepreneurial process, and they are relationship, managerial and tolerance efficacy. Opposing to what was proposed; the findings reported that there was no difference found between intuitives and analytics on opportunity identification efficacy. This is because maybe analytical individuals think they could recognize opportunities with their analytical skills rather than intuition and gut feelings. Moreover, it was found that intuitive individuals scored lower than analytical individuals on relationship, managerial and tolerance efficacy. The previous findings are partially consistent with Olson's, (1985) notion that both intuitive and analytical thinking styles are most effective in different phases of the entrepreneurial process.

In a consistent manner, Kickul et al, (2009) examined the role of an individual's cognitive style in influencing their perceived entrepreneurial self-efficacy according to the specific phases of the entrepreneurial process that is often labeled as new venture creation process. The findings showed that an individual's intuitive cognitive style enhances his/her self-efficacy in the opportunity identification process as individuals possessing an intuitive cognitive style had higher confidence in their capabilities to identify and exploit new opportunities, whereas, they didn't have much confidence when it comes to evaluating those opportunities, marshaling resources and implementation. On the other hand, it was found that an individual's analytical cognitive style enhances his/her self-efficacy in planning, marshaling resources and implementation to create their new venture as individuals possessing an analytical cognitive style were found to have higher confidence in their competencies to evaluate opportunities, plan, marshal resources and implementation, whereas, when it comes to identifying new opportunities, they don't have much confidence in their skills (Kickul et al, 2009). Moreover, Vance et al, (2012) conducted an empirical study to test the correlation between thinking style balance and entrepreneurial self-efficacy. The findings reported that thinking style balance is significantly associated with all dimensions of entrepreneurial self-efficacy as all measures of efficacy were found to be significantly influenced by thinking style balance. Therefore, both constructs are believed to be important cognitions that highly contribute to entrepreneurial intentions and success. The past findings suggest that both analytics and intuitives may acquire different skills through their mastery experiences which will subsequently improve different types of self-efficacy that will eventually affect their intentions differently. Based on the above discussion, the second and third research questions and hypotheses are as follows:

"RQ2: What is the impact of cognitive style on entrepreneurial self-efficacy?"

> ***Hypothesis 2A:*** *Linear thinking style will positively correlate with entrepreneurial self- efficacy.*
>
> ***Hypothesis 2B:*** *Non-linear thinking style will negatively correlate with entrepreneurial self-efficacy.*
>
> ***Hypothesis 2C:*** *Balanced thinking style will positively correlate with entrepreneurial self-efficacy which exceeds the magnitude of the relationship predicted in H1.*

"RQ3: How would cognitive styles affect the entrepreneurial self-efficacy-entrepreneurial intentions relationship?"

> ***Hypothesis 3:*** *There will be a stronger and higher significant relationship between entrepreneurial self-efficacy and entrepreneurial intentions for individuals with balanced thinking style than for those with linear and non-linear styles.*

3. Methodology

3.1 Research Design and Sample

A total of 906 surveys were distributed of which 864 surveys were complete and usable. The survey was distributed to graduates from three private universities in Egypt: German University in Cairo (GUC), British University in Egypt (BUE) and Nile University (NU). The age of the target sample ranges from 20 to 26 years old. Regarding the gender distribution of the sample, males represent 30% of the sample and 70% of the sample were females. Moreover, 42.7% of the sample was unemployed as they were fresh graduates, whereas 32.8% of the sample was employed in salaried work. Furthermore, the sampling technique adopted was non-probability judgmental sampling which is a form of convenience sampling where the researcher selects a certain sample of the population based on who he/she thinks would be appropriate for the study (Malhotra,

2010). Finally, the questionnaire was distributed by integrating both online and offline data collection techniques within the time frame of June 2018 till the end of June 2019. It is worth mentioning that participants were informed that participation in the study is entirely voluntary, and confidentiality was guaranteed.

3.2 Measures

The scale adopted to measure cognitive style was Linear Nonlinear Thinking Style Profile (LNTSP) developed by Vance et al, (2007). It is a 26-item, four-dimensional, forced-choice self-report measure of decision- making style; 13 items measuring linear thinking style dimension while the other 13 items assess the nonlinear thinking style dimension. Whereas the thinking style balance score is calculated as the difference between total linear and total nonlinear scores (Ettlie et al, 2014). It is worth mentioning that there is an alternative approach to measure thinking style construct. For multiple groups comparison analysis, further classification/categorization of thinking style was made; the researcher created three groups (linear, nonlinear, and balanced) based on the spread of the difference scores (linear – nonlinear) (Ettlie et al, 2014). In this study, three groups were created, and they are categorized as follows: nonlinear thinking (difference score ≤ -1), balanced thinking (difference score= 0 through 9) and linear thinking (difference score ≥10).

While the scale adopted to measure entrepreneurial self-efficacy was the Entrepreneurial Self-Efficacy (ESE) Scale developed by McGee, Peterson, Mueller, Sequeira, (2009). It is a 19-item, five-dimensional self-report measure of entrepreneurial self-efficacy. Respondents were asked to voluntarily indicate on a 5-point Likert scale (1 = very little, 5 = very much) how much confidence they had in their ability to engage in each of the 19 entrepreneurial tasks. Furthermore, entrepreneurial intention scale was adopted from the Entrepreneurial Intention Questionnaire (EIQ) developed by Linan and Chen, (2009). It is a six-item, one factor, general pure intention measure built on Likert type scale assessing the degree to which individuals have seriously considered to become entrepreneurs. Respondents were asked to voluntarily read the statements and indicate on a 5-point Likert scale (1 = strongly disagree, 5 = strongly agree) their level of agreement or disagreement.

4. Results

Before conducting the data analysis, confirmatory factor analysis (CFA) for LNTSP, ESE and EI scales were carried out to measure the validity of the scales. According to table 1, the goodness of fit indices shows acceptable and satisfactory validity of the three scales. The CHI standardized is within the acceptable baseline. Moreover, all values of the six indices; Goodness of Fit Index, Normed Fit Index, Relative Fit Index, Incremental Fit Indexes, Tucker-Lewis Index, Comparative Fit Index are greater than 0.90, thus within the acceptable baseline as well. Additionally, the values of Root Mean Square Residual and Root Mean Square Residual Error Approximation are below 0.08 which is acceptable and indicates a very good fit of the three models (Hair et al., 2014).

Table 1: The Goodness of Fit Indices for Research Variables

	CMIN/DF	GFI	NFI	RFI	IFI	TLI	CFI	RMR	RMSEA
Required threshold	(2-5)	>.90	>.90	>.90	>.90	>.90	>.90	<.08	<.08
LNTSP Scale	2.271	0.975	0.930	0.916	0.960	0.951	0.959	0.020	0.038
Entrepreneurial Self-Efficacy Scale	4.136	0.960	0.944	0.923	0.957	0.940	0.956	0.065	0.06
Entrepreneurial Intentions Scale	3.326	0.994	0.996	0.989	0.997	0.992	0.997	0.009	0.052

Additionally, as shown in table 2 all research variables have shown acceptable and satisfactory reliability scores as Cronbach's alpha scores were (> 0.7) (Pallant, 2007). According to the below table the Cronbach's alpha scores of the Linear thinking style, Non-Linear thinking style, searching efficacy, planning efficacy, marshaling

efficacy, implementing efficacy and entrepreneurial intentions were as follows α = 0.796, α = 0.796, α = 0.707, α = 0.720, α = 0.778, α = 0.898 and α = 0.936 respectively. Another method was applied to test the reliability of the scale using Structure Equation Modeling (SEM) which is the Composite Reliability (CR). Composite reliability is intended to measure the internal consistency of the scale as well. The Composite Reliability scores of the scales have reported satisfactory and acceptable values (> 0.7) (Hair et al., 2014).

Table 2: Reliability for Research Variables

Dimension	Reliability Coefficient α	Composite reliability (CR)
Linear (Analytical) Thinking style	.796	0.870
Non-Linear (Intuitive) Thinking style	.796	0.870
Searching efficacy	.707	0.727
Planning efficacy	.720	0.739
Marshaling efficacy	.778	0.782
Implementing efficacy	.898	0.867
Entrepreneurial Intention	.936	0.898

As shown in table 3, the results show that there is a significant correlation between linear, non-linear and balanced thinking style and entrepreneurial self-efficacy at a significant level (P<0.01). It was shown that linear and balanced thinking style are positively correlated with entrepreneurial self-efficacy (r=0.121, 0.127) respectively. Yet, the magnitude of the Balance-ESE relationship is higher compared to Linear-ESE relationship. While non-linear thinking style was negatively correlated with entrepreneurial self-efficacy (r= -0.121). Thus, the previous findings provide support for Hypotheses 2, 3 and 4.

Table 3: Correlation between cognitive style and entrepreneurial self-efficacy

Correlations					
		self-efficacy	Linear (Analytical)	Non-Linear (Intuitive)	Balanced
self-efficacy	**Pearson Correlation**	1	.121**	-.121-**	.127**
	Sig. (2-tailed)		.000	.000	.000
Linear (Analytical)	**Pearson Correlation**		1	-1.000-**	.992**
	Sig. (2-tailed)			0.000	0.000
Non-Linear (Intuitive)	**Pearson Correlation**			1	-.992-**
	Sig. (2-tailed)				0.000
Balanced	**Pearson Correlation**				1
	Sig. (2-tailed)				
**. Correlation is significant at the 0.01 level (2-tailed).					

As shown in table 4, the results show that there is a significant positive correlation between entrepreneurial self-efficacy and entrepreneurial intention (p-value=.000, r=0.424). Thus hypothesis 1 is supported.

Table 4: Correlation between entrepreneurial self-efficacy and entrepreneurial intention

		Self-Efficacy	Entrepreneurial Intention
Self-Efficacy	**Pearson Correlation**	1	.424**
	Sig. (2-tailed)		.000
Entrepreneurial Intention	**Pearson Correlation**		1
	Sig. (2-tailed)		

Structural Equation Model Results for the Non-linear, Balanced and Linear Groups

Multiple group comparison analysis which is commonly applied in experimental research was conducted using structure equation modeling (SEM) to compare between the three thinking style groups, non-linear, balanced, and linear groups on the relationship between entrepreneurial self-efficacy and entrepreneurial intentions. Before presenting the multiple group analysis results, the goodness of fit indices of the model will be presented. The results of the model fit show that the model is acceptable and satisfactory in terms of overall goodness of fit measures. The CHI standardized is 2.078 which is within the acceptable baseline. Moreover, all six values of Goodness of Fit Index, Incremental Fit Indexes, Normed Fit Index, Relative Fit Index, Tucker-Lewis Index and Comparative Fit Index are greater than 0.95, thus all values are considered exceptional which indicates that the model is highly fit. Furthermore, the values of Root Mean Square Residual and Root Mean Square Residual Error Approximation are below 0.05 which are exceptional values as well and indicate an excellent fit of the model (Hair et al., 2014).

Table 5: Measuring the Goodness of Fit of the Model

	CMIN/DF	GFI	NFI	RFI	IFI	TLI	CFI	RMR	RMSEA
Required threshold	(2-5)	>.90	>.90	>.90	>.90	>.90	>.90	<.08	<.08
Model	2.078	0.993	0.988	0.976	0.994	0.987	0.994	0.015	0.035

According to table 6, the results showed that even though, the relationship between entrepreneurial self-efficacy and entrepreneurial intentions was significant across the three thinking style groups, the relationship was stronger in effect (beta=0.2>0.171, 0.161) and had higher significance (0.003>0.03, 0.047) for graduates with balanced thinking style than for those with linear and non-linear thinking style. Therefore, the previous findings provide support for hypothesis 5.

Table 6: The Regression Path Coefficient and the Standardized Path Coefficient between constructs in the model for linear, non-linear and balanced cognitive style groups

Dependent	Path	Independent	Non-Linear (Intuitive)		Balanced		Linear (Analytical)	
			Standardized Estimate	P-value	Standardized Estimate	P-value	Standardized Estimate	P-value
Implementing	<---	self-efficacy	0.154		0.396		0.273	
Marshaling	<---		0.536	0.026*	0.421	***	0.508	***
Planning	<---		0.679	0.024*	0.649	***	0.603	***
Searching	<---		0.719	0.024*	0.549	***	0.62	***
Entrepreneurial Intention	<---	self-efficacy	0.161	0.047*	0.2	0.003**	0.171	0.03*
*p < 0.05, **p < 0.01, ***p < 0.001								

5. Discussion

This study's findings were consistent with the literature review as the results indicate that the higher the analytical cognitive style, the higher the confidence level in performing the overall entrepreneurial tasks and thus the higher the entrepreneurial intentions. While the higher the intuitive style, the lower the confidence level in performing the overall entrepreneurial tasks and thus the lower the entrepreneurial intentions. Furthermore, the results reported that the higher the balance cognitive style, the higher the confidence level in performing the overall entrepreneurial tasks and thus the higher the entrepreneurial intentions. Yet, the magnitude of the Balance-ESE relationship is higher compared to Linear-ESE relationship.

One of the main objectives of this study is to assess how differences in cognitive style would impact the relationship between entrepreneurial self-efficacy and entrepreneurial intentions. The empirical results of the multiple group comparison supported the role of thinking style balance in influencing entrepreneurial behavior since the relationship between entrepreneurial self-efficacy and entrepreneurial intentions was stronger in

effect and had higher significance for graduates with balanced thinking style than for those with linear and non-linear thinking styles. This indicates that individuals with balanced thinking style would have higher chances of starting up their own businesses as they would have higher self-confidence in their abilities and thus higher entrepreneurial intentions compared to those with linear and non-linear thinking styles. The previous findings are somehow consistent with the literature as Ettlie, (2014) found that thinking style balance is more associated with innovative intentions and behavior than would non-linear and linear styles. Therefore, this research supports the claim in the literature that the more the individuals are capable of achieving a greater versatility in employing either linear or non-linear thinking, the more they are capable of developing entrepreneurial competences and thus demonstrating higher entrepreneurial behavior. This is because thinking style balance is a key component throughout the entrepreneurial process, thus it predicts successful innovative outcomes and capabilities (Ettlie et al, 2014).

6. Practical Implications

This research has important implications for *educators and program designers.* There is a widespread criticism in the literature that business education overemphasizes the linear thinking style, although the nonlinear thinking style is as important as the linear style in entrepreneurship and business education. Therefore, Entrepreneurship and business educators in universities should strive to develop a curriculum that endorse versatility by developing students' intuitive and rational thinking and design an evaluation system that recognizes both styles as well. Moreover, this research has valuable implications for *entrepreneurs* as well. One important implication of this research is to raise awareness and help entrepreneurs understand their own cognitive styles, allowing them to identify their dominant and auxiliary styles so that they could seek expert assistance through self-development training to further strengthen and develop their auxiliary styles to be able to enhance their thinking style versatility which would result in better innovative behavior. Finally, this research could be valuable to *venture capitalists and financial/investment institutions.* This research emphasizes balanced thinking style as an important criterion for identifying, screening and nurturing future entrepreneurs as it would give venture capitalist and financial/investment institutions valuable insights on the entrepreneurs' capabilities to outperform the entrepreneurial tasks in creating and managing businesses successfully.

7. Conclusion

This study supports the important role of cognitive style in affecting the road to entrepreneurial intentions as it was found that differences in individual's cognitive style would affect their self-perceptions towards entrepreneurial self-efficacy which subsequently affect their entrepreneurial intentions. The findings of this study pinpoint the significance of the new notion of balanced thinking style by verifying its positive role in stimulating entrepreneurial behavior and intentions. In conclusion, this research provides a better understanding of how differences in individuals' cognitive styles affect their paths to entrepreneurial intent, hence having a clearer picture of the process that leads to entrepreneurial intentions.

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Social Entrepreneurship in the Japanese Context Through the Lens of a Social Entrepreneur's Experience

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Abstract: Social entrepreneurship (SE) demand has increased globally, highlighting the importance of understanding the activities and processes involved to enhance entrepreneurial awareness and social well-being. This study examines the experience of a social entrepreneur in Japan who manages twin parenting and transportation, aiming to clarify the development of social entrepreneurial competency. The entrepreneur's eight-year state-up experience was shared through a book in 2022, a narrative lecture observed in November 2023, and interviews conducted in April and May 2024. These data were analyzed using Trajectory Equifinality Modeling (TEM). Throughout the creation of a bicycle for parents of twins, the entrepreneur faced conflicts with a partner during the prototype development and created a community for parents of twins through SNS and face-to-face events. The effectuation in these processes considers the essence of who you are, what you know, and whom you know. The entrepreneur focused on affordable loss, partnership creation, and maintaining flexibility despite unexpected challenges. She overcame these issues by studying social welfare at a university and business at community learning schools. Twin bicycles are a tool not only for transportation, but also for life. They are a symbol of an open-free mind given the constraints of society and are joyful in their own warm place for twin children, parents, and their communities.

Keywords: Social entrepreneurship, Social entrepreneur, Effectuation, Well-being

1. Introduction

Social entrepreneurship (SE) involves creating value for society as a whole, rather than for individuals, by developing better solutions for social issues, such as poverty, hunger, and environmental issues, while maintaining efficiency and sustainability over existing solutions (Phills, Deiglmerier, & Miller, 2008). SE belongs to the field of entrepreneurship (Bornstein & Davis, 2010; Martin & Osberg, 2007). Social issues have traditionally been addressed by the government; however, as social issues have become more diverse and complex, it has become difficult for governments to address them in a top-down manner. Economic fundamentalism instigates traditional entrepreneurs to be reluctant to address social issues that are not directly linked to profit. Nevertheless, human resources that undertake the challenge of creating businesses that combine broad perspectives, expertise, and the ability to identify and solve problems are required to find effective solutions to social issues. Accumulated solutions to these issues will eventually lead to measures that will move large governments and significantly impact society from the bottom up to realize a better society (Tanimoto, 2006; Yunus, 2010). There is limited understanding of the essence of SE. Therefore, this study investigates how SE is linked to the life experiences of social entrepreneurs. This study used a qualitative approach that combined document analysis, observation, and interviews. The key study participant was a social entrepreneur who had launched several novel and effective social businesses and services. The remainder of this paper is structured as follows: Section 1 provides a literature review of the main concepts of the entrepreneurial ecosystem. Section 2 provides a brief explanation of the analytical methodology used. Sections 3 and 4 present the results and discussion, while Section 5 provides the conclusion.

1.1 Entrepreneurship

Entrepreneurship is the creation of a business through opportunity acquisition, business development, self-employment, and venture creation and development (Fayolle & Gailly, 2008; Mahieu, 2006; QAA, 2012). One theory of entrepreneurship is effectuation, which is a practical approach. Sarasvathy developed a theory of effectuation by studying the decision-making processes of accomplished serial entrepreneurs when facing problems in their new ventures (Sarasvathy, 2001; Sarasvathy, 2008; Sarasvathy & Dew, 2005; Sarasvathy & Venkataraman, 2011). There are five principles of effectuation: 1) bird in hand, 2) affordable loss, 3) crazy-quilt, 4) lemonade, and 5) pilot-in-the-plane. A bird-in-hand approach refers to understanding who you are, what you know, and whom you know and then creating something new using these three existing tools. Affordable loss implies that commitments are made based on the extent to which a loss is possible. In crazy-quilt, a person negotiates with all parties willing to do the same so that partnerships can be formed. The lemonade approach highlights traits, such as not shying away from the unexpected, acknowledging uncertainty, and responding appropriately. The pilot-in-the-plane method implies that a person adjusts flexibly and produces results when faced with uncertainty. The person focuses on controllable activities rather than external factors, such as

socioeconomic trends, and work with humans as agents to drive business creation (Sarasvathy, 2008, 2015). The effectuation process is an evaluation of existing means of identifying who you are, what you know, and whom you know. A person then considers what can be done within their tolerance for loss and interacts with old acquaintances and new people to gain a commitment from their partners. Finally, the person arrives at new means and new ends and creates new companies, new products, and new markets (Read, Sarasvathy, Dew, Wiltbank, and Ohlsson, 2011).

1.2 SE

In a systematic review of SE, Miah, Lakner, and Fekete-Farkas (2024) showed an SE trend from 1998 to 2022. From 1998 to 2006, there was no activity. Since 2009, research on SE has grown, and the number of articles has consistently exceeded 40% per year since 2019. According to the author's corresponding country of residence, the United Kingdom contributed the most to the research, especially in social innovation and entrepreneurship, sustainable development and policy implications, and value creation in addressing global challenges. Spain and the United States followed with the number of SE research articles. Collaborative research has emerged from most European countries (the United Kingdom, Spain, Italy, Germany, and the Netherlands), the United States, and Asia (China, India, and Malaysia). Van Lunenburg, Geuijen, and Meijer (2020) showed rules and support of networks, financial aides, and knowledge as institutional factors. Social entrepreneurs' characteristics include willingness of ambition, desire to control, logic and entrepreneurial skills, leadership and dependency, geographical volume or influence on public discourses, political agendas and legislation, and level of social and sustainable impact in the framework of the social and sustainable initiative scale in 133 articles. SE research, including collaborative research, has expanded, and some characteristics of SE have been discovered.

SE is still poorly defined (Mairm and Martí, 2006). Austin, Stevenson, and Wei-Skiller (2006) define SE as an "innovative, social value creating activity that can occur within or across the nonprofit, business, or government sectors." Austin, Stevenson, and Wei-Skiller (2006) mentioned that SE revolves around addressing a specific social issue, and the choice of organizational structure should be driven by its effectiveness in mobilizing resources to tackle a problem. Instances of SE can emerge within or traverse nonprofit, business, or governmental sectors. According to Peredo and McLean (2006) SE aims to create social value and pursue goals, employ innovation, tolerate risk, and use limited resources. Bornstein and Davis (2010) mentioned that SE progresses from observation and experimentation to the institutionalization of innovative solutions, which are subsequently independently adopted. Bornstein and Davis (2010) described SE as a process aimed at solving social problems and categorized the history of SE. In the first stage, SE focused on three key objectives: identifying individuals with innovative ideas to achieve significant social impact, highlighting their work in society, and establishing support systems to facilitate their success. The emphasis then shifted toward organizational excellence and drawing upon business strategies and management principles to assist social entrepreneurs in building sustainable and impactful organizations. Today, the focus is expanding beyond individual founders and institutions to harness the transformative potential of all individuals and their interactions. Mairm and Martí (2006) mentioned that SE integrates economic and social value creation. SE drives social change by addressing societal needs. Although value creation encompasses both social and economic dimensions, the primary emphasis is on generating social value, with economic viability viewed as essential for sustainability. Additionally, it is crucial to recognize that the examples provided focus on SE in developing nations to underscore its global relevance or in developed countries, such as the United States, Canada, and the UK. Numerous studies have explored SE in the context of community development in these regions. Wang and Yee (2023) demonstrated that SE encompasses a broad spectrum of research areas, but the research output in the field tends to be diversification and decentralization. Therefore, it is important to investigate SE in a specific region.

Dees (1998) delineates the multifaceted nature of SE and highlights its diverse manifestations. E includes not-for-profit organizations, social responsibility in business operations, or not-for-profit organizations starting with profit or earned-income ventures. SE combines passion for a social mission with an image of a business-like discipline and innovation. It encompasses not only traditional not-for-profit organizations with alternative funding (Austin, Stevenson, and Wei-Skiller, 2006) but also for-profit ventures infused with social responsibility (Sagawa and Segal, 2000), a mix of profit and non-profit approaches (Dees, 1998), and a focus on social problems, transformation, and impact (Alvord, Brown, and Letts, 2004; Zahra *et al*., 2009). Moreover, SE creates social value rather than personal and shareholder wealth (Mairm and Martí, 2006; Martin and Osberg, 2007; Peredo and McLean, 2006). Furthermore, Dees (1998) describes social entrepreneurs as reformers and revolutionaries. In further expounding the 5 traits of social entrepreneurs delineated their modus operandi. First, a deep-rooted dedication to a social mission forms the cornerstone of their endeavors, driving them to create and perpetuate

social value. Second, they possess a keen eye toward identifying novel opportunities aligned with their mission, demonstrating a propensity to view challenges as prospects for positive change. Third, social entrepreneurs exhibit a relentless pursuit of innovation, embracing uncertainty, and leveraging failure as stepping stones toward progress. Fourth, they exhibit boldness in action and maximize scarce resources through strategic partnerships and collaborative ventures. Finally, social entrepreneurs display a heightened sense of accountability not only to their constituents but also to the outcomes generated by their initiatives. Tanimoto (2008, p.2) describes a social entrepreneur as "a person who finds a social need, starts a new business and promotes social innovation."

1.3 Authentic Social Entrepreneurial Leadership

Nakamura and Horimoto (2020) proposed a conceptual framework for authentic social entrepreneurial leadership development among Japanese women. Triggering life events plays a pivotal role in shaping women's entrepreneurial pursuits. These moments of crisis prompted deep introspection, compelling women to reevaluate their core values, origins, and significance. Through this introspective process, women clarify their values in relation to their professional aspirations. Self-efficacy has emerged as a key determinant contributing to a better society, and social space provides a platform for networking. However, social norms toward women's roles and enterprises and the lack of social networks make it difficult to start and maintain a business. To overcome this problem, an authentic social entrepreneurial leadership is required. Kernis (2003) suggested that the awareness aspect of authenticity entails understanding one's own needs, values, emotions, personality traits, and how these factors influence behavior. Liu, Leanne, and Grant (2015) mentioned that authenticity is related to leadership and leaders perform authentic leadership rather than they have or they are.

To date, little attention has been paid to the essence of social entrepreneurial and SE process in Japan. This study aimed to investigate SE as a key aspect of life and how it is linked to creating value and contributing to a community.

2. Methods

Yasuda *et al.* (2015, p. 32,33) explained the purpose of trajectory equifinality modeling (TEM). TEM focuses on the trajectory equifinality point and aims to write about the aspects of human behavior and development and the transformation and maintenance of choices and perceptions that lead to it, in terms of home and emergence, in historical, cultural, and social contexts and time.

Sato *et al.* (2006, p.257,258) have explained the history of TEM. It starts with the general system theory by Bertalanffy (1968), followed by the development of TEM theory around 2000, the conceptualization of TEM around 2004, and TEM as a qualitative method around 2005. In the first stage, the significance of the isochronous concept and the concept of multiple pathways are explained in the treatment of development in cultural psychology. Valsiner (2001) demonstrated the concept of equifinality, which is the core of TEM. Sato (2009) highlights that the history of TEM is intricately linked to a sampling methodology known as HSS (historically structured sampling), in contrast to random sampling. A sample system should reflect both the real-life experience of any person within an irreversible time and non-random sampling of individual cases, not the systematic practice of random sampling (Valsiner, 2009; Valsiner & Sato, 2006; Sato, 2007).

Yasuda *et al.* (2015) explained that the TEM conceptual tools include equifinality point (EFP), the point in a person's life where their actions and experiences are important to them in some way and are the focus of research; Bifurcation Point (BFP), the point at which a path originates or branches off; Obligatory Passage Point (OPP), an event that is experienced as essential to reaching the equinoctial point; Social Guidance (SG), the force that encourages the steps toward the equilibrium point; and Social Direction (SD), the force that hinders the steps toward the equilibrium point.

The researcher samples the businesses and experiences of interest as EFP. Data are collected and divided into the smallest units of interviewed or cursors, which will serve as the unit of analysis. The researcher then establishes BFP and OPP employing not only the information obtained through deception but also social, institutional, and cultural knowledge. The polarized EFP is then established. Finally, the researcher writes down the repairing events of the project they are interested in and draws a path to the two polarized EFP, charting them as a TEM and taking into account the multiple paths.

Sato (2007) suggests that the TEM theory provides valuable insights into understanding processes at three distinct levels. At the macro level, TEM offers a lens through which one comprehends the irreversible progression of time and the historical evolution of societies, social groups, and institutions. At the meso-level, TEM elucidates

the developmental trajectory of individual lives, encompassing the human life course. Finally, at the micro level, TEM sheds light on decision-making processes within the context of semiotically complex everyday situations influenced by various symbolic meanings and interpretations.

According to TEM, the "rule of 1 / 4 / 9" proposes a guideline for the number of researchers involved in a study. Specifically, one case is sufficient for delving deeply into the individual experience, whereas approximately four cases (up/down to one) offer insights into the diversity of experiences. Furthermore, approximately nine cases (up to one) enable the researchers to discern typologies or patterns of pathways. One social entrepreneur was selected to thoroughly investigate the process of developing competence through the startup creation process (Yasuda *et al.*, 2015).

Sato (2009) mentioned that the TEM method has a short history, and there were only a few studies using TEM in 2009. Studies using TEM have expanded self-reassessment in infertility treatment (Yasuda, 2005), young women's abortion experience (Yasuda *et al.,* 2015), nursing teachers' experience (Tanaka *et al.*, 2004), and career history (Nishino, Tubone, & Yata, 2020; Yamamoto, 2019; Okuyama, 2018).

In this study, a social entrepreneur was selected to explore the depth of the experience of forming competence by creating a state-up process. TEM, based on cultural psychology, is used to analyze and discover the process of entrepreneurial competence in the face of a lack of twin transportation. The author had the opportunity to listen to her lecture and interviews at a university in Japan in November 2023. Data were collected from Nakahara's (2022) experience and interviewed in April and May 2024. The author explained the purpose of the study and the participants provided informed consent.

3. Results

The process of Ms. Nakahara's SE is described in chronological order, starting with the birth of twins and continuing for eight years, through TEM analysis, as shown in Figure 1. The first period involved epic twin-rearing, the second period was longing and despair for twin bicycles, the third period was reactivation of twin bicycles, the fourth period was reaffirmation of the need for twin bicycles, and the fifth period was new activity as a non-profit as well as a profit-making company. A detailed chronological description of the experiences and perceptions during each period was provided.

3.1 Fierce Twin Parenting

Ms. Nakahara gave birth to her first son in 2003, followed by twins, the second and third sons, in 2010. During this period, [there was no time to spare or leave, and multiple births were psychologically and physically difficult. The mother was isolated from the rest of the society, and there was a lack of understanding of twin births in society and insufficient support from the local government] (SD1). She had experience raising singletons but was distressed by the differences between raising singletons and twins and keenly felt the difficulties] (OPP1). In particular, [not being able to go out freely with multiple children] (BFP1) became a burden for her. She tried to go out, using a stroller, and even used a bicycle to travel easily; however, she once fell over while carrying the twins on the front and back of the bicycle. After gaining such experience [looking for a commercialized twin bicycle] (BFP2), she could not find an off-the-shelf product, and it was impossible to manufacture a custom product. In other words, [an ideal commercial bicycle is not available in Japan] (OPP2). Under these circumstances, she chose to [commercialize twin bicycles herself] (BFP3).

> *Ms. Nakahara says, If I stop the twin bicycle now, the same problem will just repeat itself again. If I'm the closest to solving this problem and I'm just going to keep living, I know that raising twins is hard.*

3.2 Longing and Despair for Twin Bicycles

To commercialize the twin bicycles, Ms. Nakahara activated two things: first, she searched for a manufacturer of twin bicycles; second, she opened a personal blog to disseminate information. [The Amagasaki City bicycle network development policy was released] (SG1). To find a manufacturer, she researched the road traffic law and conducted prior research on design and patent rights. Through the experience of requesting and creating a prototype, she learned about the difficulties in creating a prototype. However, in the prototype, she recognized the joy of mobility and felt the pleasure of having her mind freed by it. Owing to concerns regarding the safety of the twin bicycles, the relationship with the manufacturer that created the prototype was terminated. The lesson learned from this activity was to continue to try to achieve her goals.

> *Ms. Nakahara says, There is nothing you can't do that you can imagine. I used the money I had saved at the time, and I decided to do it within that. I thought it would be interesting and fun.*

3.3 Re-Activating Twin Bicycles

Ms. Nakahara was [looking for a partner for the product from scratch] (BFP4). She re-examined the road traffic law and consulted the Japan Bicycle Promotion Institute. She also sought referrals to identify product partners. She learned how to create businesses at Amagasaki business support agencies. She gathered supporters through a blog and organized a test-ride event at the twin association.

> *Ms. Nakahara says, I tried to stay close to mothers and just pick up the voice of their help where they would be using it.*

3.4 Recognizing the Need for Twin Bicycles

Moreover, [she obtained information and learned from the local government and community] (OPP3). While learning about the twin bicycles, she encountered the business model canvas, a tool for creating business plans that gave her confidence in visualizing the value proposition that she had implemented. In addition, her experience as a mother, who faced difficulties in achieving mobility with twin children, motivated her activities. She was convinced that the twin bicycles would allow her to move freely and of her own will. These encounters and activities allowed her to [redefine the significance of commercializing twin bicycles] (OPP4). However, a fear overtook her in moving on with the project. As a result of her continuous efforts, she was able to negotiate with a manufacturer of child sheets after receiving a pamphlet that she had created. [The manufacturer's philosophy matched] (BFP5). She attended a mother's event and obtained 1,000 likes on Facebook. She was able to connect with other parents of twins online; later, an event was held in Kansai for the first time. There is a clear demand for twin bicycles. [A mass-production model of twin bicycles is completed] (BFP6). [She recognized the joy of mobility and the pleasure of having a free mind] (OPS5). After graduating from university [she obtained her Bachelor of Social Work degree] (BFT7), she began selling the twin bicycles (OPP6).

> *Ms. Nakahara says, When an executive director of the company saw the twin bicycles, he said I wonder what kind of expression a mother of twins has. I thought this person would be fine because of the words that show care for people.*

3.5 New Activities

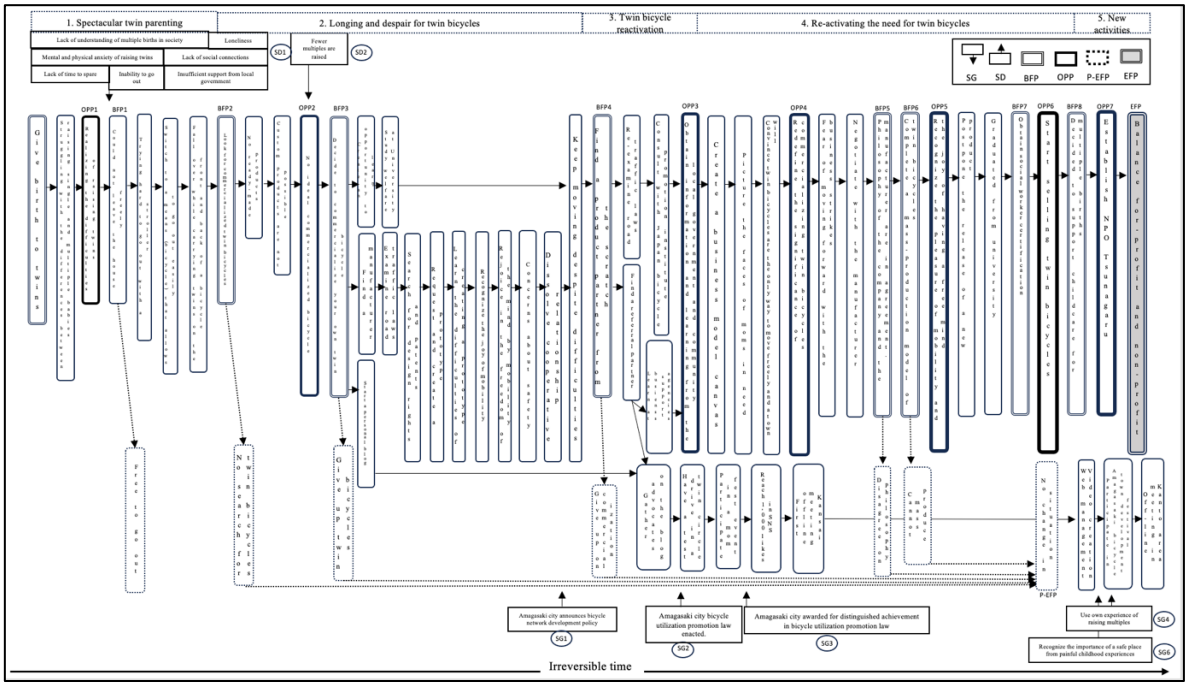
[After experiencing painful childhood experiences, she reaffirmed the importance of having a safe place to live] (SG4). [She used her own experience of multiple births] (SG5). [She decided to support multiple births] (BFT8). [She established the NPO Tsunagaru] (OPP6). [She implemented a balance between for-profit and non-profit] (EFP). She created a video to inform people about the twin bicycle initiative and provided accurate information about twin bicycles. She participated in the Amagasaki City bicycle town development fest and held face-to-face meetings with the parents of twins in the Kanto region.

> *Ms. Nakahara says, I would like to create a connection and freedom for parents of twins through a non-profit organization.*

The key processes involved in Ms. Nakahara's activities and social movements are listed in Table 1. EFP is a balance between for-profit company and non-profit organizations. The P-EFP is not a social change in the status of twin bicycles as a transportation or support activity. BFP includes 8 points. She was unable to go out freely and founded a commercial twin bicycle company. She decided to commercialize the twin bicycle, find a product partner, reach an agreement with the manufacturer, complete a mass-produced twin bicycle model, acquire a license to be a social worker, and support childcare for multiple children. The OPP includes the fact that she realized the difficulty of raising twins and realized that there were no ideal commercialized bicycles for twins on the market. She obtained information and learned from the local government and community, reconfirmed the significance of commercializing twin bicycles, recognized the joy of mobility, enjoyed having a free mind, started selling the twin bicycles, and established the NPO Tsunagaru. SG shows that she learned diverse perspectives and reflections at university, used the Amagasaki city bicycle network, reaffirmed the importance of a safe place through painful childhood experiences, and used her own experience of raising multiple children. SD shows a lack of understanding of twins in society, social connections, time, and support from the local government. Loneliness, mental and physical anxiety related to raising twins, inability to go out, and only a few people raising multiple children are affected by SD.

The results revealed several key characteristics of these social entrepreneurs, including notification of difficulties, willingness to create a better society, challenges for passion, personal resilience, empathy, knowledge, and networking abilities. Additionally, identifying social issues through problem-based learning and discussion has been highlighted as an effective approach to SE education. To foster a culture of SE in higher

education, it is essential to understand how to cultivate these key characteristics of SE and instill their values into future generations.



Source: Author

Figure 1: The process of Ms. Nakahara's action and social movement

Table 1: The key process of Ms. Nakahara's activities and social movement. Source: Author

Point	Explanation
EFP	Balance for-profit and non-profit
P-EFP	No social change in the status of twin bicycles as transportation and support activities
BFP	1. Can't go out freely 2. Find a commercialized twin bicycle 3. Decide to commercialize a twin bicycle 4. Find a product partner 5. Make an agreement with a manufacturer 6. Complete a mass-produced twin bicycle model 7. Acquire a license to be a social worker 8. Decides to support childcare for multiple birth children
OPP	1. Realize the difficulty of raising twins 2. No ideal commercialized bicycle on the market. 3. Obtain information and learning from the local government and community 4. Reconfirm the significance of commercializing twin bicycles 5. Recognize the joy of mobility 6. Pleasure of having a free mind 7. Start selling twin bicycles 8. Establish NPO Tsunagaru
SG	1. Use Amagasaki City Bicycle Network 2. Amagasaki city bicycle utilization promotion law enacted 3. Amagasaki city awarded for distinguished achievement in bicycle utilization promotion law 4. Reaffirm the importance of a safe place through painful childhood experiences 5. Use my own experience of raising multiple children
SD	1. Lack of understanding of twins in a society 2. Loneliness 3. Mental and physical anxiety of raising twins 4. Lack of social connections 5. Lack of time 6. Inability to go out 7. Inadequate support from local government 8. Only few people raising multiple birth children

4. Discussion

While SE spans a wide array of topics, research is often varied and spread across different areas. Thus, conducting research focused on SE within a particular region has become crucial to better understand localized dynamics. This study examined the process of the social entrepreneur Ms. Nakahara, who faced the issue of twin parenting and transportation in Japan. It aimed to clarify the process of entrepreneurial competency using TEM. TEM uses EFP, bifurcation point as BFP, polarized EFP, and OPP and describes SG and SD in an irreversible time. There are 5 periods for epic twin-rearing, the longing and despair for twin bicycles, the re-activation of twin bicycles, the reaffirmation of the need for twin bicycles, and the new activity as a non-profit as well as a profit-making company, is shown as EFP. As Tanimoto (2006) mentioned, the door to social issues through profit is not completely open; Ms. Nakahara also faced this challenge. She faced social issues and was challenged to overcome them by accumulating knowledge in universities and community schools and by networking with private and public community members. Twin bicycles evolved beyond mere transportation, representing liberation from societal limitations and offering a joyful, inclusive environment for twin children, parents, and their communities. Following the establishment of her twin-bicycle company, she launched a non-profit organization aimed at supporting families with multiple children and fostering community values.

According to Peredo and McLean's (2006) definition, Ms. Nakahara had a clear vision of creating social value by creating twin bicycles, recognizing opportunities, employing innovation, and considering risks with limited available resources. As Bornstein and Davis (2010) mentioned, SE progresses from observation and experimentation to innovative solutions; she observed mothers' behaviors on the road and listened to the real voices of mothers with twins. Making a mockup, she tried to look for manufacturers many times and experimented with creating prototypes. As Bornstein and Davis (2010) mentioned, SE describes a process aimed at solving social problems; Ms. Nakahara considered social issues seriously. She said, "the same problem will just repeat itself again if she does not take up the challenge to solve the issue."

Following Sarasvathy's (2008, 2015) five principles of effectuation, Ms. Nakahara reflected on her words and notes many times to know who she was and used her knowledge of SE, creating a business and community, demonstrating the bird-in-hand concept. She mentioned that she would create a business with her savings as an affordable loss. She used her parents-of-twins community and members of the community school where she studied business. Even though her work experience was as an office worker, she built and expanded her new twin family community like a crazy-quilt, both online and offline, and her supporters helped her find a manufacturer. Unexpectedly, she found her first partner to create the twin bicycles. However, her opportunity to learn about the law, mechanism of twin bicycles, and business creation was open, and she moved forward to the next step while making weak ties in the local community and government. Dreaming of having a twin bicycle, she adjusted flexibly to conflicts and produced results in the face of resolving the mobility of parents of twins in uncertain situations.

Her behavior adjusted for Dees's (1998) five criteria for social entrepreneurs. Her mission was clear and sustained social value for profit and non-profit organizations. She recognized new opportunities in spectacular twin parenting and pursued new opportunities to serve that mission. During the process, she improved the parents' well-being and satisfied herself as to well-being.

She adapted what she had learned in university and community schools regarding how to manage scarce resources through collaboration with others. Additionally, she learned about the laws, affordable loss, and philosophy for agreement with a manufacturer. All processes resulted in better mobility for parents of twins. Collecting the information from parents, she cared about her own needs, valued emotions mentioned by Kernis (2003), and learned and activated authentic leadership, as mentioned by Liu, Leanne, and Grant (2015).

Yin (1994) highlights the importance of a single case study. However, the main limitation of this study was its lack of objective thoughts and analyses. Another method, or a combination of analyses, can be used to understand the in-depth process of a social entrepreneur. Future studies should conduct longitudinal research on the SE process.

5. Conclusion

It is essential that SE research focuses on a specific area to gain deeper insights into entrepreneurial competency of SE. This study explores a crucial element of SE and its connection to life experiences of the social entrepreneur in Japan. Japanese society is still culturally closed to for-profit companies and open to government support in solving social issues. Ms. Nakahara suffered from community issues in achieving mobility as a parent of twins.

Her challenge with the new type of twin bicycle, which was officially supported by law, was a long journey. While creating a twin bicycle and building a twin community through social media and face-to-face events, she encountered conflicts with her partner. Throughout this process, she utilized effectuation principles by considering her identity, knowledge, and connections. She assessed affordable losses, formed partnerships, and adapted to sudden changes. She continuously learned to navigate these challenges while studying social welfare at universities and business in community learning schools. Twin bicycles have become more than simply a means of transportation. They symbolize freedom from societal constraints and provide a joyful and welcoming space for twin children, parents, and their communities. After creating a twin-bicycle company, she opened a non-profit organization to support multiple children and their parents and create value for communities. It is important to accumulate and use the life processes of social entrepreneurs for value creation in communities and for research.

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Key Factors for Student Startup Success: Insights from Higher Education Professors

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Abstract: The study aims to identify and analyse the key factors of student start-ups from the perspective of higher academic institution professors. Entrepreneurial students in higher education face challenges such as limited funding, scarce resources, lack of business experience and struggling to balance academic commitments with their start-up ventures. Additionally, they struggle with navigating complex business regulations and often lack access to proper networks or mentorship. This research contributes to a better understanding of how the entrepreneurial ecosystem in higher education institutions can support student start-up initiatives to succeed. For the research, a survey was conducted targeting ten experts from higher education institutions engaged with business or entrepreneurial study programmes. The research used the content validation method and descriptive statistical analysis to evaluate the responses, focusing on measures of central tendency and variability to determine the degree of consensus among respondents regarding the 36 statements provided. The study results revealed that while respondents agreed on the importance of student attitudes towards failure and self-confidence, there was strong disagreement among them regarding the belief that non-business students have a lesser chance of creating a successful startup. Also, experts suggested that entrepreneurship education should place more emphasis on the development of students' entrepreneurial mindset, which is considered to be an essential quality for the uncertain journey of entrepreneurship. Finally, the survey results indicated that networking and experiential learning are crucial for startup development. This underscores the importance of scientific debate not only on innovative funding models but also on non-financial support systems that surpass traditional educational methods in higher education environments.

Keywords: Entrepreneurial learning, Start-ups, Student entrepreneurship, University start-up ecosystem

1. Introduction

A significant body of research conducted in recent years suggests that conventional methods of developing startups and innovative enterprises often do not yield high success rates. A variety of academic sources highlight that the failure rate among startups is notably high, with estimates that 90% of new ventures do not succeed (Bangdiwala et al., 2022; Subrahmanya, 2022). Further evidence suggests a challenging landscape for new businesses, with only around 8% managing to establish themselves successfully (Startup Genome, 2023). Additionally, it has been noted that up to three-quarters of ventures receiving startup capital do not progress past advanced developmental stages (Gosh, 2020). Similar findings on the high incidence of startup failures have been echoed in other scholarly work (Yusoff et al., 2019).

These studies identify the most common reasons for startup failures, including products that do not meet market needs, conflicts within development teams, poorly planned cash flows, lack of finance, inability to attract venture capital investment, failure to create a competitive advantage, inappropriate business models, and ineffective marketing strategies (Szathmari et al., 2024). Moreover, a study published in the Harvard Business Review states that the average age of a successful startup founder is 45 years old (2018). The high failure rate and these mentioned reasons for unsuccessful startup attempts suggest that founders often lack the knowledge, skills, and understanding of how the entire startup ecosystem functions and, fundamentally, what the supporting startup ecosystem framework should be in this entrepreneurial journey.

Besides being seen as theoretical and bureaucratic institutions, higher educational institutions are increasingly recognized for their pivotal role in fostering innovation and entrepreneurship among students. This evolving perception underscores the potential of academic environments to bridge the gap between theoretical knowledge and practical application, supporting the next generation of entrepreneurs. On other hand, students naturally lack life experience, professional skills and knowledge, and other qualities needed for successful startup building and scaling. Despite a wealth of scientific literature analyzing student entrepreneurship, debates among scholars continue, highlighting a gap in the efficient startup ecosystem and creation process. Creating an appropriate, effective, and impactful structure for facilitating startup ecosystems in academic environment continues to be a significant topic for research.

Thus, to identify and analyse the key elements within higher educational institutions' entrepreneurial ecosystems that contribute to the success of student start-ups, ten business school professors were surveyed

to gather empirical data. Only professors with practical and academic backgrounds in business and entrepreneurship were selected for the survey. To ensure the validity of experts' opinions, the content validation method was applied.

The paper is divided into five sections: The first section analyses a scientific literature on factors influencing the entrepreneurial ecosystem at an academic institution. The second section describes the research methodology. In the third section, the results of the experts' survey are analysed. The fourth section provides a discussion of the findings and propose entrepreneurial university ecosystem framework based on the perspective of business and entrepreneurship professors. Finally, the last section presents the conclusions and proposes recommendations for further studies.

2. The Theoretical Background of the Research

Students who try to start their own businesses or launch startups face many challenges, such as not having enough knowledge, skills, capital needed for idea execution, network, real-world experience, knowledge of the industry, and the right entrepreneurial mindset, which includes understanding emotions, being able to take risks, and being able to accept failures. On the other hand, universities are still perceived as institutions that prioritize theoretical learning over the practical training required to navigate the complexities of the business world. This perception presents a significant obstacle to fostering an entrepreneurial mindset among students and the creation of startups within academic environments.

Student entrepreneurship and startup launch are complex phenomena analysed extensively in academic studies. Table 1 presents the most prevalent research areas pertaining to student entrepreneurship within higher education institutions, as identified in scientific literature. Beyond formal entrepreneurship education, universities offer a variety of support mechanisms. Additionally, the personal traits of students significantly influence their perception of entrepreneurship, as well as their motivation and intention to embark on risky ventures. Some studies (e.g., Morris et al., 2017), highlight the ambiguity of funding for student-run startups, suggesting that university funding can be seen as more of a negative than a positive factor in facilitating such startups.

A substantial volume of literature examines the networks necessary for students. Networking is identified as a critical facilitator for acquiring resources, particularly in the early stages of startup development. A pivotal factor in fostering student entrepreneurial intentions and the successful launch of startups within an academic environment is the direct involvement of professors in the business and entrepreneurship education process. Research indicates that the professor's role has a significant and positive impact on student motivation to initiate new ventures.

Table 1: Factors Influencing Student Startup Success.

Factors	Key area of research	Authors
Formal educational programs	Studies in business and entrepreneurship enhance students' understanding of developing startups and contribute to increased efficiency.	Wang et al. 2021; Breznitz et al., 2019; Hahn et al., 2017.
Technology skills in entrepreneurship	The integration of technology skills in entrepreneurial education has been extensively analysed.	Karpenko, 2022; Haneberg et al., 2020
Entrepreneurial mindset, emotional intelligence and personality traits	Students' attitudes towards failure, risk tolerance, and comfort zones have been analyzed and identified as very important factors for their motivation and intentions.	M. van Gelderen, 2023; Daspit et al., 2021; Hägg et al., 2021; Kitsios et al., 2021
Supporting mechanism	Pre-accelerators, accelerators, and incubators can not only increase students' motivation and intention but also provide practical learning opportunities, mentorship, and networking.	Vardhan et al., 2022; Theodoraki, 2020; Lyken-Segosebe et al., 2020; Åstebro et al., 2012; Morris et al., 2017.
Alumni	Alumni entrepreneurship clubs can offer valuable resources to students, such as experience and networking opportunities, particularly in the early stages of startup development.	El-Awad, 2022; Landoni et al., 2021; Wright et al., 2017.
Professor's previous experience in business	An professor's previous experience in entrepreneurship can increase the motivation and intention of students to launch new startups.	Wraae et al., 2020; San-Martín et al., 2019; Diegoli et al., 2018.

Factors	Key area of research	Authors
Funding	Various financial support mechanisms can be provided at universities for students' ventures.	Hisrich et al., 2020; Morris et al., 2017; Choi et al., 2017; Klyver et al., 2013.

Source: Authors

In summary, while academic research offers valuable insights into the factors affecting student entrepreneurship, there is a paucity of literature that provides a more in-depth analysis of the ways in which these factors interact, their relative importance, and other practicalities of implementing student-led startup support structures within academic institutions. The current study bridges this gap by critically examining key factors such as comprehensive educational programs, the integration of technology skills, the cultivation of an entrepreneurial mindset, and the establishment of robust support mechanisms like accelerators and incubators. Despite the recognized importance of these elements, there remains an underexplored need to understand how they synergistically contribute to student's entrepreneurial success. For instance, while educational programs provide foundational knowledge, their effectiveness is amplified when coupled with technology skills that prepare students for the digital landscape of modern entrepreneurship. Similarly, fostering an entrepreneurial mindset through experiential learning environments like incubators and accelerators is crucial, yet the optimal balance and interaction between these supports require further scrutiny. Alumni networks and experienced faculty play pivotal roles in mentoring and providing practical insights, but their impact varies depending on the extent of engagement and integration with institutional resources. Moreover, financial support mechanisms are essential but must be strategically aligned with these factors to ensure sustainability and growth of student ventures. This study highlights the necessity for higher education institutions to adopt a holistic and integrated approach, focusing on the interplay between these factors to create an effective entrepreneurial ecosystem that not only supports but also enhances student-led startups.

3. Research Methodology

The research methodology was devised to collect data directly from the professors of business and entrepreneurship programmes who are most closely involved in the educational process. A content validation method approved by experts, combined with a descriptive statistical analysis approach, was employed with the objective of integrating insights derived from both qualitative and quantitative methodologies. This approach facilitated a more nuanced understanding of the entrepreneurial ecosystem within higher educational institutions based on professors' perspectives.

The research design and sample selection were carefully considered in establishing a solid foundation for choosing professors in a study on how higher educational institutions can promote startup creation. The profile of the professors was carefully considered in their selection process. All participants had between 5 to 30 years of experience teaching business and entrepreneurship subjects. Eight out of ten reported having previously run a business, and two had held CEO positions before transitioning to teaching. The professors were selected from a single business school located in Barcelona, Spain.

To capitalize on the benefits of the survey's results, the Likert scale was employed in the research. The Likert scale, a commonly used tool in survey research, has been the subject of various studies (Bhati et al., 2023; Yin, 2023). Various authors (Wu et. Al., 2017) suggest different point scales for Likert scale, however this scale typically ranges from 1, indicating strong disagreement, to 5, signifying strong agreement. The scale's structure is straightforward, assigning numerical values to each choice: 1 corresponds to "strongly disagree," 2 to "disagree," 3 to "neither agree nor disagree," 4 to "agree," and 5 to "strongly agree." The Likert scale is renowned for its ease of use and effectiveness in transforming subjective opinions, attitudes, and preferences into quantifiable data for analytical purposes.

The study type was qualitative with combination of quantitative techniques. Regarding the content validation process, there is a diversity of scholarly opinions on the ideal number of experts required. It has been proposed that a minimum of three experts is necessary to ensure effective content validation (Lynn, 1986). A comprehensive validation process requires at least three panels, including both content experts and laypersons (Rubio et al., 2003). Further research suggests that the ideal number of experts may vary significantly, from as few as two to as many as twenty, depending on the specific needs of the study (Walz et al., 1991). Additionally, others argued that the number of experts engaged should match the required expertise and research scope (Grant et al., 1997).

On the other hand, the specific number of experts involved in the content validation process should not be rigidly determined, even though many studies typically involve around 10 experts. This viewpoint is based on the challenge of achieving a unanimous decision within a large panel of experts. Conversely, having too few experts might result in limited information for the development of the instrument. Some authors suggest that an optimal number of experts is between 5 to 10. (Roebianto et al., 2023).

Engaging 5-10 experts offers a diversity of perspectives while remaining manageable in terms of data analysis and coordination. According to studies and scholars, including V. Rudzkiene (2005) it is posited that the evaluation of opinions from 10 experts correlates with a 95% reliability rate in their opinions. This approach is both efficient and sufficient for gaining a comprehensive understanding of the subject under study and for determining the validity of content. The literature review suggests that involving 10 experts is considered optimal for content validation purposes.

Questionnaire and results interpretation. Initially, a panel of ten experts with extensive backgrounds in entrepreneurship education was assembled. These experts were provided with a draft of the survey questions and asked to evaluate each item for clarity, relevance, and alignment with the research objectives. They provided detailed feedback on ambiguous wording, the appropriateness of the questions, and the overall structure of the survey. Based on their feedback, several iterations of revisions were made to the survey instrument. The refinement process involved incorporating suggestions to enhance question clarity, ensuring that all questions were directly relevant to the key factors being studied, and restructuring the survey for better logical flow. This rigorous validation process not only improved the reliability and validity of the survey but also ensured that it comprehensively captured the critical elements necessary for analysing the success factors of student start-ups in higher education contexts. Finally, the online survey was developed using the Google Docs tool. The questionnaire comprised both closed-ended and one open-ended question, designed to capture quantitative data and qualitative insights, respectively. 34 statements based on scientific literature review were formulated. The statements were analyzed based on descriptive statistics.

Data Collection. Distribution of the survey was supported by faculty members.

Data Analysis. Quantitative data were analyzed using the MS Excel software package. Descriptive statistics, including mean, median, mode, standard deviation, skewness, kurtosis, sum, standard error, range, minimum, and maximum values, were computed for this analysis. This approach enabled the identification of which statements received the most agreement and disagreement among startup founders, as well as how the data (responses) were distributed across each statement.

The top 5 scores, collecting both maximum and minimum sums, were identified to represent the extent of professors' agreement or disagreement with each statement. Subsequently, the standard deviation was calculated for these scores, isolating the top 5 maximum and minimum values. A comparative table was then created to correlate the maximum and minimum sums with the maximum and minimum values of standard deviation. This analysis enabled the identification of statements with the highest level of consensus (agreement) and those that were more contentious (disagreement), highlighting which statements were unanimously agreed upon and which ones were more debatable. The final results were presented in a table. Based on the professors' perspectives and a literature analysis, a framework outlining the elements that influence the success of student-run startups was proposed in the discussion section.

The choice to analyse the top 5 statements is a deliberate methodological decision that balances cognitive efficiency, practical significance, academic norms, and the need for focused, impactful communication of research findings. This choice is supported by established principles and practices in both quantitative and qualitative research.

Validity and Reliability. To ensure the content validity of the survey, a panel of experts from the fields of entrepreneurship and business research reviewed the survey. Feedback was incorporated to refine the questionnaire.

Limitations. This research may have several limitations. The findings might not be generalizable to all countries, types of universities, or various academic disciplines such as natural sciences, technology sciences, social sciences, and humanities. Academic institutions in each field possess their unique characteristics, and thus the insights provided should be interpreted with caution. For example, the factors contributing to startup success can differ significantly between fields like space technology, biotechnology, and software technology. In the case of space or biotechnology startups, funding may be a crucial factor, whereas it might be less critical for software startups. However, it is important to note that this research was specifically targeted at academic

institutions within the social sciences. Therefore, caution should be exercised when interpreting the results in the context of industry-specific startups, such as those in deep tech, within academic ecosystems.

4. Results

The results of research highlight the elements with the strongest agreement among professors, reflecting a consensus on the critical drivers of student startup success within academic environments. The minimal standard deviation for attitudes toward failure and self-trust, alongside high sum values, underscores a robust professors' consensus on these key psychological factors of entrepreneurship. These traits are seen not just as advantageous but as crucial for fostering entrepreneurial spirit within the educational system.

The high valuation of a constructive attitude towards failure and self-trust aligns with the literature that emphasizes the entrepreneurial mindset. This mindset includes both the resilience to endure challenges and the ability to view failures as lessons to be learned, instead of as unbeatable barriers. By cultivating such attitudes, professors can potentially improve students' persistence and adaptability in educational process, which are crucial in the volatile journey of entrepreneurship.

Supportive faculty, investor networking, and structured program elements like pre-accelerators, accelerators, and incubators reflect an agreement on the importance of community engagement and experiential learning. The emphasis on these areas highlights the professors' belief in the necessity of practical, hands-on involvement and real-world connections to cultivate successful student-led startups.

The focus on the role of practical experience of professors and structured programs like pre-accelerators and incubators suggests a strong belief in the power of guided experiential learning. These structured programs provide a sandbox environment for students to test theories and assumptions, iterate on their business models, and gain real-world experience in a relatively risk-free environment. They also serve as pathways for mentorship, where practitioners can impart practical wisdom and insights that are not readily derived from textbooks.

Networking is repeatedly highlighted, indicating the critical role of social capital in startup success. By facilitating connections with investors and experienced entrepreneurs, professors can bridge the gap between academic learning and the practical realities of the entrepreneurial ecosystem. This may enhance students' ability to secure funding, mentorship, and strategic partnerships, which are often pivotal for a startup's growth and sustainability.

Table 2 summarize top 5 statements with highest agreement among surveyed professors.

Table 2: Top 5 Statements with Highest Agreement Among Professors

No.	Statement	SD min	Sum Max	Coef.
28	A constructive attitude towards failure, viewing setbacks as learning experiences, is critical in developing student-run startups.	0,32	49	0,65
29	Trusting in oneself is essential for entrepreneurs; it fuels determination and is key to the success of student-run startups	0,32	49	0,65
8	The presence of supportive faculty and staff is pivotal in nurturing entrepreneurial activities, providing students with the guidance, mentorship, and resources necessary to turn innovative ideas into successful start-ups.	0,42	48	0,88
19	Networking opportunities with investors can foster successful student-run startup development	0,42	48	0,88
10	The active programs of pre-accelerators can significantly foster students' initiatives in developing start-ups.	0,48	47	1,02
11	The active programs of accelerators can significantly foster students' initiatives in developing start-ups.	0,48	47	1,02
12	The active programs of incubators can significantly foster students' initiatives in developing start-ups.	0,48	47	1,02
6	Professors' previous experience in business / entrepreneurship can significantly foster students' Start-up successful development	0,48	47	1,02

Source: Authors

Other selected statements where professors exhibited the least agreement, pointing to areas of contention regarding student startup success within academic environment. The highest standard deviation for the impact of the field of study on startup success indicates substantial debate among professors. This could reflect differing views on the relevance of non-business disciplines in cultivating entrepreneurial capabilities. The stark variance on the impact of non-business studies suggests a debate over the breadth of skills necessary for entrepreneurship, questioning the traditional business-centric model. The reduced focus on specific fields of study signals a call for curricular reforms that embrace a cross-disciplinary approach, equipping students with a wider entrepreneurial skillset. On the other hand, this also indicates that entrepreneurial studies alone are not sufficient for the successful development of startups.

Divergent opinions on legal support and the utility of dedicated physical spaces — such as labs and collaborative areas — highlight a lack of consensus on their roles in startup development. These elements, while recognized, may not be seen as central to the entrepreneurial process compared to other factors. This variability, especially where coefficients are high, suggests that the impact of these factors on student startup success is subject to interpretation and possibly dependent on individual institutional contexts. The professors' mixed responses here could signify the complexity of defining a one-size-fits-all approach to entrepreneurship education and indicate potential areas for further investigation and dialogue.

Differing views on the importance of risk-taking and comfort zone expansion point to a critical examination of how entrepreneurship education addresses personal growth versus business awareness. Varied opinions on student-run clubs reflect a critical look at their practical impact versus formal entrepreneurship programs. These disparities call for a critical re-evaluation of educational approaches to better align with the complex and dynamic nature of startup success.

Table 3 summarizes top 5 statements with lowest agreement among surveyed professors.

Table 3: Top 5 Statements with Lowest Agreement Among Professors

No.	Statements	SD_Max	Sum_Min	Coef.
4	The impact of field of study on students' start-up success: non-business students have less chance to create a successful start-up.	1,37	31	4,42
23	Providing students with dedicated physical space and infrastructure, such as rooms, corners, labs, and hubs, can significantly enhance their startup activities and success.	1,03	42	2,45
27	The willingness and readiness to step out of student's comfort zone often serves as a catalyst for students run startup successful development.	0.97	45	2,16
24	Student-run start-up and entrepreneurial clubs play a pivotal role in fostering a culture of innovation, providing peer mentorship, and offering a collaborative platform that can significantly boost the growth and success of student-led startups.	0.95	43	2,21
20	Legal and regulatory support, including trademark, patent, and company registration, can foster startup development within higher educational institutions	0,82	40	2,05

Source: Authors

In summary, the research indicates a strong consensus among professors on the significance of psychological factors like a positive attitude towards failure and self-trust for student entrepreneurial success. These traits are considered essential for encouraging an entrepreneurial spirit in academic environments, aligning with the literature on the entrepreneurial mindset focused on resilience and learning from failure.

There is also agreement on the value of community engagement and experiential learning through support from faculty, investor networking, and participation in structured programs like pre-accelerators, accelerators, and incubators. Such programs are seen as vital for providing practical experience, mentorship, and real-world business model testing.

However, professors showed less consensus on the influence of the field of study on startup success, suggesting a debate over the necessity of a business-focused curriculum versus a broader, cross-disciplinary approach. Opinions also varied on the importance of legal support and dedicated physical spaces, indicating these may be more institution-specific in their impact on startups.

Furthermore, the research calls for a re-evaluation of entrepreneurship education, considering divergent views on the roles of risk-taking, comfort zone expansion, and the effectiveness of student-run clubs compared to formal programs. This underscores the necessity for a comprehensive startup support framework within higher educational institutions to effectively address the complexities of entrepreneurship.

5. Discussions

Based on scientific literature analyses and empirical survey of professors, it is possible to structuralize and propose the elements of ecosystem for entrepreneurial higher education institution. The framework depicts various factors that influence a startup ecosystem within an academic environment, plotted along two axes. The Y-axis represents the level of influence of provided elements of the startup ecosystem, and the X-axis represents likelihood of student startup success within academic institution.

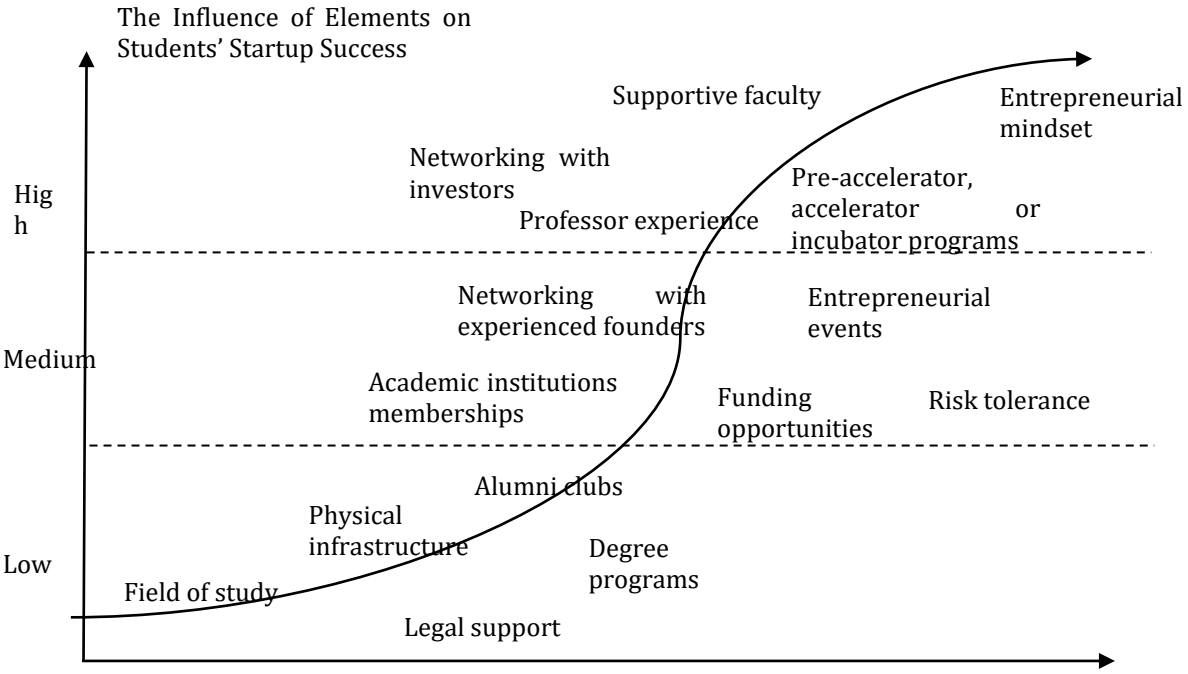


Figure 1: Framework of Influential Factors in Student Startup Success within Academic Institutions (authors creations)

The framework underscores a shift from traditional academic achievements to a more holistic and network-oriented approach in fostering successful student-led startups. The presence of accelerator and incubator programs suggests the university's role is not just educational but also as an ecosystem builder, facilitating students' practical business skills and risk tolerance.

This framework reinforces the idea that while foundational academic offerings like field of study and infrastructure are necessary, they are not sufficient. Instead, the emphasis should be on creating a robust support system through mentorship, networking, and a campus culture that promotes and understands the nuances of entrepreneurship.

6. Conclusion

The key following findings highlight the complex nature of entrepreneurial success in higher education and the necessity for institutions to adopt comprehensive, inclusive, and practical approaches to support student start-ups:

- The study revealed that entrepreneurial attitudes, specifically towards failure and self-confidence, are crucial for the success of student start-ups. Professors agreed that fostering a constructive attitude

towards failure and encouraging self-trust are essential psychological factors that significantly influence entrepreneurial success.

- There was strong disagreement among respondents regarding the belief that non-business students have a lesser chance of creating a successful start-up. This indicates a need for a more inclusive approach that supports students from diverse academic backgrounds in their entrepreneurial endeavours.
- Experts suggested that entrepreneurship education should place more emphasis on the development of students' entrepreneurial mindset. This mindset, which includes resilience, risk tolerance, attitude to failure and adaptability, is considered essential for navigating the uncertain journey of entrepreneurship.
- The survey results indicated that networking opportunities and experiential learning are vital for the development of student start-ups. Practical learning environments such as pre-accelerators, accelerators, and incubators, along with mentorship and real-world connections, are critical components of a supportive entrepreneurial ecosystem.
- The findings underscore the importance of not only innovative funding models but also non-financial support systems that go beyond traditional educational methods. These support systems are vital for creating a nurturing environment that can help student entrepreneurs succeed.

The results of the conducted research yield several theoretical and practical implications.

6.1 Theoretical Contribution

The findings from the presented framework contribute to entrepreneurial theory by emphasizing the critical role of social and human capital in the success of student startups. They suggest that while foundational academic elements such as field of study and physical infrastructure are important, the intangible assets gained through networks and mentorship are more influential. This highlights a potential shift in entrepreneurial theory toward the significance of an educational institution's social infrastructure over its physical or traditional academic offerings. By reinforcing the value of experiential learning, faculty support, and an entrepreneurial culture, these findings can inspire a revaluation of how educational policies and programs are structured to cultivate successful student entrepreneurs, providing a blueprint for future theoretical exploration in the realm of student entrepreneurship and entrepreneurial university ecosystems.

6.2 Practical Implications

The findings and proposed framework could guide academic institutions in designing policies and programs that prioritize these high-impact elements, therefore creating an environment where student-led startups can thrive. Integrating this framework into the research would provide a deeper understanding of what contributes most significantly to the success of student entrepreneurs and would likely resonate with the broader academic and entrepreneurial communities. Based on the findings, the following practical recommendations are proposed for higher education institutions to foster successful student start-ups a) Integrate comprehensive entrepreneurial courses that combine theoretical knowledge with practical applications, b) Incorporate technology skills training into entrepreneurship programs, c) Develop workshops and seminars focused on resilience, risk management, and learning from failure, d) Establish and maintain pre-accelerator, accelerator, or incubator programs, e) Create platforms for current students to connect with successful alumni entrepreneurs, f) Hire and support faculty with real-world entrepreneurial experience, g) Develop funding programs such as grants, loans, and venture capital partnerships specifically aimed at student ventures, H) Encourage cross-disciplinary collaborations and courses that combine business, technology, and other relevant fields.

6.3 Future Research Developments

Several constraints could affect the applicability of this study's results. Its conclusions may not universally apply across different nations, university models, or academic sectors, including the natural and technological sciences, as well as the social sciences and humanities.

Furthermore, as the elements indicate, the nature of student-led startups in academic environments is quite complex. The results are based on the perspectives of professors. It's important to highlight that the ecosystem comprises a variety of stakeholders, so developing a research methodology that includes the viewpoints of other key players—such as investors, corporate partners, experienced founders, and the students themselves—would be beneficial.

Moreover, the findings and proposed framework based on professors' perspective could be used as a foundation for developing hypotheses for further research, such as exploring the causal relationships between these elements and the actual success of student-run startups.

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Emphasizing Sustainability in Entrepreneurship Education: Lessons Learned from a Case Study

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Abstract: In response to the growing imperative for sustainable entrepreneurship, this study investigates the efficacy of integrating targeted sustainability content into an action-learning-oriented international entrepreneurship course. This case study aimed to evaluate the impact of integrating sustainability content into an existing entrepreneurship course focusing on food-related business ideas to enhance students' sustainability literacy and understanding of sustainable entrepreneurship. Self-reflection protocols of two consecutive student cohorts of the same course were compared before and after the curriculum modification. The results clearly show that both student groups have built up many competencies, and significant knowledge of, entrepreneurial skills. However, the first group built up fewer skills in sustainability. The findings serve as an essential insight for entrepreneurship lecturers who aim to enhance entrepreneurial and sustainability skills among their students, as well as a thorough understanding of impact entrepreneurship. They receive helpful advice on which content to add to their existing entrepreneurship courses to emphasize sustainability.

Keywords: Entrepreneurship education, Impact entrepreneurship, Sustainable entrepreneurship, Social entrepreneurship, Project-based education, International collaboration

1. Introduction

A significant challenge in teaching-learning nowadays is to encourage entrepreneurship among university students (Ratten & Usmanij, 2021; Rauch & Hulsnik, 2015). Another priority is the development of critical competencies for sustainable development within universities (Barth et al., 2007). Therefore, integrating sustainability is a challenge that universities are beginning to address (Salleh et al., 2019). Strengthening students' entrepreneurial mindsets and creating positive social and environmental benefits is a crucial goal (Severo et al., 2019). The authors aimed to emphasize this goal in the entrepreneurship course they had been teaching for seven semesters. Even though they had told their students to make sure the business ideas they developed during the course should have a positive impact on society or the environment, most teams came up with "classic" business ideas focusing on economic aspects only. Therefore, the lecturers decided to include additional sustainability content into the course and to measure the before-and-after learning success. The results provide practical insights for entrepreneurship lecturers who also seek to emphasize sustainability in their entrepreneurship courses.

After explaining the theoretical foundation of this research, the methodology is described. This is followed by the results of the empirical research which are discussed, by implication, regarding both theory and practice. Finally, the limitations of this research are outlined, future avenues for research are presented and conclusions are drawn.

2. Theoretical Foundation

Acquiring sustainability competencies is essential for students and faculty to deal with sustainability topics and to create impact. Education for sustainable development is paramount and the challenges and potentials of this field need to be recognized (Leal Filho et al., 2018). Several studies show examples of combining entrepreneurial and sustainable learning goals into the curriculum (Grimm & Bock, 2022; Krzywonos et al., 2023).

However, integrating sustainability aspects to enhance the environmental or social impact of student business ideas should not be a task by faculty alone. Student involvement in curriculum development is essential and can positively influence the effectiveness and relevance of educational programs. Bovill et al. (2011) suggest that engaging students in curriculum design can increase engagement. They are more likely to develop a sense of ownership for their studies when actively involved in curriculum design. Furthermore, student engagement in

curriculum development may result in enhanced academic performance and a greater enthusiasm for learning (Heller et al., 2010). Additionally, project-based learning approaches focusing on sustainability topics can create societal and environmental impact driven by students (Rajan et al., 2019). Figure 1 shows the theoretical foundation for this research.

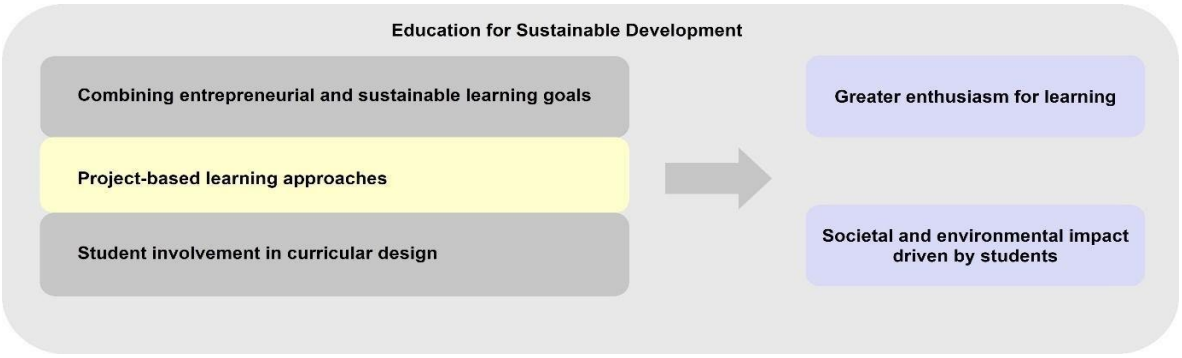


Figure 1: Research framework (source: Own illustration)

The authors aimed to combine entrepreneurial with sustainable learning goals and to involve their students in this effort within an existing project-based, international, and multidisciplinary entrepreneurship course. They wanted to determine whether they could enhance students' sustainability competencies by explicitly adding additional sustainability content and measuring the before-and-after of two consecutive courses. The authors asked the following research question: What is the effect of integrating sustainability content into an existing entrepreneurship course?

3. Methodological Approach: Case Study Research

Coming from a critical realism philosophy and an abductive approach to theory development, mixed method research was chosen using a case study (Yin, 2018). Two consecutive entrepreneurship courses (before and after adding more sustainability topics) served as a comparison for this real-life setting; hence, it was a longitudinal study (Saunders et al., 2023).

3.1 Case Study Setting

The case study's entrepreneurship course was launched in the winter term of 2020 by the Munich University of Applied Sciences (HM). The instructors from the Business School and the Faculty of Applied Sciences and Mechatronics jointly offered an entrepreneurship course focusing on Food and Agriculture, targeting students from their respective departments. The course embraced a problem-based learning approach. Students were tasked to develop an innovative business idea for an existing problem in Food and Agriculture. The lecturers and their business network brought in the challenges to solve. Universities can foster learner-to-content engagement and promote active participation in sustainable initiatives by including real-world projects that build technical and critical thinking skills (Martin & Bolliger, 2018). In the following semester, the course was opened for students from two partner universities: King's College in Kathmandu, Nepal, and Durban Technical University in South Africa; thus, apart from being interdisciplinary, the course became international. The semester after, subject-matter expertise in Food was brought with a lecturer and students from Wroclaw University of Economics and Business in Poland, and the course switched to a flipped classroom format. The theoretical underpinnings of the course were delivered via videos that the lecturers had recorded and provided on sce.academy, the Massive Open Online Course (MOOC) platform of the Strascheg Center for Entrepreneurship (SCE), the entrepreneurship center of HM. Students prepared themselves by watching the lecture material before class, which allowed for more coaching and discussion time during classes. Successful founders in Food and Agriculture were invited to give impulse speeches about their as entrepreneurs. Even though the authors continuously emphasized that students should aim for business ideas that impact the environment or society, students often came up with business ideas focusing solely on the economic aspect. Thus, the lecturers decided to add additional sustainability content to the course and measure whether this would raise sustainability literacy and result in business ideas with more impact.

3.2 Changes to the Course Content to Emphasize Sustainability

To create a basis for a sustainability definition and a setting for the course in terms of what impact means, the authors added a flipped classroom lecture on Sustainable Development Goals (SDGs, https://sdgs.un.org/goals),

following Popelo et al's (2022) advice to align institutional capabilities with global sustainability efforts like the SDGs and the quest to develop courses and activities that focus on the implementation of SDGs in university teaching (Botes et al., 2014; Brugmann et al., 2019).

Additionally, the authors looked at the results from the self-reflection protocols from the summer cohort to assess what type of sustainability content to add. The students were asked (apart from their module assignments regarding their business idea) to write a self-reflection protocol on several predefined questions regarding their learning success and acquired competencies during the course. This self-reflection was marked and resulted in 10% of the final grade. 26,3% of the students mentioned that they needed some slides or introduction material to the topic of sustainability. As one participant phrased it: "There was no basic introduction to the topic of sustainability." (Summer23_RP Food - Reflection 6, Pos. 29). Another recommendation from students was to ask guest speakers to discuss about more sustainable management within their startups.

The authors took this feedback and added two new videos (on Sustainable Business Models and Circular Business Models) and two new readings on Impact Business Models to the flipped classroom platform, taking into consideration Collado et al.'s (2021) advice to develop programmes that focus on innovation for environmental sustainability to create a long-term effect on students' positive ecological behaviours. Sady et al.'s (2019) suggestion to organize extracurricular activities to develop impact-oriented competencies was incorporated by inviting students to participate voluntarily in the Start for Future community (https://startforfuture.eu) to get even more international exposure and inspiration from other student teams and coaches. All this additional content was integrated into the course to increase sustainability literacy among students (Albinsson et al., 2020). The next step was to evaluate whether student-perceived sustainability literacy has been increased via the course.

3.3 Data collection and Analysis

Data was collected from participating students from Nepal, Poland, and Germany of the summer term 2023 (19 participants) and winter term 2023/24 (25 participants) via self-reflection protocols. Inspired by the EntreComp Entrepreneurship Competency Framework (Bacigalupo et al., 2016) and the GreenComp European sustainability competence framework (GreenComp, 2022), the self-reflection protocols contained three open questions and five closed questions. The closed questions were collated with Excel. The open questions were analysed using Kuckartz's (2018) qualitative content analysis with the support of MAXQDA. Qualitative content analysis is a technique whereby text, voice, or visual data is categorized by developing and using a systematic coding scheme to enable quantitative analysis (Saunders et al., 2023, p. 584). For this paper, only text data from the self-reflection protocols of the two student cohorts was used.

In the first step, the first author coded 20% of the total material and developed a coding system. The main categories from the coding system were developed deductively, derived from the questions themselves: "What have you learned about entrepreneurship and innovation? How can this knowledge be useful for your future life?" built the main category "Learning outcome entrepreneurship." The questions "What have you learned about sustainability? How can this knowledge be beneficial for your future life?" built the main category "Learning outcome sustainability." Finally, the question "What has not been addressed in this course to address sustainability and foster positive impact generation?" built the main category "Not addressed to foster positive impact generation." The sub-categories for these three main categories were developed inductively and in-vivo during the coding process, and one main category emerged during the coding process: "Other learning outcomes." After the first coder had developed the basic coding system, all authors gathered to discuss it and applied it to two additional protocols. During this process, slight changes to the names of the codes were made, and a new main category, *Influencing factors*, was added, as well as the sub-code *Adaptability*.

The artificial intelligence functionality called "automatic coding" from Atlas.ti 2024 was used to develop a coding system compared to the one created manually. This exercise delivered 674 codes in total. The authors concluded that the level of detail was too high and that the intended aggregation of meaningful categories was not addressed adequately. Therefore, this logic was disregarded. Instead, another artificial intelligence functionality in Atlas was used: coding based on the research question. This exercise delivered 839 codes, and the authors agreed that three of them were meaningful and an excellent addition to the coding system and were therefore added: *Broadening understanding*, *Applicability*, and *Perseverance*. A codebook was created where each code was assigned a definition and an anchor example, making it easier for the authors to discuss the coding system. All changes to the coding system were captured in the logbook functionality of MAXQDA for traceability and reliability. After inter-coder reliability was ensured, the first author manually coded the remaining self-reflection

protocols of the summer and winter cohorts. Finally, the coding system consisted of five principal codes and 13 subcodes. Figure 2 shows the coding system.

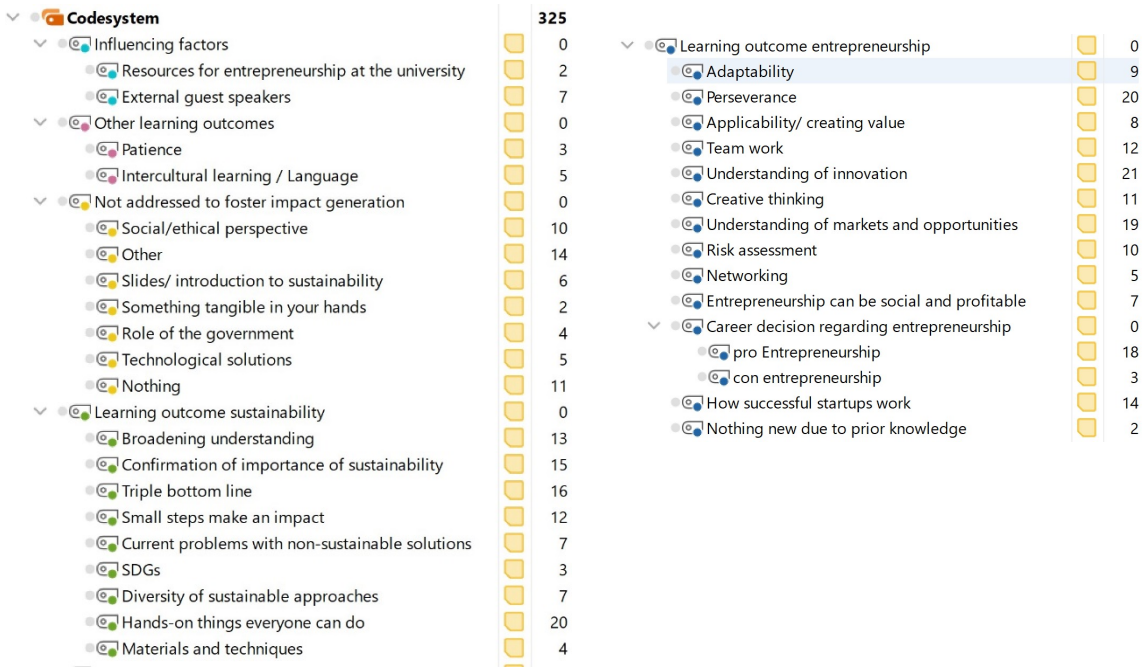


Figure 2: Coding system overview (source: own illustration from MAXQDA)

Besides analysing the open questions with qualitative content analysis, the authors looked at the five closed questions from the self-reflection protocols to answer the research question. Students answered the following questions in a Likert-scale-5 format referring to the skills they had developed during the course.

- How would you rate your knowledge of sustainability in startups?
- How would you rate your knowledge of eco-design?
- How would you rate your knowledge of social sustainability?
- How would you rate your knowledge of life cycle assessment?
- How would you rate your knowledge of Sustainable Development Goals?

The answer spectrum ranged from 1 = I have no idea to 5 = I am an expert in this topic. One student from the winter cohort still needs to fill out these questions. Therefore, N was 24 in the winter and 19 in the summer cohort.

4. Results

To answer the research question: *What is the effect of integrating sustainability content into an existing entrepreneurship course?* The following three questions from the self-reflection protocols were analysed with MAXQDA and compared regarding the two different student cohorts:

- Which topics should be included in this course to address sustainability and foster positive impact generation?
- What have you learned about sustainability? How can this knowledge be beneficial for your life?
- What have you learned about entrepreneurship and innovation? How can this knowledge be beneficial for your future life?

To compare the results of the two cohorts, all analyses were run for summer and winter term students separately. Analyses were run quantitatively first. In a second step, the codes that differed between the summer and winter cohorts in frequency were analyzed qualitatively using the interactive segmentation matrix from MAXQDA, as suggested by Rädiker and Kuckartz (2019). Figure 3 shows a crosstab for proportional code frequency as a quantitative comparison of the two cohorts. Percentages are according to N (meaning multiple mentions within one student protocol are not counted).

Regarding *Influencing factors* or *Other learning outcomes*, nothing surprised the authors concerning the two cohorts. In terms of what was *Not addressed to foster positive impact generation*, 36% of respondents from the

winter cohort mentioned that the social/ethical aspect of sustainability should be further strengthened. On the other hand, 32% of the winter cohort stated that they learned something about the triple bottom line (meaning the holistic view of the environmental, social, and economic dimensions of entrepreneurship; see Baumast and Pape, 2022). Roughly the same percentage in both cohorts mentioned that nothing was missing (26,3% in the summer and 24% in the winter cohort, respectively). Still, the authors will take this feedback and integrate more social and ethical emphasis in the upcoming classes.

Summer Cohort	Total	in % of N
Influencing factors		
Resources for entrepreneurship at the university	2	10,5%
External guest speakers	4	21,1%
Other learning outcomes		
Patience	1	5,3%
Intercultural learning / Language	2	5,3%
Not addressed to foster impact generation		
Social/ethical perspective	1	5,3%
Other	6	21,1%
Slides/ introduction to sustainability	5	26,3%
Something tangible in your hands	1	5,3%
Role of the government	1	5,3%
Technological solutions	2	10,5%
Nothing	5	26,3%
Learning outcome sustainability		
Broadening understanding	2	10,5%
Confirmation of importance of sustainability	1	5,3%
Triple bottom line	8	42,1%
Small steps make an impact	4	15,8%
Current problems with non-sustainable solutions	4	15,8%
SDGs		
Diversity of sustainable approaches	1	5,3%
Hands-on things everyone can do	7	36,8%
Materials and techniques	3	15,8%
Learning outcome entrepreneurship		
Adaptability	3	15,8%
Perseverance	11	36,8%
Applicability/ creating value	4	21,1%
Team work	9	42,1%
Understanding of innovation	10	52,6%
Creative thinking	4	21,1%
Understanding of markets and opportunities	7	26,3%
Risk assessment	4	21,1%
Networking	1	5,3%
Entrepreneurship can be social and profitable	1	5,3%
Career decision regarding entrepreneurship		
pro Entrepreneurship	3	15,8%
con entrepreneurship	2	10,5%
How successful startups work	4	21,1%
Nothing new due to prior knowledge	1	5,3%
SUM	124	
N = Documets (self-reflection protocols)	19	

Winter Cohort	Total	in % of N
Influencing factors		
Resources for entrepreneurship at the university		
External guest speakers	3	12,0%
Other learning outcomes		
Patience	2	8,0%
Intercultural learning / Language	3	12,0%
Not addressed to foster impact generation		
Social/ethical perspective	9	36,0%
Other	8	32,0%
Slides/ introduction to sustainability	1	4,0%
Something tangible in your hands	1	4,0%
Role of the government	3	12,0%
Technological solutions	3	12,0%
Nothing	6	24,0%
Learning outcome sustainability		
Broadening understanding	11	44,0%
Confirmation of importance of sustainability	14	44,0%
Triple bottom line	8	32,0%
Small steps make an impact	8	32,0%
Current problems with non-sustainable solutions	3	12,0%
SDGs	3	12,0%
Diversity of sustainable approaches	6	20,0%
Hands-on things everyone can do	13	44,0%
Materials and techniques	1	4,0%
Learning outcome entrepreneurship		
Adaptability	6	24,0%
Perseverance	9	32,0%
Applicability/ creating value	4	16,0%
Team work	3	12,0%
Understanding of innovation	11	40,0%
Creative thinking	7	28,0%
Understanding of markets and opportunities	12	44,0%
Risk assessment	6	24,0%
Networking	4	16,0%
Entrepreneurship can be social and profitable	6	24,0%
Career decision regarding entrepreneurship		
pro Entrepreneurship	15	56,0%
con entrepreneurship	1	4,0%
How successful startups work	10	28,0%
Nothing new due to prior knowledge	1	4,0%
SUM	201	
N = Documets (self-reflection protocols)	25	

Source: Own illustration from MAXQDA.

Figure 3: Crosstab for proportional code frequency of summer and winter cohort

For *Learning outcome sustainability*, as anticipated, students from the winter cohort gained a broader understanding of sustainability (44% versus 10,5% of the summer cohort) and a more decisive confirmation of the importance of sustainability (44% versus 5,3%). The triple bottom line was mentioned roughly equally, as a few slides on that topic had already been provided during the summer term. However, students in the winter cohort felt more strongly that small steps towards sustainability can make an impact (32% versus 15,8%). They better understood the diversity of sustainable approaches (20% versus 5,3%). With regards to SDGs, this was not mentioned at all as a learning outcome in the summer term, but 12% of students from the winter cohort mentioned it after the authors had integrated a dedicated module on SDGs. This clearly shows the positive effect that the integration of additional sustainability content had on the respective learning outcomes of students. It also becomes apparent when looking at the *Learning outcome of entrepreneurship.* Students from the winter cohort mentioned more frequently (24% versus 5,3%) that learning for them was that entrepreneurship could be social **and** profitable. They also mentioned much more often (56% versus 15,8%) that they could imagine pursuing an entrepreneurial career. This might be because they were amazed by the impact their business ideas could have and inspired to help shape a better future. This is well described by the following two quotes from winter semester participants: “This knowledge has empowered me to consider entrepreneurial ventures with a focus on sustainable practices, fostering innovation that addresses pressing environmental and social issues like

for example, the electricity problem the people in South Africa encountered." (WS 23-24_RP Food_Reflection 12, Pos. 19). "Moving forward, I am excited to apply the knowledge gained from this course. I am eager to begin conceptualizing, designing, and eventually launching an app that facilitates eco-friendly food delivery." (WS 23-24_RP Food_Reflection 13, Pos. 7).

The only other difference between the winter and summer cohorts regarding the learning on entrepreneurship was that the summer term students emphasized teamwork much more (42,1% versus 12%). The authors assume this is because the summer course took place on-site and the winter course remotely. Therefore, the summer cohort had more direct team interaction, get-togethers after class, joint breakfasts, etc. However, this effect cannot be attributed to the course content. The other learning outcomes on entrepreneurship were similar in both groups. Similar to typical entrepreneurial competencies outlined in literature (Green Comp, 2022), they were: Adaptability, Perseverance, Applicability, Teamwork, Understanding of innovation, Creative thinking, Understanding of markets and opportunities, Risk assessment, Networking, and How successful startups work. On a side note, there were also a few students whose takeaway from the class was that they are sure never to pursue an entrepreneurial career. This is a fair point, and this realization is appreciated. One student from the winter cohort phrased it pointedly: "I probably will not bring any new inventions onto the market in the future, as it was very nerve-wrecking for me." (WS 23-24_RP Food_Reflection 2, S. 2)

To summarise, the results from the qualitative content analysis show that the level of knowledge gained in entrepreneurship was similar among the two groups. In contrast, the knowledge gained in sustainability was higher in the winter cohort after adding additional content. This cohort gained a broader understanding of the diversity of sustainability, the SDGS, the triple bottom line, and a more decisive confirmation of the importance of sustainability. Students felt more empowered to take small steps towards sustainability and were more inclined to pursue an entrepreneurial career and develop business ideas with impact. The social/ethical aspects of entrepreneurship should be further emphasised in upcoming cohorts.

The quantitative part of this study focused on five specific areas: sustainability in startups, eco-design, social sustainability, life cycle assessment, and the Sustainable Development Goals (SDGs). Tables 1 and 2 show the results of the two cohorts; each student rated themselves in this knowledge before and after participating in the course.

Table 1: Learning outcome summer cohort, n=19 (source: own illustration).

	1 = I have no idea	**2**	**3**	**4**	**5 = I am an expert in this topic**				
How would you rate your knowledge of sustainability in startups?						Average	Delta	Median	Mode
Before	1	8	6	4	0	2,68		3	2
After	1	0	4	12	2	3,74	1,05	4	4
How would you rate your knowledge of eco-design?									
Before	10	5	3	1	0	1,74		1	1
After	2	2	8	5	2	3,16	1,42	3	3
How would you rate your knowledge of social sustainability?									
Before	2	5	9	3	0	2,68		3	3
After	1	0	4	13	1	3,68	1,00	4	4
How would you rate your knowledge of life cycle assessment?									
Before	3	6	7	3	0	2,53		3	3
After	0	3	8	7	1	3,32	0,79	3	3
How would you rate your knowledge of Sustainable Development Goals?									
Before	2	4	6	6	1	3,00		3	3and4
After	0	2	2	13	2	3,79	0,79	4	4

Table 2: Learning outcome winter cohort, n=24 (source: own illustration).

	1 = I have no idea	2	3	4	5 = I am an expert in this topic				
How would you rate your knowledge of sustainability in startups?						Average	Delta	Median	Mode
Before	4	11	5	4	0	2,38		2	2
After	0	0	6	17	1	3,79	1,42	4	4
How would you rate your knowledge of eco-design?									
Before	10	9	2	3	0	1,92		2	1
After	0	3	12	7	2	3,33	1,42	3	3
How would you rate your knowledge of social sustainability?									
Before	3	3	13	3	2	2,92		3	3
After	0	1	5	15	3	3,83	0,92	4	4
How would you rate your knowledge of life cycle assessment?									
Before	6	10	7	1	0	2,13		2	2
After	0	2	9	12	1	3,50	1,38	3	4
How would you rate your knowledge of Sustainable Development Goals?									
Before	3	4	10	4	3	3,00		3	3
After	0	1	6	12	5	3,88	0,88	4	4

For the area of eco-design the knowledge gain was roughly the same for both cohorts. For all other aspects, the Average Delta was higher in the winter cohort, especially for the knowledge in life cycle assessment (Delta 1,38 points versus 0,79 points) and sustainability in startups (Delta 1,42 points versus 1,05 points). The knowledge gained on SDGS was only slightly higher in the winter cohort. The Median and Mode analysis also shows a larger knowledge gain for the winter cohort for all areas except for eco-design. These figures are in line with the results from the qualitative content analysis. After adding dedicated lectures on circular business models, SDGs, and specific questions for founders of sustainable startups, the additional knowledge gained by the winter cohort was expected. Interestingly, knowledge gain in social sustainability was even lower in the winter cohort than in the summer cohort. This emphasizes the need to add more of this content in upcoming cohorts of this course.

The research question can be answered as follows: Integrating additional sustainability content into the course material increases students' knowledge. They have a broader understanding and are more eager to apply their knowledge about sustainability to business ideas and future entrepreneurial ventures.

5. Discussion

The results of this case study have implications for theory and practice and possibilities for future research, which are described below, as well as certain limitations.

5.1 Implications for Theory

This study clearly shows a positive effect on students' learning outcomes on sustainability and a deepened desire to pursue impact business models or a future career in impact entrepreneurship, ultimately resulting in societal and environmental impact driven by students. There was also greater enthusiasm for learning among students who developed impact business models as they felt that their actions could lead to positive change. This effect was achieved after entrepreneurial and sustainable learning goals were combined in the curriculum; students were involved in course development based on their feedback in self-reflection protocols and via a project-based learning approach. This is in line with the suggested theoretical framework. It can be further developed and tested and signifies a small contribution to the vast area of Education for Sustainable Development.

5.2 Implications for Practice

The case study reveals hands-on practical implications for the authors as lecturers. It confirms that adding sustainability content encourages students to develop more impactful business ideas during the course and beyond. Based on the qualitative and quantitative analysis results, stressing the ethical and social dimensions is important. Therefore, in the upcoming winter term another flipped classroom video dedicated to this pillar of

sustainability will be added. Additionally, specific challenges will be chosen for students to address social problems within food and agriculture, such as the precarious working conditions of tomato pickers in Italy and asparagus pickers in Germany.

5.3 Limitations

Even though the findings may inspire other lecturers to adapt their entrepreneurship curriculum to emphasize sustainability, they can only be generalized to apply to some university teaching settings (Saunders et al., 2023, p. 214). Regarding reliability, intercoder-reliability (Goldenstein et al., 2018, p. 103) was given in that all three authors agreed and applied the developed coding system, which was additionally cross-checked and enhanced with the artificial intelligence functionality of Atlas. In terms of overall research design, as with any case study, the research is not replicable as the same cohorts of students cannot be retested. Other consecutive courses could replicate the research with the same research questions and methods, but other research teams might come to different conclusions. Semantic validity was ensured as the self-reflection protocol questions were specially developed to answer the research question. Construct validity was ensured in that the setting of the case study was clearly described, and all analysis steps, development of the coding system, etc., were noted in a logbook (Goldenstein et al., 2018, p. 104). Given the fact that both qualitative and quantitative data were used, triangulation was ensured. As the authors are teaching this course themselves, objectivity was not reached. Other researchers with an outside perspective might have come to different conclusions.

Students rated their knowledge before and after the course. However, the evaluation was conducted after the course was finished. This might result in a particular bias as students might have wanted to show the lecturers that they did gain additional knowledge through the course. Asking the *before* questions at the beginning and the *after* questions at the end of the course should be considered for upcoming self-evaluations. Also, the numbers of students in both cohorts, with 19 and 25, respectively, are relatively small for a quantitative comparison. The validity of the data should therefore be treated with caution.

5.4 Future Research

With regards to other lecturers and courses, based on the results of this case study, the following hypothesis can be generated: If dedicated sustainability modules are added to existing entrepreneurship courses, the competency gain in sustainability is higher, resulting in a higher impact of students' business ideas and a higher desire to pursue a career in impact entrepreneurship. This hypothesis could be tested in a quantitative longitudinal study at other universities where students and lecturers are asked to evaluate the level of impact of their developed business ideas on a scale before and after adding sustainability content and their willingness to work in an impact startup.

Another area of future research would be to analyse the business ideas of student teams in more detail to understand what they have been focusing on, how much they contribute to the different SDGs, how they could generate even more impact, and if any patterns emerge that would suggest specific topics that should beffurther emphasised during lectures. This could be done by interviewing student teams or conducting focus groups and by analysing them through qualitative content analysis (Kuckartz, 2018).

6. Conclusions

To conclude, this case study provides practical suggestions on emphasizing sustainability in the authors' entrepreneurship course, thereby contributing to the academic discussion on Education for Sustainable Development Goals. The results might serve as food for thought for other lecturers and pave the way for future research.

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Dealing with Failure: The Media's Portrayal of Entrepreneurs in Croatia

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Abstract: Entrepreneurship and stigma have been subjects of interest in various studies within the entrepreneurship field. The evidence suggests that societal stigma may lead to the stigmatization of entrepreneurs who have faced business failure, potentially influencing their strategic decisions and the likelihood of re-entry into entrepreneurship. Additionally, the liability of newness and the stigma of failure are critical factors that shape entrepreneurial dynamics and outcomes in different national contexts. The fear of societal judgment and negative perceptions can deter individuals from engaging in entrepreneurial activities, hindering entrepreneurial risk-taking and innovation, and limiting the growth and development of entrepreneurial ventures. The societal stigma associated with business failure in former socialist economies has been a significant factor influencing entrepreneurial activities in these regions. Research has indicated that socialist ideology historically stigmatized private proprietorship, associating it with negative connotations such as parasitism, exploitation, and profiteering. This lasting stigma has had implications for individuals pursuing entrepreneurial opportunities in post-socialist economies, impacting their perceptions and decisions regarding entrepreneurship. The transition from socialist planned economies to market-oriented systems has brought about changes in attitudes towards entrepreneurship. While socialist legacies may have initially influenced societal norms and perceptions of entrepreneurship, the emergence of market economies has led to a reassertion of entrepreneurship in these regions. Numerous studies indicate that the way media depicts entrepreneurs and their ventures plays a crucial role in shaping the attractiveness of entrepreneurship as a career choice and in developing social norms pertinent to the entrepreneurial spirit. In our research, we utilize qualitative content analysis to examine the representation of entrepreneurship, including the successes and failures of entrepreneurs, in Croatian media. The findings reveal a dominant adverse perception of entrepreneurship as a career in Croatia, with entrepreneurs frequently depicted as tycoons. Additionally, since the 1990s, entrepreneurs have faced stigma, and there appears to be no evident direction for improvement in this area.

Keywords: Entrepreneurs, Stigma, Media portrayal, Former socialist economies, Qualitative content analysis

1. Introduction

Stigma in the context of entrepreneurship has been a subject of interest in various studies, particularly in understanding its implications for entrepreneurial activities and outcomes. Stigma is broadly defined as a stain on one's reputation (Singh, Corner, and Pavlovich, 2015). It is a complex phenomenon occurring on multiple levels. At the macro level, social groups form collective judgments about the consequences associated with a specific stigmatizing trait. At the micro level, individuals who possess this trait are influenced to internalize society's broader judgments into their self-concept (Goffman, 1963).

Scholars primarily investigate stigma within the context of entrepreneurial failure (Cardon, Stevens, and Potter, 2011; Hegarty, Stephens, Gallagher, and Cunningham, 2020; Omorede, 2021; Simmons, Wiklund, and Levie, 2014; Singh et al., 2015). Although existing research shows that the stigma of entrepreneurial failure varies from one national setting to another (Singh et al., 2015), evidence from the former socialist economies of Central and Eastern Europe (CEE) demonstrates the complex interplay between former socialist and communist legacies and adopted neoliberal ideologies on entrepreneurship (Aidis, Estrin and Mickiewicz, 2008; Bohle and Greskovits, 2007; Djip, 2014). However, what remains underexplored is how societal stigmatization of entrepreneurship and entrepreneurs in post-socialist economies impacts entrepreneurial activity. We thus seek to deepen our understanding of entrepreneurial stigmatization beyond failure.

The study employs qualitative content analysis of published online media articles to investigate how entrepreneurship and entrepreneurs are positioned in Croatia, a former socialist economy. Media representations of entrepreneurs and entrepreneurship play a crucial role in shaping societal perceptions, influencing attitudes towards entrepreneurship, and contributing to the overall entrepreneurial ecosystem. Media stories and representations contribute to the construction of cultural norms and identities surrounding entrepreneurship. For instance, the portrayal of entrepreneurs as heroes or jesters, as discussed by Anderson and Warren (2011), can shape societal views on entrepreneurial behaviour and values, impacting the cultural positioning of entrepreneurs within society. Croatia is an appropriate empirical setting to explore the research question because the country has recently undergone significant economic and social transformations, transitioning from socialism to capitalism and achieving membership in the European Union (EU).

2. Overview of the Literature

In the context of entrepreneurship, stigma is investigated within the specific context of entrepreneurial failure. Singh et al. (2015) identify two research themes. The first stream deals with stigma related to bankruptcy (for instance Lee, Yamakawa, Peng, and Barney, 2011; Rawal and Sarpong, 2020), while the other research stream investigates socio-cultural aspects of failure stigmatisation. For instance, Begley and Tan's (2001) study found that the perceived high penalty for failures could lead to a greater scrutiny of entrepreneurial prospects, induced by the shame of failure in East Asian countries compared to Anglo countries. This highlights how the fear of failure and the stigma associated with it can impact entrepreneurial decision-making and risk-taking behaviour. Ferreto, Lafuente and Leiva (2018) explore the impact of entrepreneurial role models in reducing the fear of failure among individuals who have not yet engaged in entrepreneurial activities. The results indicate that exposure to entrepreneurial examples significantly diminishes the fear of failure in individuals not currently involved in entrepreneurship, demonstrating the importance of entrepreneurial role models as a key precursor to entrepreneurial engagement. Vaillant and Lafuente (2007) examine how various institutional contexts in Spain's regions shape the impact of specific social characteristics—namely, the social stigma associated with entrepreneurial failure and the availability of entrepreneurial role models—on the levels of entrepreneurial activity in rural areas with strong entrepreneurial heritage compared to those without such a tradition. The study's finding reveals a notable difference in the levels of entrepreneurial activity between rural areas in one region (Catalonia) compared to the others. This disparity is explained in relation to the unique influence of the social traits observed, "mainly due to the superior impact of positive entrepreneurial examples (role model effect)" (p. 332). In addition, the study confirms the negative influence of social stigma associated with failure on entrepreneurial activity. Simmons et al. (2014) explored the impact of stigma and business failure on entrepreneurs' career choices, underlining the societal perceptions that stigmatize failed entrepreneurs. Additionally, Shepherd and Haynie (2011) discuss the self-verification and self-determination view of venture failure stigma, providing insights into how entrepreneurs manage impressions in the face of societal views of failure.

However, in the context of former socialist economies during the transition period, the positioning of entrepreneurs and entrepreneurship has been a complex phenomenon. Aidis, Estrin, and Mickiewicz (2008) examined the development of entrepreneurship in Russia, highlighting the challenges posed by corruption and government intervention. The "grabbing hand" model of government intervention and the impact of corruption on private sector development contributed to a negative perception of entrepreneurship in the region. Estrin and Mickiewicz (2011) delve into the role of institutions and generational change in entrepreneurship within transition economies, providing insights into the evolving institutional, social, and cultural environment for entrepreneurs. This research shed light on the institutional dynamics that influence entrepreneurial behaviours and outcomes during the transition period. Namely, communism left a legacy of values and norms that are not conducive to entrepreneurship, and Estrin and Mickiewicz's (2011) findings suggest that the whole generational change is needed to bring the changes in values and attitudes necessary for entrepreneurship development. Fritsch, Bublitz, Sorgner and Wyrwich (2014) investigation examines the relationship between institutional transformation and the resurgence of entrepreneurship in East Germany. It took approximately 15 years for self-employment rates in East Germany to align with those in West Germany while the characteristics of East German self-employment continue to reflect traces of its socialist heritage, supporting the notion that informal institutions evolve more gradually than their formal counterparts.

Socio-cultural perceptions of entrepreneurship encompass views on the social legitimization of entrepreneurship. National culture, understood as a shared set of values and norms among a group, can foster entrepreneurship both through this social legitimization and positive attitudes towards it. In recent years, media representations emerge as a significant cultural factor influencing perceptions of entrepreneurship (Laguía and Moriano, 2021). A number of studies have shown that media portrayals of entrepreneurs and entrepreneurship influence the desirability levels of entrepreneurship as a career and the creation of social values relevant to entrepreneurial culture (Hindle and Klyver, 2007; Levie, Hart and Karim, 2010; Radu and Redien-Collot, 2008). Ljunggren and Alsos (2001, p. 2) describe the dual role of the media as both reflective and manipulative in relation to entrepreneurship. On one hand, the media play a significant role in shaping attitudes and promoting "role models"; on the other hand, they can also enforce and promote widely accepted social attitudes about entrepreneurship.

One of the few studies on media representation of entrepreneurs in the former communist economies of CEE reveals how the private sector in Belarus is portrayed as a "dangerous territory" where "businessmen have to be controlled" (Miazhevich, 2007, p. 1338). Consequently, entrepreneurs are often viewed as potential

disruptors, socially constructed as being "close to criminals... who... threaten the stability of the country and the morality of the nation" (p. 1339). Miazhevich (2007, p. 1346) argues that the “state's discursive practices not only reinforced the antagonism of entrepreneurs towards the state but also, by fostering an environment of general hostility within society, provoked the multiplication of out-groups within the business community itself.” In contrast, research from the UK and France shows that media articles depict entrepreneurs as dynamic, active pursuers of opportunities, and agents of change. In the UK, they are seen as key economic and social actors, while the French press describes them as a "miraculous alternative" (Radu and Redien-Collot, 2008, p. 286) to the challenges of globalization and unemployment. The study by Nicolson and Anderson (2005) explores the social construction of entrepreneurship through an analysis of myth and metaphor in media representations. The study uncovers various archetypes attributed to male entrepreneurs, including dynamic wolfish charmers, supernatural gurus, successful skyrockets, community saviours, and corrupters. This highlights the diverse and sometimes contradictory ways in which entrepreneurs are depicted in the media, showcasing the multifaceted nature of entrepreneurial identity construction. The study by Laguía and Moriano (2021) focuses on the perceived representation of entrepreneurship in the mass media and its impact on entrepreneurial intention. The research delves into how media discourses influence individuals’ perceptions, attitudes, and beliefs towards entrepreneurship, ultimately affecting their intention to engage in entrepreneurial activities. Their results point that perceived social legitimacy granted to famous entrepreneurs by the media was positively associated with attitudes and self-efficacy. Attitudes had the strongest connection to entrepreneurial intention, demonstrating the significant impact of media on shaping attitudes. Entrepreneurship has been a subject of increased interest in media representations over the last few years, particularly concerning gender roles and stereotypes. Studies have delved into how female entrepreneurs are portrayed in the media, highlighting issues of gender inequalities and the impact of such representations (Eikhof et al., 2013). The portrayal of male entrepreneurs has also been scrutinized, especially in the context of movements like #metoo, to assess if there have been changes in media depictions (Jernberg et al., 2020).

In former socialist economies, where the legacy of state control and economic transition has influenced entrepreneurial activities, media representation can play a significant role in shaping the narrative around entrepreneurship, promoting positive role models, and challenging stereotypes. The stigmatization of private proprietorship in socialist ideology has had implications for individuals pursuing entrepreneurial opportunities in post-socialist economies, impacting their perceptions and decisions regarding entrepreneurship. By investigating media representations of entrepreneurs in Croatia, this study responds to the calls to investigate broader societal factors that influence entrepreneurial behaviour and perceptions in post-socialist economies.

3. Methodology

To investigate the representation of entrepreneurship, including the successes and failures of entrepreneurs in Croatian media, this study adopts qualitative content analysis. Qualitative content analysis is a research method that involves a systematic and in-depth examination of textual data to identify patterns, themes, and meanings (Mayring, 2014). This approach includes both qualitative and quantitative methods, but all share a common feature—the systematic categorization of textual data to facilitate understanding (Hsieh and Shannon, 2005). After collecting all relevant published media articles, they were extensively reviewed and analysed by both researchers.

Our research focused on all available media articles using the following key terms: "entrepreneur," "tycoon," "entrepreneurship failure," "entrepreneur thief," "entrepreneur success," "entrepreneur politician." Twenty articles published from 2012 (the first year when online media articles were available in Croatia) to 2024 were selected and analysed. Articles which repeat the same story are excluded from the analysis (42 articles).

Analysed media articles with the source name, article title and publication year and dominant discourses are provided in Table 1.

Table 1: Analysed media articles

ONLINE MEDIA ARTICLES	TITLE OF THE ARTICLE & YEAR OF PUBLICATION	DOMINANT DISCOURSES
Slobodna Dalmacija	„Milanović: The way things are going, soon we won't have any salaries!; Employers: They don't like us; Čačić: Trade unions would be politicians“ (2012.)	negative attitude, bad laws and judiciary, administration, anti-business climate

ONLINE MEDIA ARTICLES	TITLE OF THE ARTICLE & YEAR OF PUBLICATION	DOMINANT DISCOURSES
Večernji list	„Croatian entrepreneurs have the opportunity to use EU support programs“ (2013.)	crisis and recession, poorly developed entrepreneurial culture
Al Jazeera Balkans	"The mysterious past of Croatian tycoons " (2014.)	favours, privileged conditions, stigmatised entrepreneurs, Ivica Todorić, Emil Tedeschi
Posao.hr	"The only obstacle when entering entrepreneurship was actually a mental one - we were afraid to leave the security of a large system" (2014.)	mental barriers, starting a business in Croatia
Tportal	„Croats enter entrepreneurship out of trouble“ (2014.)	high unemployment, no job opportunities, low motivation coefficient
Slobodna Dalmacija	„An entrepreneur is a class enemy for a Croat“ (2015.)	entrepreneurial nation, parenting, not standing out in society, job security
Poslovni dnevnik	" Tedeschi: Entrepreneurship is not a hob and an enemy, and a whole series of people were stigmatized in the 90s " (2016.)	stigma from the 90s, non-transparent business, corruption, violation of the rules of ethics and morality
tportal	"Here is how students evaluate the entrepreneurial climate" (2016.)	legal regulation, negative social attitude, stigma (tycoons), influence of family and friends
Lider	"Entrepreneurs, turn the fear of failure into an ally" (2018.)	failure, social stigma, bankruptcy, fear motivation
Netokracija	"In Croatia, only every 12th citizen decides to become an entrepreneur, can we change that as a digital community?” (2020.)	negative perception of entrepreneurship, risk, comfort, safe workplaces
Ekonomska klinika	"How Rimac brought success to the Croatian economy" (2021.)	the success of Mate Rimac, role models, new discourse on success
Večernji list	"Most enter into entrepreneurship out of necessity. It's a weak motivation" (2021.)	entrepreneurship in the Republic of Croatia is not important
Slobodna Dalmacija	"How did Mate Rimac succeed? An entrepreneur admired by the whole world in less than ten years earned more than 1 billion HRK" (2021.)	foreign investors, success story,
Hrvatska udruga banaka	"In Croatia, there is still a low level of research transfer to the business sector and a restrictive entrepreneurial environment" (2022.)	entrepreneurial environment, limitation, entrepreneurial imbalance, family life, cultural context
Weekend Media Festival	"Entrepreneur: public enemy number one" (2022.)	negative image in the society, negative public perception
Poslovni dnevnik	"Croatia is no longer a macho country for entrepreneurs" (2023.)	negative perception of entrepreneurs in the society
Netokracija	"Rimac invested in a startup of entrepreneur who "saved Rimac Automobile" 6 years ago!” (2023.)	positive success story
Večernji list	"Rimac sent a message to young entrepreneurs" (2023.)	an entrepreneurs can succeed in Croatia, global market, importance of networking
Zimo	"Croats want to be entrepreneurs, but the state doesn't make it easy for them" (2023.)	barriers to market entry, government non supportive policies

ONLINE MEDIA ARTICLES	TITLE OF THE ARTICLE & YEAR OF PUBLICATION	DOMINANT DISCOURSES
Forbers[HRV]	"We investigated how successful Damir Vanđelić, an entrepreneur in the political race, is in business." (2024)	personal resilience and background, political engagement, integration of business and politics

4. Findings

The analysis of articles reveals that society in Croatia still predominantly holds a negative view of entrepreneurship, as it did decades ago. Additionally, significant media attention is given to tycoons, which weakens society's inclination toward entrepreneurial activities. Recently, this focus has shifted to politicians who have turned into entrepreneurs, where the discourse remains grounded in potential negative connections between these former politicians and corruption, as well as a favour-based economy.

Business Daily in two of its articles points out that there is a low perception of entrepreneurship in Croatia. In its second article from 2016, it recounts a speech by Emil Tedeschi at the EY Entrepreneur of the Year award ceremony, where he emphasized the need to highlight successful entrepreneurs to remove the stigma from the 1990s, which is still prevalent in Croatian society. Furthermore, entrepreneurship in Croatia is still seen as non-transparent, corrupt, and not aligned with morals and ethics.

A search of articles in Večernji List concludes that entrepreneurship in Croatia is not valued, and Croatians enter entrepreneurship out of necessity due to lower-paying jobs, not for a "better" life. Additionally, Večernji portrays a poor perception of entrepreneurship in Croatia. Articles from 2013 show how recession and crisis also affected entrepreneurship, but a poorly developed entrepreneurial culture is the main reason. Večernji also emphasizes Mate Rimac, who highlights how Croatia is now a good country for developing businesses, but young entrepreneurs should be open for global markets and share their ideas with others. In addition, the article transmits but does not engage in Rimac's call for cultural change, where he urges young entrepreneurs to apply for equity and sacrifice their ownership stake. This message reflects a new wave of thinking about entrepreneurship in Croatia and also media's shift in agenda. However, this was an isolated attempt.

Netokracija's articles describe the negative sides of entrepreneurship in Croatia in that Croatian society is described as comfortable. By this, they mean that Croatians, generally having a poor perception of entrepreneurship, prefer comfort and avoiding risk in such a way that they do not want to engage in entrepreneurial activities if they have a secure and well-paid job. Linked with Netokracija's articles, Slobodna Dalmacija in its articles from ten years ago also displays and confirms today's results on how Croatians have a poor perception of entrepreneurship, with a large emphasis on family upbringing. More precisely, they emphasise it is important not to stand out in society, to be quiet and reserved, and to do a "safe" job without any possibility of bearing the risk of entering entrepreneurship.

Al Jazeera Balkans, on the other hand, portrays entrepreneurship through stories of tycoons. The focus is specifically on their rapid enrichment and the privileged conditions that allowed them to amass wealth and enter the entrepreneurial field. This narrative mentions Ivica Todorić, Emil Tedeschi, Luka Rajić, and Željko Kerum, among other 'famous' tycoons. The analysed article dates back to 2014. Even though many years have passed since the successes and failures of these 'tycoons', the media continues to reinforce the stigma of corrupt entrepreneurs from the transition period. Other articles from sources such as tportal, Weekend Media Festival, and the Croatian Association of Banks discuss the entrepreneurial imbalance and restrictive environment in Croatia. A significant emphasis is placed on the influence of family and friends in starting entrepreneurial activities; however, they also highlight a tendency towards family life and more secure jobs. A Forbes article describes the story of an entrepreneur who recently entered politics. Written almost like a biography, it lists all the achievements and educational background of the entrepreneur. This is the first article in the discourse on entrepreneurs and politics that does not suggest that entrepreneurs are successful solely because of their political connections.

The analysis reveals that Croatia continues to harbour a negative perception of entrepreneurship. Primarily, this perception is linked to the prominence of tycoons, who often dominate discussions about entrepreneurship. Moreover, the entrepreneurial stigma from the 1990s persists, further tarnishing the reputation of entrepreneurship as a viable career choice. Additionally, the cultural context in Croatia, which favours family life, secure employment, and comfort, significantly influences entrepreneurial activity. Evidence from articles spanning eleven years shows that Croatian society remains inclined toward safe jobs and is often discouraged from pursuing entrepreneurship by family and friends. Furthermore, a pervasive fear of failure is closely

associated with this preference for a comfortable lifestyle, as individuals are reluctant to engage in 'unnecessary' risks when secure employment options are available that do not demand extra effort.

5. Discussion

The findings from the qualitative content analysis of Croatian media articles reveal a persistent stigmatization of entrepreneurship, rooted deeply in the socio-economic transformations and cultural legacies from the socialist era. This stigma is multifaceted, primarily reflecting historical prejudices against private enterprise and a contemporary association of entrepreneurship with negative traits such as corruption and privilege. The portrayal of entrepreneurs as tycoons or politically connected figures suggests a continuing narrative where entrepreneurs are not just business innovators but are seen through a lens of scepticism and mistrust. Historically, socialist ideologies have stigmatized private ownership, equating it with exploitation and economic parasitism. This has long-term implications in post-socialist societies like Croatia, where transitioning from state-controlled to market-driven economies has been complex and fraught with challenges. The media's role in shaping the perception of entrepreneurship as risky or morally ambiguous continues to influence public attitudes, making the entrepreneurial career path less appealing. This is particularly poignant in the depiction of high-profile entrepreneurs who are often portrayed not as successful business figures but rather as opportunistic and corrupt. Interestingly, the case of Mate Rimac provides a counter-narrative. Initially, the media's focus on his achievements came with a sceptical undertone, but over time, as his success became globally recognized, the tone shifted towards a more positive portrayal. This highlights a potential turning point in media representation, where success can lead to a more favourable entrepreneurial image. However, such examples are exceptions rather than the norm, indicating that while individual success stories can challenge prevailing stereotypes, they do not necessarily overturn entrenched cultural attitudes.

The negative media portrayal has practical implications for entrepreneurial activity. The fear of being associated with failure or corruption can deter potential entrepreneurs from pursuing business opportunities, leading to a lower rate of enterprise creation and innovation. This is exacerbated by a cultural preference for stability and risk aversion, further compounded by the familial and social discouragement of entrepreneurial endeavours. The result is a self-perpetuating cycle where the lack of entrepreneurial activity reinforces the stigma, which in turn keeps the level of entrepreneurship subdued.

Moreover, the research indicates that despite Croatia's integration into the European Union and exposure to more liberal market economies, the legacy of the past continues to loom large. This suggests that changing the narrative around entrepreneurship is not merely a matter of economic policy but also of cultural transformation. Efforts to enhance the entrepreneurial ecosystem must therefore address these cultural perceptions directly, perhaps by promoting educational initiatives that redefine entrepreneurship, celebrating diverse entrepreneurial role models, and fostering a more supportive community for start-ups and business innovators.

In conclusion, while the stigmatization of entrepreneurs in Croatia reflects broader historical and socio-cultural dynamics, there is a window of opportunity to reshape public perceptions through strategic media engagement and community-oriented policies. The challenge lies in overcoming deep-seated stereotypes and fostering a new understanding of entrepreneurship that aligns with modern economic realities and the aspirations of a younger, more globally connected Croatian population.

6. Limitations and Future Research

The first limitation relates to the media agenda, which this research does not address. Prior studies have confirmed the potential for pro or anti-business biases in media coverage (Cardon et al., 2011), which may influence how specific events are reported. The second limitation concerns the availability of data; only media articles published after 2012 are available online, creating a gap in the analysis.

Regarding future research, it would be valuable to conduct a Critical Discourse Analysis (CDA) of published media articles. CDA is a method that explores how language, whether written or spoken, constructs perceptions of specific phenomena and thereby creates or perpetuates social inequalities, misuse of power, or domination within a social context (Weiss and Wodak, 2007). Additionally, studying the same phenomenon from multiple perspectives—including those of existing entrepreneurs and the general population—would help understand the impact of such perceptions on decisions to enter or exit entrepreneurship. Finally, understanding the nuances of entrepreneurship stigma in other former socialist economies is crucial for developing strategies to support and promote entrepreneurship in these contexts. By addressing and challenging existing stigmas, policymakers, educators, and business leaders can create a more inclusive and supportive environment for

entrepreneurship to flourish in these regions. The state can provide support through targeted educational campaigns that highlight successful entrepreneurial stories, implementing policies that reduce bureaucratic obstacles and provide financial incentives for start-ups, and establishing mentorship programs that connect aspiring entrepreneurs with experienced business leaders. Additionally, creating public-private partnerships to fund entrepreneurial initiatives and fostering a culture of innovation through state-sponsored incubators and accelerators can further help to dismantle the stigma and encourage a thriving entrepreneurial ecosystem.

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Transforming Academic Libraries Into Hubs of Innovation and Entrepreneurship: A Case Study of a New Library Model

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Abstract: In a data-driven era, academic libraries must evolve beyond traditional roles as spaces for reading and storing information resources to become platforms promoting learning, research, innovation, future skills, and entrepreneurship. Based on the triple helix model of innovation, this paper highlights the new library model in a case study aimed at transforming traditional academic library services into enterprising, innovation-driven activities. For over ninety years, Thammasat University Library has been located on Rattanakosin Island, an historical area of Thailand. More recently, the library business model has evolved to meet modern needs. This qualitative research uses a case study to explore library strategies to create space meeting requirements of diverse user groups: students, faculty, staff, alumni, businesspeople and the community, including older residents. Service innovations responding to user demands are prioritized by drawing on the expertise of librarians. These changes generate new revenue for the library and enhance the space design and use through the Life Space concept. Co-working spaces, learning areas, inspirational corners, and performance venues make the library a platform for inspiring creativity, learning, life enhancement, and business ventures. The Thammasat University Library has also become an innovative bridge linking university research with small and medium-sized enterprises (SMEs), facilitating knowledge transfer and research commercialization. These findings may serve as guidelines for academic libraries seeking to adapt the Library of Life approach to be centres catering to readers of all generations and stations in life.

Keywords: Library space design, Service innovation, Cluster theory, Triple helix model, SMEs

1. Introduction

Competing in the innovation economy instrumentalizes collaboration between universities and the private sector to hasten innovation development in developed and developing nations (Secundo et al., 2016). Universities help shorten delays in marketing entrepreneurial innovations, with technology transfer offices used as mechanisms for commercializing university research (Chais et al., 2018). Universities participate in transforming scientific and technological knowledge through industrial innovation (Ismail et al., 2018). However, the success rate of technology transfer remains low, including in the United States (Oliveira and Teixeira, 2010). Small- and medium-sized enterprises (SMEs) fail to transfer technology from universities due to different factors: investment limitations, extant SME production processes (Khongmalai & Distanont, 2022), and entrepreneurial intent to adopt technology transfer (Distanont, Khongmalai, & Kritpipat, 2018).

Recently, research has sought solutions for how universities and SMEs may collaborate to enhance innovation and business capabilities. In Europe, governments have continuously promoted SME-university collaborations, with SMEs participating in short-term strategies to join government projects annually. Others find benefits in long-term strategies of research funding at universities, resulting in diverse research and development (R&D) outcomes for each country (Bjerregaard, 2009). In some nations, universities lacking expertise in commercialization focus on transferring knowledge about innovation processes to empower SMEs by application through organizational innovation (Lundberg & Öberg, 2021). In Australia, micro, small, and medium-sized enterprises (MSMEs) often rely on generic university-industry knowledge through conventional channels such as short-term training and academic publications from libraries, which is adapted for business purposes, rather than engaging in university research collaboration. In addition, MSMEs emphasize the importance of knowledge transfer in the business ecosystem from national and international customers and suppliers (Zubielqui et al., 2015).

University libraries serve as other mechanisms for institutions of higher learning to drive innovation and entrepreneurship. Space is a valuable library asset as a study, research, and usage hub for intellectual properties. With the advance of digital virtual technology, the traditional model of providing book reading space has become partly outdated. Service models have transformed into anywhere, anytime libraries for users from all groups in addition to students (Chan & Spodick, 2014). University libraries have transitioned into flexible spaces where users hone skills according to their needs. These may include spaces for learning, research, social interactions, innovation, and innovative incubation (Li, 2006; Chan & Spodick, 2014; González-Solar and Fernández-Marcial, 2019).

However, university libraries are challenged by burgeoning subscription costs, necessitating cancellation of subscriptions with important publishers (Piwowar et al., 2018). Simultaneously, a demand for scientific papers is growing among students, researchers, and entrepreneurs. Therefore, a new Open Access trend in accessing scientific publications has emerged on platforms such as Sci-Hub, providing cost-free access to scientific publications (González-Solar and Fernández-Marcial, 2019). The increasing popularity of Sci-Hub emphasizes the need to access scientific publications for advancing R&D. From another perspective, a unique, specialized free access hub for scientific publications is a model that encourages increased readership (Ajani, et al., 2023).

In Thailand, the Office of SMEs Promotion (OSMEP), a government agency responsible for setting policies to promote MSME competitiveness, centrally links the public and private sectors. The OSMEP Annual Report 2021 indicates that Thailand's gross domestic product (GDP) grew by 1.5%, with SMEs contributing 5.60 trillion baht or 34.60% (OSMEP, 2021). This highlights the key role of SMEs in driving Thailand's economic expansion. OSMEP provides annual financial support to universities to develop SME business capabilities. However, SMEs still face challenges in accessing knowledge and research to continuously innovate business processes. One reason for this difficulty is the fragmented nature of research in Thailand, often distributed across faculties and research institutes in universities, transmitted by academic papers which are not easily translated into commercial applications. Therefore, OSMEP has collaborated with Thammasat University, a leading university in Thailand, to transform academic libraries into innovation and entrepreneurship hubs.

This paper investigates an effective model for transforming academic libraries into hubs of innovation and entrepreneurship, to become continuous collaborative spaces for researchers, business consultants, and SMEs. The main research targets comprise: 1) the ideal format for transforming academic libraries into hubs of innovation and entrepreneurship; and 2) factors adding to the success of building academic libraries into hubs of innovation and entrepreneurship.

2. Literature Review

2.1 Cluster Theory and SME Development

Porter (1998) proposes that a nation's ability to compete must start with companies as the smallest unit of the economic system. By increasing productivity, especially labor productivity, rather than just reducing costs, companies may achieve a competitive advantage. If several companies in an industry increase productivity, overall industrywide competitiveness is attained. When many industries increase productivity, national competitiveness is boosted. Porter (1998) defines clusters as a group of related companies and institutions in close proximity within the same field, linked by commonalities and complementarities. The geographical scope of clusters may range from regional to state or neighboring cities and countries. Thus, clusters cover different interconnected industries and other organizations required for competition, such as providers of specialized components, machinery, and services, including specific infrastructure. Many clusters also include government agencies, universities, research institutions, vocational training providers, standard-setting bodies, and trade associations which facilitate specialized training, education, data, research, and diverse forms of technical support.

Michael Porter's cluster theory provides a framework for understanding the concept of geographical clusters, which are concentrations of interconnected companies, specialized suppliers, service providers, and associated institutions in a particular field that are present in a specific location (Porter, 1990). According to Porter, these clusters promote increased efficiency, productivity, and innovation through several key mechanisms. First, proximity reduces the cost of transactions and information, allowing for better coordination and trust among businesses. Second, clusters stimulate competition and cooperation, which drives firms to enhance their own capabilities and innovate faster. This environment of enhanced competition and collaboration results in a more dynamic business atmosphere that is conducive to productivity improvements and innovation. Clusters also help companies to access specialized input, skilled labor, and complementary products, which are facilitated by the cluster's developed infrastructure and the regional focused educational and training institutions. In addition, being part of a cluster allows companies to directly access the latest information on technology and market trends, which can significantly enhance competitive advantage (Porter, 1990).

Abundant research examines cluster development as a strategy for building competitiveness in different contexts and dimensions (BCI Global, 2022; Abdin & Rahman, 2015; UNIDO, 2006; Porter & Bond, 2004; Doeringer & David, 1995). Porter (1998) argues that clusters influence competition in three key areas: 1) increased productivity of local firms located in the area; 2) driving the direction and acceleration of innovation; and 3) stimulating new business creation to expand and strengthen the cluster. Clusters enable members to gain mutual benefits and strengthen business operations. Developing clusters helps SMEs to leverage cooperation to strengthen competitiveness in their respective sectors. By coordinating activities in their sectors, SMEs may

achieve economies of scale surpassing the potential of standalone companies. Examples include bulk purchase of raw materials, shared use of machinery, and combined production capacity to fill large orders. These collaborative efforts translate into a competitive advantage for businesses in the cluster. This competitive edge stems from two main sources: 1) expanding business knowledge to cover areas such as design, quality control, and market-related data; and 2) building networks linking to a diverse range of technologies and other resources. Cooperation among SMEs enables entrepreneurs to focus on core businesses, resulting in overall improved production efficiency. BCI Global (2022) identifies nine key factors for developing successfully sustainable business cluster management as shown in table 1.

Table 1: Nine key factors for developing successfully sustainable business cluster management (BCI Global, 2022)

Key factors	Definition
Cluster formation	Creating robust entrepreneur communities is principally about shared space to promote collaborative work and knowledge sharing by facilitating collaboration through access to vital resources. In this context, shared space refers to physical spaces that encourage interactions and encounters among businesses.
Supportive authorities	Policymakers, governmental agencies, and local institutions are essential for building resilient entrepreneur communities.
Talent pool	Diversely talented stakeholders are key components for community building. Successful entrepreneurs, along with skilled personnel with expertise, experience, and diverse perspectives, enhance innovation, collaboration, and overall business ecosystem growth.
Education	Providing knowledge, skills, and resources to interlace businesses, teaching vitally promotes entrepreneurs and community building.
Advanced technology	Revolutionizing how entrepreneurs start, operate, and expand businesses.
Understanding market	Seeing how changes and opportunities occur, as well as responding to customer demands, are essential for entrepreneurial success.
Business networks	Creating entrepreneurial communities fosters cooperation, shares knowledge, and exchanges resources.
Capital	Access to funding sources enables entrepreneurs to invest in business infrastructure, hire skilled personnel, and seek growth opportunities.
connectivity	Building relationships and connecting entrepreneurs transforms entrepreneurial communities into potential clusters. In an increasingly interconnected world, entrepreneurs mutually rely on one another to access information, collaborate, and leverage diverse resources.

2.2 Triple Helix

The triple helix model of Etzkowitz and Leydesdorff (1995) emphasizes the interplay between three key sectors: universities, industry, and government. Collaboration among these entities can drive innovation through diverse channels, including joint university-industry research, policy and business collaboration networks, and establishing innovative experimentation spaces. These collaborative efforts facilitate accelerated market introduction of innovations, continuous improvement, and adaptation to evolving market and societal demands. The roles of the three sectors are interconnected and complementary: 1) universities help create and spread knowledge by academic R&D, generating new technology and innovation with industrial applications while contributing to workforce development by training graduates with required labor market skills; 2) industry uses current knowledge and innovations to develop new products and services, growing businesses and creating economic value to generate jobs and implement innovation; 3) government formulates policies supporting innovation and SME development by providing financial support, tax incentives, and measures to reduce barriers to business initiation and operations while encouraging investment and balanced competition.

Several research studies have applied the triple helix model of innovation as a framework for analyzing business competitiveness, innovation, and sustainability. Khouroh, et.al., (2019) and Dudin et al. (2015) found that cooperation promotes innovation, leading to competitive advantages and improved business efficiency. Etzkowitz and Ranga (2011) applied the triple helix model to analyze the emergence of innovation and business development. Ranga and Etzkowitz (2013) found that innovation stems from the three-partner relationship as well as the business-government relationship, as seen in industrial societies. Luengo-Valderrey, et al. (2020) and Lahi and Dervishi (2019) underlined that triple helix cooperation has positive economic, social, and environmental impacts. In addition, Sato and Okamoto (2019) emphasized the role of a conducive working environment in promoting sustainable innovation. Papagiannidis, Li, Etzkowitz, and Clouser (2009) found that the triple helix model is used to analyze business and cluster integration, while universities are increasingly involved in entrepreneurial activities, beyond their traditional roles as research and teaching institutions.

Universities have become resource providers for businesses, and the role of government has also changed. Apart from regulatory operations, governments now promote innovation and flexibility within legal frameworks through tax incentives, loans, and grants. Lahi (2019) found that universities significantly drive sustainability through triple helix cooperation. In sum, the triple helix model is essential for businesses to foster operational innovation, competitiveness, and sustainability.

2.3 The Evolving Role of Academic Libraries in Innovation

Recent scholarly discussions have increasingly recognized the transformative role of academic libraries in supporting innovation and entrepreneurship. Academic libraries are no longer seen merely as book and journal repositories, but as active partners in the innovation ecosystem. Institutions such as the Thammasat University Library are now engaging directly with SMEs to facilitate technology transfer and commercialization of research, embodying a new paradigm where libraries act as connectors between academia and industry (Li, 2006; Chan & Spodick, 2014). The academic literature suggests that modern academic libraries can play a pivotal role in fostering innovation by providing resources and spaces that encourage creativity, collaboration, and entrepreneurship (González-Solar and Fernández-Marcial, 2019). For instance, the modern university library model proposes an adaptive approach where libraries serve varied community needs, from digital learning hubs to innovation incubators (Li, 2006). This evolving role is supported by the triple helix model of innovation, which emphasizes the library's potential to act as a mediator and facilitator among the academic, business, and governmental sectors (Etzkowitz & Leydesdorff, 1995). By integrating these roles, academic libraries can significantly contribute to regional and national innovation systems.

3. Research Design

Qualitative single case study research was done. Yin (2018) and Creswell & Poth (2018) state that a case study is useful for answering the how and why questions about a social problem. The research process consisted of five stages as shown in Figure 1.

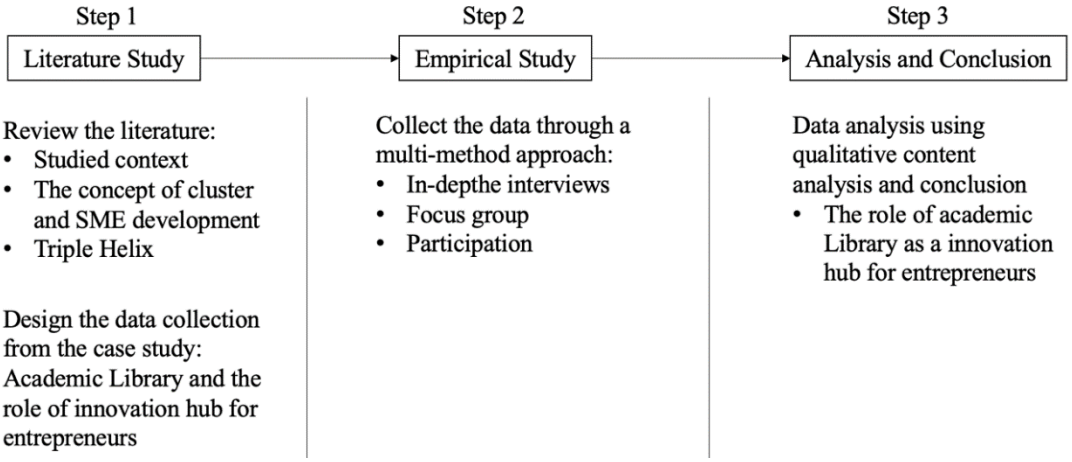


Figure 1: Research Process

The first step was developing a theoretical framework based on a literature assessment of the concepts of cluster and SME development and triple helix. The goal was to understand the overall subject and its context and design data collection from the case study, including question and structural design. This literature review defined the empirical study structure. The second step was an empirical study. Multi-method data collection included in-depth interviews, focus groups, and participation. Samples were stakeholders chosen for their expertise and participation in academic library and business development in Thailand. They were receptive and eager to cooperate with the study, which ensured rich empirical data for analysis. The third and final step was data analysis, using qualitative content analysis to interpret and draw conclusions from the collected data.

4. Results

4.1 Model Development

In Thailand, SMEs drive the economy, representing over 35% of the national GDP in 2022. They also serve as a significant employment source, accounting for 71% of total employment (OSMEP, 2022). However, the rapid pace of global development is profoundly impacting SMEs. To navigate this dynamic landscape and thrive in the face of change, all stakeholders, including SME promotion agencies, government entities, and SMEs themselves must proactively prepare and adapt. By embracing transformations, all parties may benefit from a changing

world. Thailand's strategy for sustainable economic prosperity develops the national industrial economy through business clusters to enhance economic competitiveness in manufacturing, trade, and services. From 2017 to 2022, The Thirteenth National Economic and Social Development Plan (2023- 2027) and the Fifth SME Promotion Plan (2023-2027) continuously implemented support and development for clusters to assist specific entrepreneurial groups with different needs. Distinct promotion and development guidelines are required for each SME group to create strong and sustainable clusters. Study results and data on cluster promotion guidelines in different industries (OSMEP & Thammasat University, 2023) indicated that from 2017 to 2022, OSMEP has promoted and raised the profile of prototype clusters. Over forty clusters promoted by the government pertain to the coconut and herbal industries, agricultural technology, durian, food processing, wellness tourism, future food, and e-sports & digital economy.

The concept of transforming academic libraries into hubs of innovation and entrepreneurship is based on the framework of the triple helix theory through tripartite collaboration between government, university, and SMEs. OSMEP acts as the government, SMEs represent the business sector, and the Thammasat University Library represents the university. In-depth interviews were done with nine participants, including three OSMEP administrators, three Thai Chamber of Commerce entrepreneurs, and three Thammasat University academic staff. Results revealed a conceptual model for transforming academic libraries into innovative entrepreneurship hubs based on the triple helix model (Figure 2) while indicating challenges and expectations of each party: 1) OSMEP aimed to create strategic business network connections. After completion of annual formal support programs, established business networks continued to foster connections and provide mutual support among participating businesses; 2) SMEs expected financial support for development from the government and knowledge and technology from universities for businesses, including product, marketing, and process innovation. Significantly, SMEs require suitable knowledge and technological operation backing through easily accessible channels; 3) Thammasat University Library strives to transform organizationally to link between faculties and the technology transfer office as well as to support innovation and entrepreneurship in physical and online spaces.

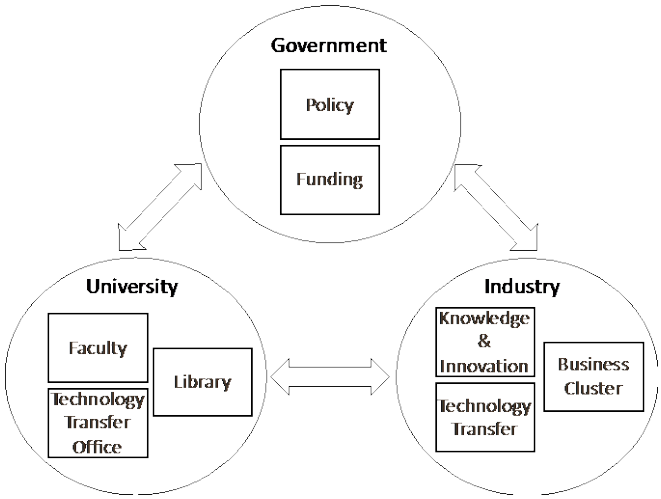


Figure 2: Conceptual model: innovation and entrepreneurship hubs based on the triple helix model

4.2 Model Testing

From October 2022 to September 2023, Thammasat University Library and OSMEP collaborated to develop business clusters by promoting MSME participation in the project to receive benefits for business development. Membership in the Thailand Business Cluster Platform included financial support for business development from OSMEP and access to diverse Thammasat University Library knowledge sources. Networking activities with other entrepreneurs in the same value chain were also offered. 162 MSMEs were chosen to participate in the project, including clusters of 55 in future food, 54 in wellness tourism, and 53 in e-sports and digital economy. Each business cluster participant received appropriate technology transfer upstream and downstream. For example, future food upstream businesses received technology transfer for vegetables, fruit, animals, and environmentally friendly chemical extractions. In addition, downstream businesses received technology for shelf-life extension, freeze-drying, spray-drying, ozone-drying, and encapsulation technology.

After closing this development project, focus groups were conducted with 23 stakeholders, including five administrators from government agency, nine university academic staff (three lecturers, three researchers, and three librarians) and nine from entrepreneurial clusters (three from future food, three from wellness tourism,

and three from e-sports and digital economy). Focus group investigated the format of transforming academic libraries into innovative entrepreneurship hubs through tripartite collaboration among the government, universities, and SMEs. Results indicated a new library model as innovative entrepreneurship hubs through three main service delivery mechanisms: 1) life space; 2) service innovation; and 3) Thailand business cluster platform (TBCP). The conceptual model for transforming academic libraries into innovation and entrepreneurship hubs is illustrated in Figure 3.

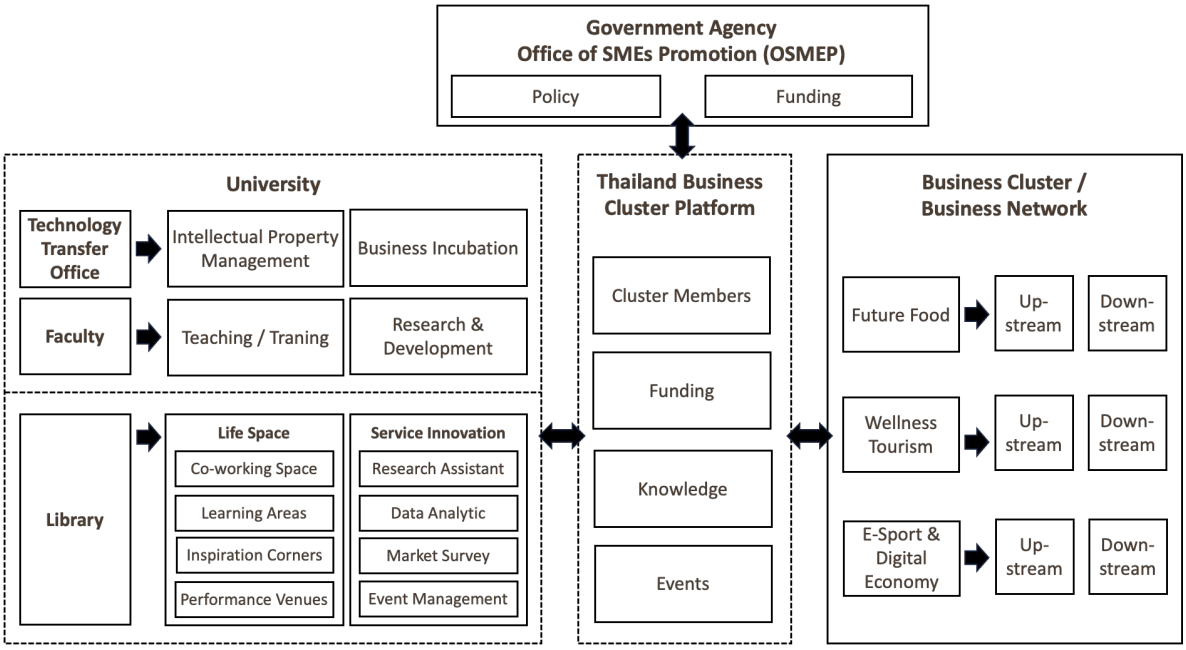


Figure 3: Model for transforming academic libraries into innovation and entrepreneurship hubs

A primary finding was the application of the Life Space Concept, which divided the library space into four distinct areas to meet different needs: co-working spaces, learning areas, inspirational corners, and performance venues (Table 2). These spaces were developed based on user feedback and needs assessments conducted through focus groups. A participant from the focus group remarked: "The inspirational corners have significantly enhanced our creative thinking process, making the library not just a place for reading, but for creating."

Secondly, Thammasat University Library introduced four service innovations to entrepreneurs, including research assistance, business data analytics, market survey, and event management (Table 3). The third mechanism was the Thailand Business Cluster Platform, providing an online connection between the business network and four key features: business; capital sources and state benefits; knowledge access; and event information (Table 4).

Table 2: Life Space Concept: zoning and definition

Life Space	Description
1. Co-working spaces	Designed to foster collaboration among students, faculty, and entrepreneurs.
2. Learning areas	Equipped with advanced technology to support learning and research activities.
3. Inspirational corners	Created to inspire creativity and innovation among users.
4. Performance venues	For events, presentations, and performances to engage the community.

Table 3: Service innovation: service type and definition

Service innovation	Description
1. Research assistance	Provides expert help for conducting and managing research projects.
2. Business data analytics	Offers data analysis services for market trends and making informed decisions.
3. Market survey	Conducts surveys to gather market insights for entrepreneurs.
4. Event management	Assists in organizing events promoting innovative entrepreneurship.

Table 4: TBCP: features and definition

Cluster platform	Description
1. Business clusters	Links entrepreneurs in the same value chain from upstream to downstream
2. Capital sources	Provides information on funding opportunities and governmental support.
3. Knowledge access	Links entrepreneurs to Thammasat University research, technology, and innovation.
4. Event information	Provides details about events fostering business collaboration and networking.

The TBCP presents multidimensional member data, including cluster, geographical area, and expertise. This enables interested businesses to easily find suitable partners. Thammasat University Library also works as a facilitator, organizing a business clinic day program to offer consultations, connecting SMEs with areas for improvement to leading companies and university experts. Experiments have shown that it facilitates business connections in the same business cluster. For example, in wellness tourism, a doctor who owns a rehabilitation center classified as a small-sized enterprise specializes in treatment and services, but faces challenges in scaling up the business. After joining a project between Thammasat University Library and OSMEP, the firm underwent quality screening and standards and were provided with business networking opportunities. They had an opportunity to discuss business with Sindhorn Kempinski, a world-class luxury hotel, and a business deal ensued. Sindhorn Kempinski created service innovations to offer inhouse rehabilitation services in their chain, with the rehabilitation center as service provider.

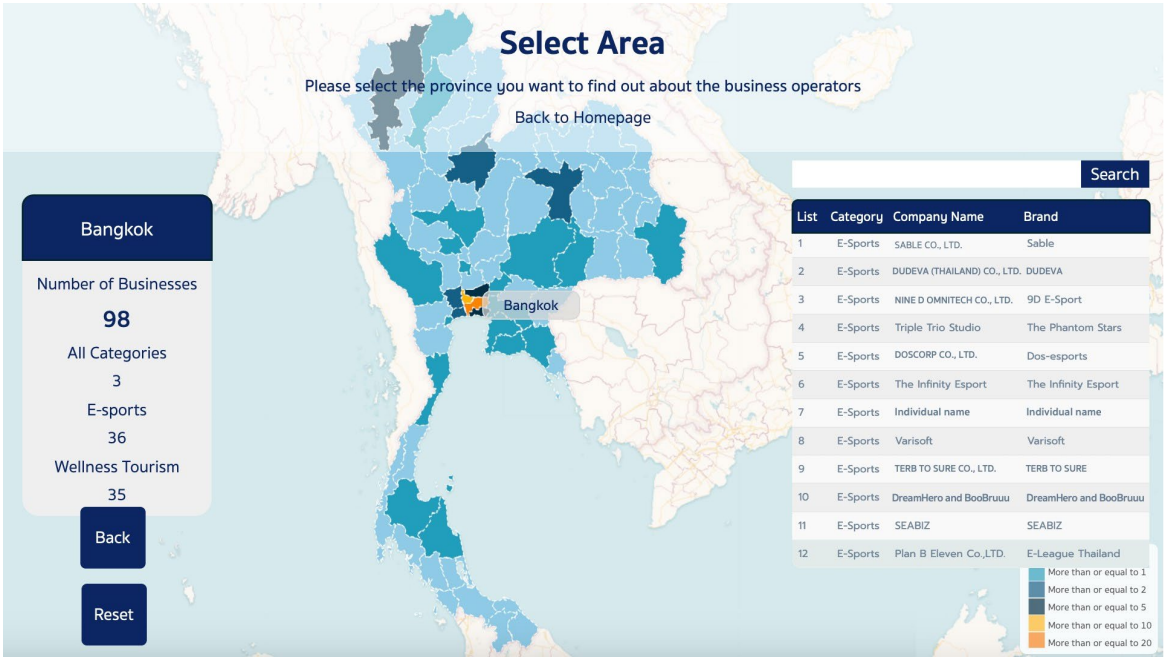


Figure 3: Thailand Business Cluster Platform (TBCP)

In sum, the Thammasat University Library has successfully transformed into hubs of innovation and entrepreneurship. The new model supports technology transfer, innovation creation, and entrepreneurship through collaborative efforts, innovative space design, and service enhancements. This approach aligns with global trends and provides a sustainable model for other academic libraries seeking to drive regional economic development and foster a culture of innovation.

5. Discussion and Implications

As a successful model, Thammasat University Library has transitioned from mainly providing book reading spaces to supporting technology transfer, innovation creation, and entrepreneurship. Several factors contribute to the success of this operation, based on the triple helix model and related components: 1) supportive authority from OSMEP participating in policy support and budget allocation; 2) education and technology provided by Thammasat University Library acting as a hub for gathering knowledge and technology to transfer to SMEs; 3) business networking, curated through initial project screening to produce a network of capable and trustworthy entrepreneurs; 4) connectivity through the TBCP facilitates searching for expert entrepreneurs in diverse fields

for collaborations; 5) shared facilities, as in the collaboration between a world-class hotel chain and small-sized rehabilitation center, allow resource-sharing such as hotel service areas and medical personnel. This enables service innovation for both parties without significant additional investment, increasing business opportunities for both parties.

This research aligns with Asian nations such as Korea, where research indicates that a main problem for SMEs is lack of technology and resources, including business networks. Universities solely serving as technology providers are inadequate. They must become network promoters in university-industry collaboration, strengthening regional business clusters to enhance SME competitiveness. Subsequently, different network formations occur among the regional business cluster members (Kim, 2018). SMEs can now receive more technology transfers for market innovation as they receive support and business engagement from cluster members. This study introduces a new approach to building a business ecosystem, departing from the traditional practice of creating collaborations among SMEs in the business ecosystem according to multi-level geographical advantage such as sharing the same state or nation (Zubielqui et., al. 2015). Instead, opportunities are proposed for creating business ecosystems based on business type, using the TBCP to transcend geographical limitations.

Linking the triple helix model and academic libraries integratively, comprising interactions between universities, industry, and government, helps transform academic libraries into hubs of innovation and entrepreneurship. In this framework, academic institutions such as the Thammasat University Library serve as nodes facilitating knowledge transfer and innovation. The library role extends beyond traditional services to support technology transfer, foster innovation, and encourage entrepreneurial activity. In this model, universities (represented by the Thammasat University Library) act as knowledge creators and transmitters, providing research, development, and educational support. Industry (represented by SMEs) uses this knowledge to develop new products and services, driving economic growth and job creation. Government (represented by OSMEP) formulates supportive policies, providing financial incentives and fostering a conducive environment for innovation and SME growth. This tripartite collaboration ensures that academic libraries become dynamic spaces that support continuous learning, innovation, and business development. By transforming into innovation hubs, libraries facilitate the interaction between researchers, entrepreneurs, and policymakers, driving regional economic development and promoting a culture of innovation.

These findings are in line with concepts discussed in the literature review, particularly the theories related to cluster development and the triple helix model. The role of Thammasat University Library as an innovation hub aligns with Porter's cluster theory, which emphasizes the benefits of geographically concentrated enterprises and institutions that collaborate to boost competitiveness and innovation (Porter, 1998). The library's engagement with SMEs and government bodies likewise reflects the triple helix model's call for university-industry-government collaboration as a framework for innovation (Etzkowitz & Leydesdorff, 1995). This study demonstrates how academic libraries can extend their traditional roles to become active participants in this model, contributing to the knowledge economy by facilitating knowledge transfer and innovation diffusion.

This paper revealed three important policies: 1) policy support: governments should consider policies that recognize and support the innovative roles of academic libraries in the national innovation system; 2) innovation funding: increased funding should be directed towards libraries to help them build the necessary infrastructure and services that support innovation and entrepreneurship; 3) partnership development: libraries should continue to foster partnerships with industry and government bodies to facilitate the effective transfer of knowledge and technology. Adopting these recommendations could significantly impact national innovation policies. Libraries could be acknowledged as central actors in the innovation ecosystem, essential for driving sustainable economic growth.

Acknowledgements

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Aspects Considered Relevant in Higher Education Curriculum to PRODUCE Business Innovative Graduates

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Abstract: Higher Education Institutions (HEIs) have been tasked with the responsibility to generate knowledge through research and educate students and **PRODUCE** graduates with the capability to innovate and develop business innovation through entrepreneurial teaching. Therefore, it is significant for a university to align itself with the needs of the industry to **PRODUCE** graduates with the capability to **PRODUCE** business innovation. The purpose of this research was to determine aspects considered relevant in the Higher Education curriculum to **PRODUCE** graduates ready to develop business innovation and become entrepreneurs. The mixed-method research approach was deemed suitable for this research, therefore both qualitative and quantitative data were collected through the use of semi-structured interviews with 11 participants from the University of Johannesburg commercialisation units and an online questionnaire from 69 innovation experts from the South African Business Innovation Community (Innovation Summit), and the Innovation, Sustainability, and Visionary Leadership Group. The data collected was then analysed through descriptive content analysis and statistical analysis. This study is part of a PhD study completed in 2022 and only the results about the aspects considered relevant in the Higher Education curriculum to **PRODUCE** graduates ready to develop business innovation are presented and discussed. Based on the findings it is significant to note that aspects, such as creativity; originality and initiative; critical thinking and analysis; analytical thinking and innovation complex problem solving; and entrepreneurship are relevant and suitable for the university curriculum. In conclusion, more emphasis should be reflected in the Higher Education curriculum on these aspects mentioned above to **PRODUCE** graduates ready and capable of developing and producing business innovation. Higher Education Institutions should regularly implement interventions to improve their curriculum to best suit the needs of the industry or the business sector.

Keywords: Higher education institutions curriculum, Graduates, Business innovation, Entrepreneurship

1. Introduction

Universities play a significant role in promoting entrepreneurship, and innovation, ensuring that graduates are ready to contribute to the innovative industry, and thus they need to have university entrepreneurial structures (Rooke, 2017; Liu, Walley, Pugh, & Adkins 2020). Although there is no single definition for entrepreneurship, there are more common descriptions of what an entrepreneurial university is. An entrepreneurial university is an HEI that thrives through its curriculum design, teachings, research, support units, community engagement, Work-Integrated learning (WIL), and information management approach to build entrepreneurial leadership and business development skills with the involvement and support from external bodies, such as the government and commercial-driven entities (Chugh, 2013; Brink, Mearns & Du Plessis, 2014; Jameson & O'Donnell, 2015; Rooke, 2017; Liu et al., 2020). Entrepreneurial universities are purposefully designed to promote and support students and staff to be enterprising individuals, inventive and creative through teaching and learning, and through research. This is all in the pursuit to create and use knowledge across their boundaries (Jameson & O'Donnell, 2015). Most university students are deemed to not fit to contribute to business innovation after graduating from their studies, this means most of them lack innovative skills and expertise.

It is therefore significant for university to align itself with the needs of the industry to **PRODUCE** graduates with the capability to **PRODUCE** business innovation. This can be achieved through curriculum reassessment and design to suite some of the industry needs while maintaining its values and principles. This research paper aimed to determine aspects considered relevant in the Higher Education curriculum to **PRODUCE** graduates ready to develop business innovation or become entrepreneurs.

2. Literature Review

Entrepreneurial universities put more emphasis on ensuring that people in their pursuit to be innovators, creators, and enterprising minds, are well empowered through teaching and various other support systems. For a university to have entrepreneurial characteristics, depends on the extent to which innovators come up with innovative ways to improve the well-being of the world or their immediate society. Simply put, an entrepreneurial university is an institution that builds its environment with the intent to apply an

entrepreneurial mind-set and encouraging behaviours associated with an entrepreneurial culture, where even rewards are granted (Jameson & O'Donnell, 2015).

Jameson and O'Donnell, (2015) identified the seven pillars that entrepreneurial universities' practice can be evaluated on:

- Governance and leadership.
- People involved, along with the capacity of an organisation and the incentives or rewards.
- The development of entrepreneurship and its inclusiveness in the curriculum.
- Various pathways and support systems for entrepreneurs.
- The collaborative efforts between HEI and external business parties to exchange knowledge.
- The internationalisation of the entrepreneurship institution.
- The way the entrepreneurial university's impact is measured.

The focus of an entrepreneurial university is to ensure that acts of entrepreneurship are embedded within the institution's DNA, across the entire institution, concerning disciplines and management (Rooke, 2017; Liu et al., 2020). An entrepreneurial university is represented by the act of transforming the functions of an institution to more entrepreneurship-based operations that include psychological ownership (Chugh, 2013). This is to ensure the viability of innovations that can adapt to the changing business environment, society, and stakeholder needs, in a manner that is sustainable and improves the aspect of student experience (Jameson & O'Donnell, 2015).

Universities are different from other entities; due to the HEI promotion system and governance, research academics play vital roles in the process of entrepreneurship education (Simmons & Hornsby, 2014). University entrepreneurship can differ from corporate innovation spin-offs and other business ventures. The level of governance, competitiveness, motivations, and systems form clear performance indicators of academic entrepreneurship and sometimes they are complex. In other instances, some other commercialised innovations that are derived from university knowledge are never disclosed, be it due to the lack of a platform or of a structure or something else (Soltanifar, Hughes, & Göcke, 2021). Furthermore, universities may prefer to only engage in external businesses that are already existing and support them.

3. Methodology

This research paper presents a component of a larger PhD study, which was on innovation and commercialisation dynamics of entrepreneurial universities. A Signification Framework was used as a method for this research, this methodology refers to a structure for underlying systems, concepts, and text representing the world philosophies and perception of researchers, it is not normally utilised to represent the meaning and applied sensemaking (Deprez & Hanchar, 2017; Magoma, 2018). A Signification Framework aims to make sense through five elements namely, Presume, Predict, Prize, Perceive, and **PRODUCE**, with their unique meaning and purpose. This paper only reports on the data from the **PRODUCE** element, with its description meaning to lead to or cause a specified thing to happen or exist, this further refers to aspects considered relevant to PRODUCE graduates ready to develop business innovation. This paper is further supported by pragmatism as a philosophical paradigm, which allows the researcher to explore real-world practical ways that can work and improve university curriculum for the benefit of graduates.

A Mixed-method research approach was utilised for this study, data was collected using both qualitative and quantitative methods through semi-structured interviews with 11 participants from the University of Johannesburg commercialisation:

- Project Management Office.
- Commercialisation & Technology Transfer Office.
- UJ Centre for Entrepreneurship.
- UJ Izindaba Zokudla.
- Process, Energy & Environment Technology Station (PEETS).
- Technopreneurship Centre.
- PurpleGrowth.
- Close the Gap: Social enterprise.
- IKM alumni entrepreneurs.

Furthermore, an online questionnaire was distributed to 100 participants and a response was obtained from 69 innovation experts from the South African Business Innovation Community (Innovation Summit), and the

Innovation, Sustainability and Visionary Leadership Group. The population sample ranged from, company representatives, Managing Directors, academics, company founders, board member, Chief Executive Officers, government representatives, Chief Operating Officer, entrepreneurs, creative director, learning manager, filmmaker and editor, lead consultant, mentor, business analyst chief of section, mentor and Ambassadors from the Vice Chairperson in the Northern Lights Northern Conference of South Africa's Youth Committee, business development, marketing and sales. Descriptive content analysis and statistical analysis were used to analyse the data collected.

Permission was granted by the College of Business and Economics Research Committee (CBEREC) with a clearance code and a clearance number (IKM2018_023) was appointed. All research participants were given informed consent forms to obtain permission to conduct research and as part of ethical consideration.

4. Results and Discussion

The results address the research objective "To determine aspects considered relevant in the Higher Education curriculum to PRODUCE graduates ready to develop business innovation"? As mentioned above and described, the research participants were given the Signification Framework terminology where the element **PRODUCE** means "to lead to or cause (a specific thing) to happen or exist". Thus, this question or Signification Framework element refers to **PRODUCE**, that is, to lead to or cause a specific thing to happen or exist. Four options were given to the respondents: to no extent, to some extent, to a moderate extent, to a great extent. It is significant to note only a small portion and relevant qualitative data is integrated into this paper, this is to support the quantitative data presented. The 13 components shown on the category axis were:

1. Strategic information management.
2. Artificial intelligence.
3. Entrepreneurship.
4. Advanced business management.
5. Systems analysis and evaluation.
6. Big data and analytics.
7. Analytical thinking and innovation.
8. Creativity, originality, and initiative.
9. Technology design and programming.
10. Critical thinking and analysis.
11. Leadership and social influence.
12. Complex problem solving.
13. Emotional intelligence.

The results on each of these components are illustrated in Figure 1.

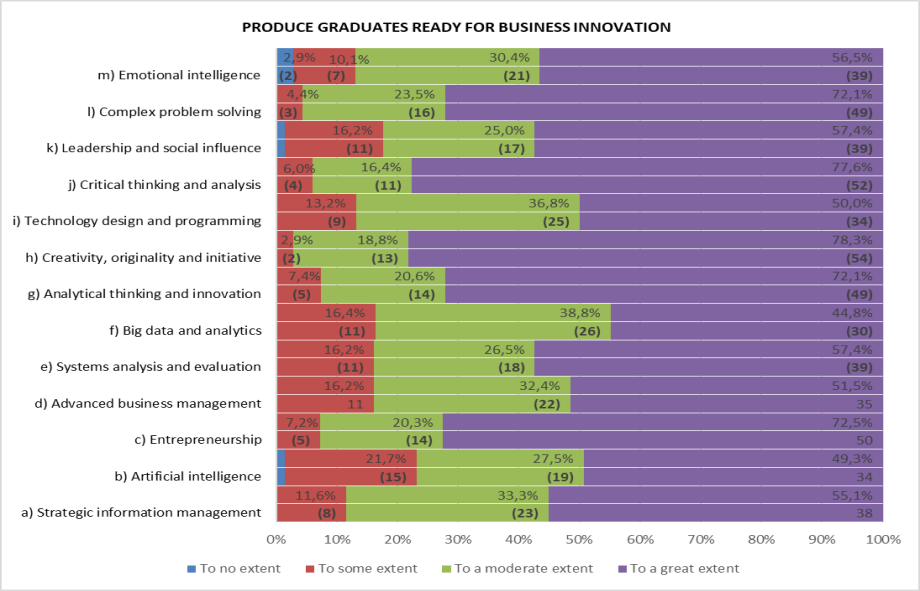


Figure 1: Aspects considered relevant in the Higher Education curriculum to PRODUCE graduates ready to develop business innovation (own source developed for this study, 2021)

The results in Figure 1 illustrate at a) on strategic information management, none of the participants indicated to no extent, 11.6% indicated to some extent, 33.3% indicated to a moderate extent, 55.1% indicated to a great extent. Figure 1 at b) on artificial intelligence, 1.4% of the participants indicated to no extent, 21.7% indicated to some extent, 27.5% indicated to a moderate extent, 49.3% indicated to a great extent. Figure 1 at c) on entrepreneurship, none of the participants indicated to no extent, 7.2% indicated to some extent, 20.3% indicated to a moderate extent, 72.5% indicated to a great extent. Figure 1 at d) on advanced business management, none of the participants indicated to no extent, 16.2% indicated to some extent, 32.4% indicated to a moderate extent, 51.5% indicated to a great extent. Figure 1 at e) on systems analysis and evaluation, none of the participants indicated to no extent, 16.2% indicated to some extent, 26.5% indicated to a moderate extent, 57.4% indicated to a great extent. Figure 1 at f) on big data and analytics, none of the participants indicated to no extent, 16.4% indicated to some extent, 38.8% indicated to a moderate extent, 44.8% indicated to a great extent. Figure 1 at g) on analytical thinking and innovation, none of the participants indicated to no extent, 7.4% indicated to some extent, 20.6% indicated to a moderate extent, 72.1% indicated to a great extent. Figure 1 at h) on creativity, originality and initiative, none of the participants indicated to no extent, 2.9% indicated to some extent, 18.8% indicated to a moderate extent, 78.3% indicated to a great extent. Figure 1 at i) on technology design and programming, none of the participants indicated to no extent, 13.2% indicated to some extent, 36.8 of the respondents indicated to a moderate extent, %50% indicated to a great extent. Figure 1 at j) on critical thinking and analysis, none of the participants indicated to no extent, 6% indicated to some extent, 16.4% indicated to a moderate extent, 77.6% indicated to a great extent. Figure 1 at k) on leadership and social influence, 1.5% of the participants indicated to no extent, 16.2% indicated to some extent, 25% indicated to a moderate extent, 57.4% indicated to a great extent. Figure 1 at l) on complex problem solving, none of the participants indicated to no extent, 4.4% indicated to some extent, 23.5% indicated to a moderate extent, 72.1% indicated to a great extent. Figure 1 at m) on emotional intelligence, 2.9% of the participants indicated to no extent, 10.1% indicated to some extent, 30.4% indicated to a moderate extent, 56.5% indicated to a great extent.

Analysis of aspects relevant to Higher Education curriculum considered to PRODUCE graduates ready to develop business innovation enabled the researcher to develop this study's Signification Framework PRODUCE element (cf Figure 1 illustrate that HEI should place more emphasis and consider creativity, originality and initiative, critical and analytical thinking, and complex problem-solving when formulating their programs. Further, Entrepreneurship should be another aspect considered by HEI when formulating their programs for producing graduates ready to develop business innovation. This discussion or interpretation is supported by participants that were interviewed, they of the opinion that universities should be able to train graduates on entrepreneurship to clearly understand the various dynamics around developing and running a business, innovation, and solution. Also, results from the interview coincided with the results of the questionnaire regarding entrepreneurship in the Higher Education curriculum.

Participant 3 indicated:

> *"Look, **I think definitely business skills,** you know, how do you run a business, so all the things that I've just mentioned, **putting in place the governance issues that will make your business run smoothly.** When I started working on my own, someone said to me, as **an entrepreneur, she said to me, you need to make time to work for your business, and you can't always work in your business".***

Participant 5 indicated:

> *"[…] to get the entrepreneur to do stuff for themselves, you know, sort of coming in, and getting a lecture on how to, on how to plan your company, […]. in closing, **the universities have the ability to say look, we need to cultivate entrepreneurship amongst our students, if a student is selling textbooks by the grass leave him alone. Because once you put a stop to it, it stifles entrepreneurship, if students sell sweets in the corridors of universities.** I mean, most of those students that actually do that, it's a, it's a survival mode…for them, you know, I mean".*

Participant 7 indicated:

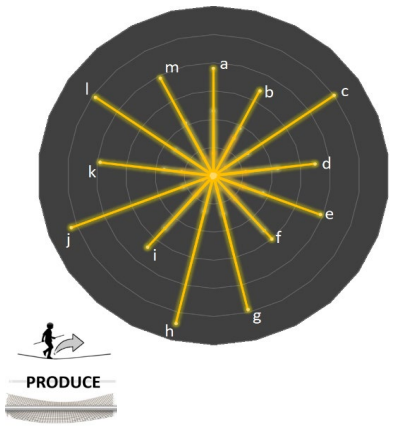
> *"[…] skills that the entrepreneur. So, it's being able to critically review your own solution, and seeing those shortfalls in the solution and then pivoting and coming up with an alternative.*

Participant 10 indicated:

> *"[…] **train entrepreneurs**. […] they must have an understanding [of] basic financial principle, strategic principles, marketing principles, business principles. That is the key thing, it's a holistic view. They need*

to know everything from how to form idea, the vision, mission, that strategic principles, they need to know how to sell it, which is marketing, they need to know how to drive the financial business and how to work out profit and loss and viability. And then obviously, yeah, that that for me is key. […] an entrepreneur must have leadership skills. An entrepreneur must understand how to communicate how to sell. They must know how the sales process they must know what behavioural [...]"

Next, Figure 2 demonstrates the PRODUCE intervention key; – looking at those aspects considered relevant in the HEI curriculum to ensure the readiness of graduates to develop business innovation. The area inside the polygon made by a to m points is a quantitative marker of the Produce Innovation so it can be further applied to other input data.



a) Strategic information management
b) Artificial intelligence
c) Entrepreneurship
d) Advanced business management
e) Systems analysis and evaluation
f) Big data and analytics
g) Analytical thinking and innovation
h) Creativity, originality, and initiative
i) Technology design and programming
j) Critical thinking and analysis
k) Leadership and social influence
l) Complex problem solving
m) Emotional intelligence

Figure 2: PRODUCE intervention key – Relevance of HEI curriculum (own source developed for this study, 2021)

Application 1: If HEI curriculum gives the highest priority to fostering creativity, originality, and initiative, but fails to include entrepreneurship, analytical thinking and innovation, critical thinking and analysis, and complex problem-solving in equal measure in all its teaching and learning activities, then the likelihood decreases of producing graduates that are able to develop business innovation. In this case, an intervention will be necessary, for example, programme review to align module outcomes.

Application 2: Although big data and analytics are relevant in the 4IR, it does not necessarily mean that its inclusion in the curriculum of an entrepreneurial university will **PRODUCE** the readiness of graduates to develop business innovation. An overemphasis on one aspect of the curriculum at the expense of other relevant aspects indicates that an intervention is needed.

Furthermore, it is noteworthy that artificial intelligence was rated the lowest, especially since the Fourth Industrial Revolution (4IR) is driven by artificial intelligence, as described by Mhlanga (2021), which has direct impacts on innovation and infrastructure development. AI seems to be the next big driver of change and will largely impact the industry and how innovation is harnessed, therefore the researcher thinks that AI should be considered significantly when HEI (re)formulates its programs.

5. Conclusion

There is a growing need for HEIs to develop graduates with an entrepreneurial mindset, innovative and capable of contributing to business innovation. This was addressed using a Signification Framework element **PRODUCE**, which produces an intervention key that addresses aspects considered relevant in the Higher Education curriculum to **PRODUCE** graduates ready to develop business innovation and entrepreneurship. The intervention key assists HEI through intervention benchmarks, to inform curriculum redesign. Based on the findings it is

important to note that aspects, such as creativity; originality and initiative; critical thinking and analysis; analytical thinking and innovation; complex problem solving; and entrepreneurship are relevant. Furthermore, it is noteworthy that based on the findings artificial intelligence was rated the lowest, this comes in specifically as 4IR is driven by artificial intelligence, as described by Mhlanga (2021), which has direct influence and largely depends on innovation and infrastructure development.

It is noteworthy to recognise that creativity; originality and initiative; critical thinking and analysis; analytical thinking and innovation; complex problem solving; and entrepreneurship should take precedence within HEI's curriculum to **PRODUCE** graduates ready and capable to develop business innovation and/or become entrepreneurs. This study allowed the researcher to understand which aspects are considered relevant for the HEI curriculum (to produce graduates with the capability to produce business innovation) and which they should consider when (re)formulating their programs.

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Predicted and Prized Critical Skills for a Graduate to Produce Effective Innovation

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Abstract: Higher Education Institutions (HEIs) have been mandated with the task to train and produce graduates with the capability to contribute to the economy and improve societies through teaching and learning. Furthermore, they are tasked with the responsibility to produce graduates with the capability to produce innovations that change the world for the better. For a university to produce such graduates it would need to focus on the curriculum and ensure that the skills and knowledge taught are relevant to produce innovative graduates. The purpose of this research paper was to identify the predicted and prized skills that a graduate can use to produce groundbreaking innovations. This objective would yield guidance on the most critical skills that should be included in a BCom degree to produce graduates with the capability to produce groundbreaking innovations. This research employed a Mixed-method approach with the use of both qualitative and quantitative approach. Data was collected using semi-structured interviews with 11 participants from the University of Johannesburg commercialisation units and an online questionnaire from 69 innovation experts from the South African Business Innovation Community (Innovation Summit), and the Innovation, Sustainability and Visionary Leadership Group. Data was collected through descriptive content analysis with the aid of Atlas.ti and inferential statistical analysis. This study is part of a completed PhD study, the reporting is only on Predicted and Prized critical skills for a BCom degree graduate. Based on the results ideation, reasoning, problem solving, complex problem solving, critical thinking, creativity and analytical thinking are skills and competences predicted to improve innovation and produce graduates with the capability to innovate. Furthermore, based on the results critical thinking, judgement and decision making are very significant skills for a person with a BCom degree. In conclusion, HEIs should place more emphasis on critical thinking skills within the curriculum and complex problem-solving skills. These skills should not only be exclusive to certain programmes but throughout the entire HEI's curriculum.

Keywords: Commercialisation, Higher education institutions, Innovation, Curriculum, Signification framework

1. Introduction

Innovation plays a critical role as a catalyst for societal and economic growth. It is also a catalyst for wellness, and prosperity and significantly seats at the core of HEIs, Government, and the Business sector. According to Nelles, Wilton, Walsh, and Tim, (2023), "*The 2020 R&D Roadmap argued that fueling an efficient system of innovation will improve lives, services, and business right around the UK and beyond – creating a fairer, healthier more prosperous and more resilient society*". It is stated that innovation should be encouraged through various sectors, as it is essential for the future prosperity of a society and a significant key to enabling societies to achieve their objectives and in turn solve societal and global challenges related to security, biodiversity, and climate (Nelles, Wilton, Walsh, and Tim, 2023). In this case, it is significant to note that humans play an integral part in ensuring effective production of innovation and, hence should possess relevant skills conducive to producing innovation. It is with no doubt that HEIs play an important role in equipping graduates with the skills relevant to produce innovation, and this is achieved through their academic programs and degree programs, etc. People are arguably critical and key in Research and Development around innovation, therefore should be equipped with relevant skills through various initiatives.

It is significant to note that various initiatives and educational programmes enhance management, commercialisation leadership, and entrepreneurial skills that will ultimately contribute to innovation adoption, and growth in business innovation (Nelles, Wilton, Walsh, and Tim, 2023). These innovation skills are critical to support the development of an innovative workforce and enable the generation of entrepreneurs, government, and business leaders to drive innovation leadership and economic growth. In this case, therefore the purpose of this research was to identify the predicted and prized skills for a graduate to produce impactful innovations.

2. Innovation as a Concept

Innovation is the ability to create and introduce a new product or service in the market, or the improvement of an already existing product and service commonly referred to as the type of innovation that is radical and incremental (Katz, 2007:32). These four types are the overarching categories of innovation, namely product, process, marketing, and organisational innovation. These types of innovation are further categorised, for example, radical innovation, digital innovation, disruptive innovation, and other types of innovation. Some types

of innovation are commercialisable. Due to the dynamic nature of innovation commercialisation that often entails PM, it is important to unpack PM theory and innovation. For example, the type of innovation known as radical innovation can be referred to as a newly created product, incremental innovation can be described as the enhancement of an existing product, and radical innovation often has a high risk due to its nature of uncertainty and complexity (Katz, 2007:33).

Innovation can be categorised into different types of innovations that are generally key to the business strategy of a business for sustainable competitive advantage (Varadarajan, 2018:144). The different types of innovation are product innovation, marketing innovation, business model innovation, and strategic innovation. Generally, innovation can be defined as the introduction or implementation of a new or improved product, service or process, and new business practice (Varadarajan, 2018:149). Innovation can further be defined as knowledge that is used uniquely and differently, it could be a new way of thinking and innovation is normally the result of complex and dynamic interactions and learning processes by different stakeholders (Pellissier, 2012:4).

3. Innovation and Commercialisation Process

Innovation plays a significant role in business growth and the creation of new businesses; hence it is important to nurture innovativeness. Innovativeness can be described as the capacity of an invention or innovation to disrupt the business industry or create a shift in the business paradigm, specifically in the market structure of a particular industry or in science and technology (Varadarajan, 2018:150). There are various definitions of innovation, namely: innovation can be defined as the process of successfully Commercialising an invention; or innovation can be defined as the successful process of Commercialising an idea, product, or practice (Varadarajan, 2018:152). These definitions bring forth the importance of commercialisation of innovation (CoI). CoI can be defined as a process in which various connected steps are undertaken to successfully introduce a product or service to the market. Commercialisation can be executed by corporations and start-up businesses through various processes (Jordan, 2010:4).

The basic commercialisation process includes screening the ideas, measuring the objectives of the business idea and the deliverables of the business project, later the product is tested and validated until it is launched to the market (Jordan, 2010:4). It is important to nurture business ideas and innovation within universities. In the university context commercialisation can be described as an intellectual process undertaken by academics and students where ideas and knowledge are converted into businesses or commercial products and services (Razak & Murray, 2017:298). The success of commercialisation depends on the strategy implemented to introduce new ideas and innovations (Sibanda, 2021). Innovation networks and components play an essential role in the commercialisation of products and services (Razak & Murray, 2017:298). There are various components that play a role in ensuring the commercialisation of products and services, such as systems thinking for entrepreneurial universities, quality information for decision making, and design thinking in a complex environment. The section will focus on the methodology applied to this research.

The above-mentioned is important to note but it is equally important to note that various skills are required to achieve innovation with the potential to be commercialised or implemented by an employer. Whorton, Casillas, Oswald, and Shaw, (2017: 05) argue that critical thinking, creativity, customer service, teamwork, metacognition, and self-regulation are critical skills for the 21st-century workforce, furthermore, they recommend that leadership, cross-cultural knowledge, and competence, and ethics and integrity are among the most critical skills for the 21st-century workforce to be effective in the workplace and demonstrate innovation.

4. Methodology

The research philosophy was pragmatism due to the practical nature of the research project, as Saunders, Lewis, and Thornhill (2016:136-137), with an action research strategy, and mixed-method complex research approach. The methods were, semi-structured interview, and an online questionnaire. The population consisted of HEI entrepreneurial support units of a South African university, the University of Johannesburg (UJ), innovators and entrepreneurs in the ranks of UJ IKM alumni, business innovation experts represented by the delegates of the annual South African Innovation Summit, and the Innovation, Sustainability and Visionary Leadership Group. The sampling method for this study was non-probability sampling, that is, purposive. Purposive sampling is the deliberate and thoughtful selection of the right participants for the research project (Saunders, Lewis & Thornhill, 2009:237). The in-depth interview was analysed inductively using the qualitative content analysis method to obtain a rich understanding from interpreting data using thematic coding techniques. Interviews were conducted with various representatives from commercialisation units and entrepreneurs. Once the

analysis of interview data was completed, statistical analysis utilising descriptive techniques was used to analyse structured data obtained from the questionnaire.

To conduct research that is valid and undisputable, the phenomenon under investigation and the research methodology were subject to obtaining research ethics clearance prior to conducting the actual research. Since the phenomenon was the commercialisation dynamics of entrepreneurial universities, and the researcher is an employee of an HEI and has direct contact with the IKM field of research, the action research strategy was approved by the researcher's employer, the University of Johannesburg. Permission was obtained to use UJ as the research site. Furthermore, permission was obtained from the UJ College of Business and Economics Research Ethics Committee (CBEREC) to conduct research in accordance with the UJ Code of Academic Research Ethics (2007).

5. Results and Findings

Based on the results form the question on "To what extent do they predict that an individual's ability to be innovative will improve because of skills and competencies listed below. The four options given to respondents were: to no extent, to some extent, to a moderate extent, to a great extent, and 13 skills shown on the category axis were:

1. Analytical thinking.
2. Innovative disposition.
3. Active learning and learning strategies.
4. Creativity, originality, and initiative.
5. Technology design and programming.
6. Critical thinking.
7. Leadership.
8. Social influence.
9. Complex problem solving.
10. Emotional intelligence.
11. Reasoning, problem solving.
12. Ideation.
13. Systems analysis and evaluation.

The results on each of these components are illustrated in Figure 1.

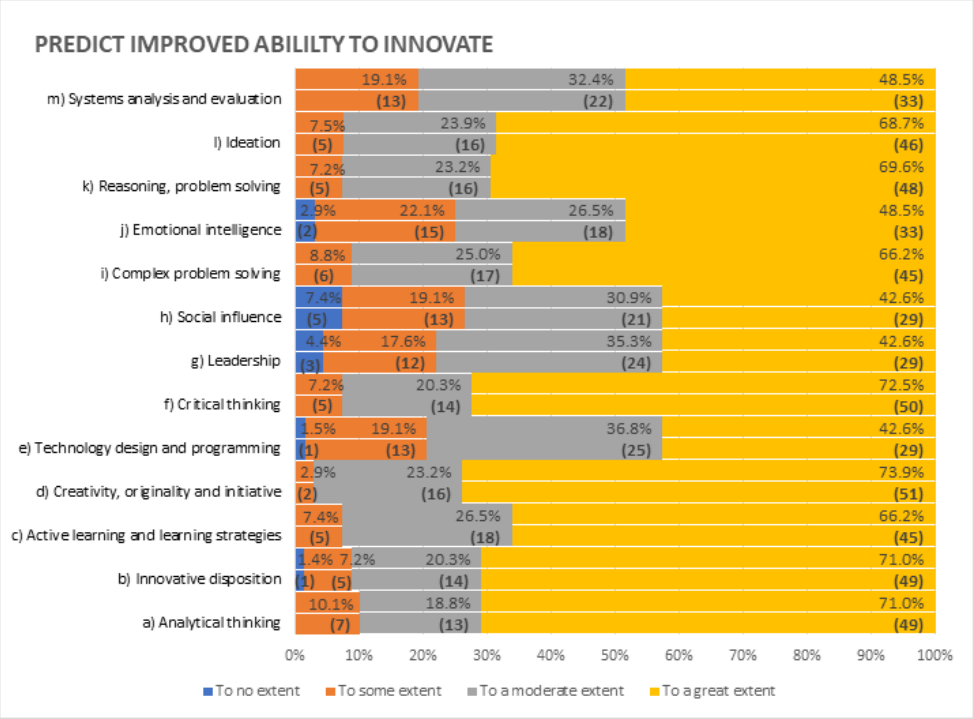


Figure 1: Skills and competencies predicted to improve ability to innovate (own source developed for this study, 2021)

Results from Figure 1, that is, the extent participants predicted that an individual's ability to be innovative will improve because of having certain skills and competencies, such as analytical thinking and active learning strategies, are illustrated in Figure 1. On analytical thinking, none of the participants indicated to no extent, 10.1% indicated to some extent, 18.8% indicated to a moderate extent, 71% indicated to a great extent. Figure 1 at b) on innovative disposition, 1.4% of the participants indicated to no extent, 7.2% indicated to some extent, 20.3% indicated to a moderate extent, 71% indicated to a great extent. Figure 1 at c) on active learning and learning strategies, none of the participants indicated to no extent, 7.4% indicated to some extent, 26.5% indicated to a moderate extent, 66.2% indicated to a great extent. Figure 1 at d) on creativity, originality, and initiative, none of the participants indicated to no extent, 2.9% indicated to some extent, 23.2% indicated to a moderate extent, 73.9% indicated to a great extent.

Figure 1 at e) on technology design and programming, 1.5% of the participants indicated to no extent, 19.1% indicated to some extent, 36.8% indicated to a moderate extent, 42.6% indicated to a great extent. Figure 1 at f) on critical thinking, none of the participants indicated to no extent, 7.2% indicated to some extent, 20.3% indicated to a moderate extent, 72.5% indicated to a great extent. Figure 1 at g) on leadership. 4.4% of the participants indicated to no extent, 17.6% indicated to some extent, 35.3% indicated to a moderate extent, 42.6% indicated to a great extent. Figure 1 at h) on social influence, 7.4% of the participants indicated to no extent, 19.1% indicated to some extent, 30.9% indicated to a moderate extent, 42.6% indicated to a great extent. Figure 1 at i) on complex problem solving, none of the participants indicated to no extent, 8.8% indicated to some extent, 25% indicated to a moderate extent, 66.2% indicated to a great extent.

Figure 1 at j) on emotional intelligence. 2.9% of the participants indicated to no extent, 22.1% indicated to some extent, 26.5% indicated to a moderate extent, 48.5% indicated to a great extent. Figure 1 at k) on reasoning, problem solving, none of the participants indicated to no extent, 7.2% indicated to some extent, 23.2% indicated to a moderate extent, 69.6% indicated to a great extent. Figure 1 at l) on ideation, none of the participants indicated to no extent, 7.5% indicated to some extent, 23.9% indicated to a moderate extent, 8.7% indicated to a great extent. Figure 1 at m) on systems analysis and evaluation, none of the participants indicated to no extent, 19.1% indicated to some extent, 32.4% indicated to a moderate extent, 48.5% indicated to a great extent.

Based on the results illustrated in Figure 1, creativity, originally and the ability to take initiative are the most significant skills and competencies that universities should put focus on, along with critical thinking skills, innovation disposition and analytical thinking. This finding coincides with the results of the interview. All participants described the importance of analysis, and two participants specifically mentioned the pitfall, lack of analytical thinking.

Participant 3 indicated:

> *"You see! Are you? Are you producing monthly financial statements? Or at least quarterly financial statements? Are you analysing your financial statements? Do you make the decisions about investing in business? Or are they just spending everything that's coming in?*

Participant 8 indicated:

> *"You know, the one thing I do not see it IRT analyses can do this is keeping, analysing, interpreting and wrinkles [sic], to constantly know exactly what happens with your stock, your inventory of cash flow, all of that, for customers, how many companies and often those kinds of entrepreneurs don't, you know, they are scared of that, because it's a data intensive thing".*

From the results of the questionnaire, creativity, originality, and initiative are the most predicted skill or capability linked to improved innovation, as illustrated in Figure 1, 73.9% of the participants indicated to a great extent. From the interviews conducted, one of the participants from the commercialisation unit emphasised creativity:

Participant 9:

> *"I think the best skill is creativity".*

Some of the entrepreneur participants interviewed, mentioned leadership and problem solving. Participant 1 indicated:

> *"[…], one of the main things is you need to be able to be a problem solver. Yeah. Because if you do not know how to solve a problem, you just be said, okay, you stand aside".*

Participant 5 indicated:

> *Okay, I think a big one for me, personally, is the ability to influence, so that talks directly to leadership, […] so, a big, big, big, big area of skill for me is that ability to influence to inspire and motivate.*

The **PRIZED** element was further informed by the results in Figure 2, from the participants when they were asked to what extent they prized the skills for a person with Bachelor of Commerce (BCom) degree obtained from a South African University; 11 skills were listed:

- Complex problem solving.
- Critical thinking.
- Creativity.
- People management.
- Coordinating with others.
- Emotional intelligence.
- Judgement and decision making.
- Service orientation.
- Negotiation skills.
- Cognitive flexibility.
- Design thinking.

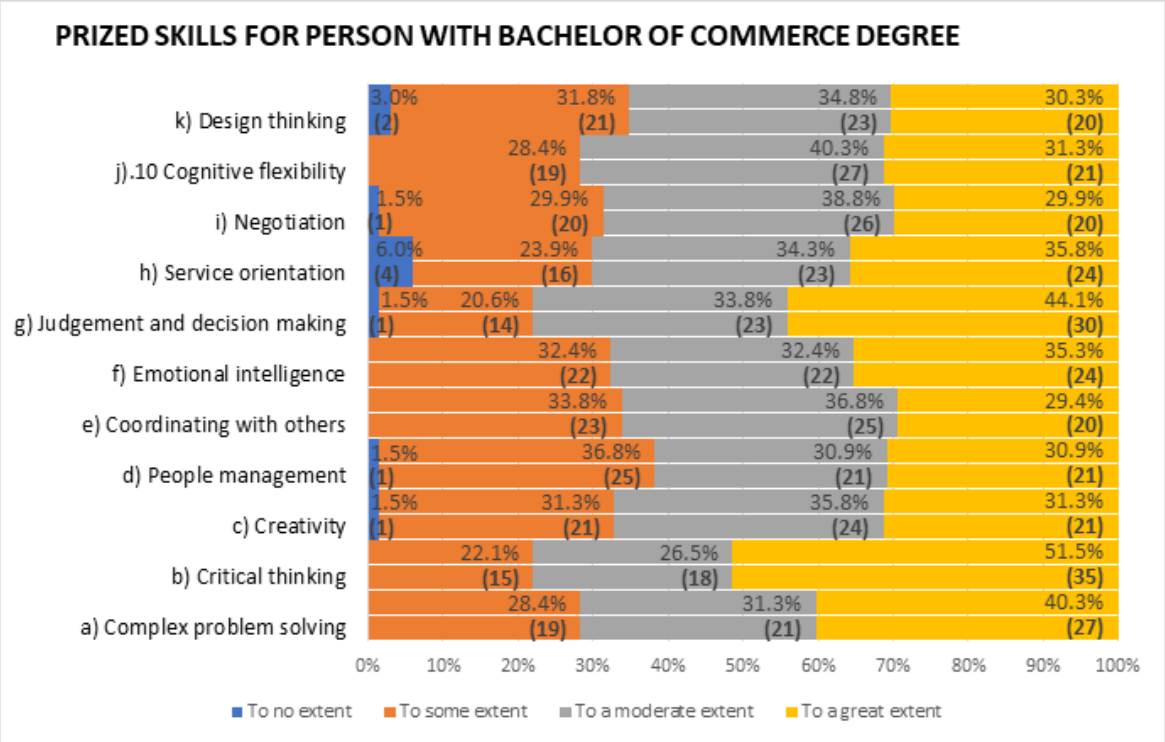


Figure 2: Prized skills for a person with a Bachelor of Commerce degree (own source developed for this study, 2021)

On Figure 2 at a), the first skill was complex problem solving, none of the participants prized to no extent, 28.4% participants prized to some extent, 31.3% participants prized to a moderate extent, and 40.3% prized complex problem-solving skill to a great extent. On Figure 2 at b), the second skill was critical thinking, none of the participants prized to no extent, 22.1% participants prized to some extent, 26.5% participants prized to a moderate extent and 51.5% participants prized to a great extent. This is a clear indication that entrepreneurial institutions should place value on instilling critical thinking within innovators and students specifically. On Figure 2 at c), the third skill was creativity. 1.5% of the participants prized to no extent, 31.3% participants prized to some extent, 35.8% participants prized to a moderate extent, and 31.3% prized creativity to a great extent.

On Figure 2 at d), the fourth skill was people management. 1.5% of the participants prized to no extent, 36.8% participants prized to some extent, 30.9% participants prized to a moderate extent, and 30.9% participants prized to a great extent the skill of people management. On Figure 2 at e), the fifth skill was coordinating with

others; none of the participants prized to no extent, in other words all participants to some extent prize the skill of coordinating with others. Of the participants, 33.8% participants prized to some extent, 36.8% participants prized to a moderate extent, and 29.4% participants prized to a great extent. On Figure 2 at f), the sixth skill was emotional intelligence, none of the participants prized to no extent, 32.4% participants prized to some extent, 32.4% participants prized to a moderate extent, and the majority (35.3%) prized emotional intelligence to a great extent. On Figure 2 at g), the seventh skill was judgement and decision making. 1.5% of the participants prized to no extent, 20.6% participants prized to some extent, 33.8% participants prized to a moderate extent, and 44.1% participants prized to a great extent.

On Figure 2 at h), the eighth skill was service orientation. In comparison to other skills, a fair percentage of the participants 6% prized the skill of service orientation to no extent. Of the participants, 23.9% participants prized to some extent, 34.3% participants prized to a moderate extent, and 35.8% prized service orientation to a great extent. On Figure 2 at i), the ninth skill was negotiation, with 1.4% of the participants indicating that they did not prize the skill of negotiation, 29.9% prized negotiation skill to some extent, 38.8% participants prized to a moderate extent, and 29.9% participants prized the skill of negotiation to a great extent. On Figure 2 at j), the tenth skill was cognitive flexibility, none of the participants prized to no extent, 28.4% participants prized to some extent, 40.3% participants prized to a moderate extent, and 31.3% prized cognitive flexibility to a great extent.

On Figure 2 at k), the eleventh skill was design thinking. 3.0% of the participants prized to no extent, 31.8% participants prized to some extent, 34.8% participants prized to a moderate extent, and 30.3% prized design thinking skill to a great extent. By integrating the findings of the interview, the researcher had with innovators, entrepreneurs, and university commercialisation units, design thinking seems to be a critical skill to aid innovation and commercialisation and enable the creation of business products and services. For instance, these research participants who were interviewed from the commercialisation unit indicated as follows.

Participant 5 indicated:

> *"Your product must fit a particular niche is very, very important. And so, you know, what we call the design thinking stage, design thinking those kinds of exercises that need to happen earlier on. So, when people come in and say this is a great idea. You go through design thinking process only to discover that there is nothing here unless we do one, two three and four You know, or things like you will be successful. If for example, we introduced a product for free to get a consumer acceptance. And then at other components, other variables onto it value addition, and then start charging for those kinds of things".*

Participant 7 indicated:

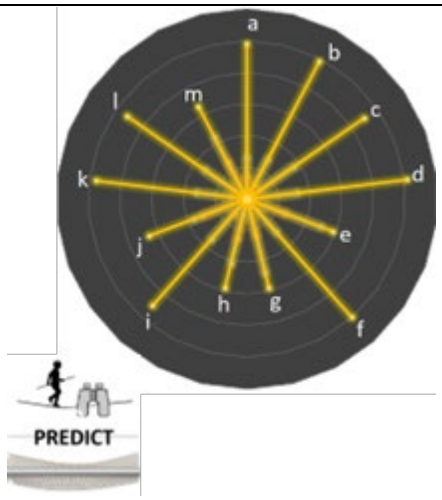
> *"So, we apply a lot of design thinking in our approach when we develop solutions. So, we very much solution orientated, and we have a requirement to ensure that whatever take all solution we want to take into an environment that it can succeed. You do that by developing as a minimum viable product. Like, testing it in that environment, seeing whether doing a bit of market research around it to see whether is addressing the problem".*

Participant 7 added:

> *"To demonstrate that the project is not feasible, that something is not feasible that they're trying to achieve. That is why we like the design thinking approach where you have a minimum viable product, before you spend a lot of money to develop a cheap and simple prototype, and to demonstrate that it can work. And then based on that, attract investment, and buy in and engage with potential buyers that would want that check to see if there's a real need within the market for it". […] So, there is this thing. Now this big thing now called design thinking […] So, my answer goes back to what I said earlier a lot of the work needs to be done in understanding the needs of the client and test the product pilot of the product with the clients to find out if they have real interest".*

The responses illustrated in Figure above indicate a fair response between some extent, moderate extent, and great extent, which indicated universities should place value on prized skills by finding balance in their curriculum. To find this balance, an intervention mechanism, such as a SIM system would then assist with the alignment of dynamic capabilities at the **PRIZED** element level. The results show that the most prized skills from among complex problem solving, critical thinking, creativity, people management, coordinating with others, emotional intelligence, judgement and decision making, service orientation, negotiation skills, cognitive flexibility, and design thinking, are critical thinking, judgement and decision-making skills.

Based on these findings, the researcher developed the **PREDICT** and **PRIZED** and of this study's signification framework (*cf* Figure 3 & 4).

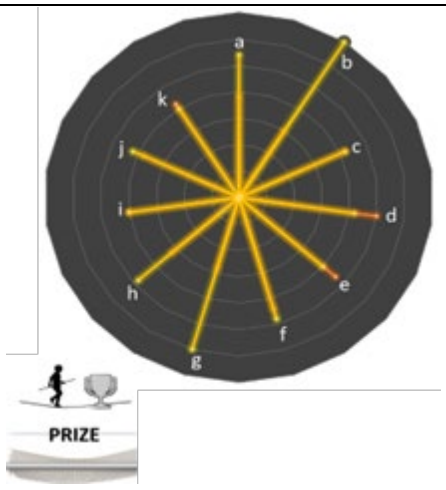


a) Analytical thinking
b) Innovative disposition
c) Active learning and learning strategies
d) Creativity, originality, and initiative
e) Technology design and programming
f) Critical thinking
g) Leadership
h) Social influence
i) Complex problem solving
j) Emotional intelligence
k) Reasoning, problem solving
l) Ideation
m) Systems analysis and evaluation

Figure 3: PREDICT Intervention key – Skills that will improve ability to innovate (own source developed for this study, 2021)

Application 1: If an entrepreneurial university provides students with an environment that encourages the creativity, originality, and initiative of innovators during academic residency, the prediction is that their ability to innovate in the business environment will improve.

Application 2: If the HEI curriculum comprises teaching and learning of a variety of skills that will improve the ability to innovate, then intervention is not necessary. The **PREDICT** intervention key will flag an issue such as unbalanced attention to one skill at the expense of another skill, in which case intervention is needed. Leadership, 2) explorative culture, and 3) brand identity.



a) Complex problem solving
b) Critical thinking
c) Creativity
d) People management
e) Coordinating with others
f) Emotional intelligence
g) Judgement and decision making
i) Service orientation
j) Negotiation skills
k) Cognitive flexibility
l) Design thinking

Figure 4: PRIZE Intervention key – Skills for a person with a BCom degree (own source developed for this study, 2021)

Application 1: When the two most prized skills of a person with a BCom degree are 1) critical thinking, and 2) judgement and decision making, but HEI designs its assessments to test BCom students' ability to memorise

theory without practical application that requires critical thinking, judgement and decision making, then intervention is needed.

Application 2: If teaching and learning activities concentrate on people management and coordinating with others yet neglecting the other prized skills of a person with a BCom degree, then teaching and learning intervention is needed.

6. Conclusion

The quest to determine the skills required to produce graduates capable of producing graduates with the capability to innovate presents a research gap for this study to add value. This study aimed to add value by determining the most predicted and prized skills required within the university curriculum to produce graduates capable of producing effective innovation. It is significant to take note of the major skills HEIs should focus on to ensure that they ensure graduates are capable of creative thinking, problem-solving, critical thinking, negotiation, decision-making skills, and leadership. This would assist in getting a clearer understanding of the level of graduates' readiness and the skills universities should be focusing on to ensure that graduates can produce innovation and business growth. Whorton, Casillas, Oswald, and Shaw, (2017: 05) confirmed some of the skills from the results by listing critical thinking, creativity, customer service, teamwork, metacognition, and self-regulation as critical skills for the 21st century workforce. Apart from the skills determined from this, it further recommended that leadership, cross-cultural knowledge and competence, and ethics and integrity are among the most critical skills for the 21st-century workforce as stated by Whorton, Casillas, Oswald, and Shaw, (2017: 05).

In conclusion, it is significant for HEIs to put an emphasis and focus on skills such as creativity, critical thinking, ideation, innovation disposition, and analytical thinking within the curriculum to produce graduates capable of producing effective innovation.

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A Literature Review: The Impact of Digital Transformation on Financial Performance

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Abstract: In recent years, digital transformation (DT) has emerged as a significant driver of organizational change, promising to revolutionize business processes, enhance operational efficiency, and ultimately improve business success. This literature review examines the empirical evidence surrounding the impact of DT on financial performance (FP) across various industries and organizational contexts. The review synthesizes findings from empirical research to provide insights into the mechanisms through which DT influences key performance metrics such as profitability, revenue growth and return on investment (ROI). Through a comprehensive analysis of existing literature, this review aims to contribute to a deeper understanding of the complex relationship between DT and FP and to provide valuable implications for both scholars and practitioners seeking to navigate the digital landscape effectively.

Keywords: Digital transformation, Financial performance, Impact, Literature review

1. Introduction

Digital transformation (DT) has emerged as a pivotal force reshaping industries worldwide. According to a survey conducted by (Gartner 2017), 91% of the businesses surveyed were engaged in some form of digital initiative, and 87% of senior business leaders say digitalization is a priority. This paradigm shift involves the integration of digital technologies into all aspects of business operations, fundamentally altering how companies create value, interact with customers, and compete in the marketplace. The advent of technologies such as artificial intelligence (AI), big data analytics, blockchain, the Internet of Things (IoT), and cloud computing has revolutionized traditional business models, leading to enhanced operational efficiencies, improved customer experiences, and the creation of new revenue streams (Matarazzo et al. 2021). Companies across various sectors are increasingly adopting digital transformation strategies to stay relevant in a rapidly evolving digital economy (Montagner & Reich 2018).

While the strategic importance of DT is widely acknowledged, its impact on the FP of companies remains a topic of extensive debate. FP, which includes metrics such as profitability, revenue growth and return on investment (ROI) is a critical measure of a company's success and long-term viability. Despite numerous case studies and anecdotal evidence suggesting the potential benefits of digital transformation, empirical research presents a mixed picture. Some studies highlight significant financial gains, while others report marginal or even negative impacts. This inconsistency underscores the need for a comprehensive examination of existing literature to better understand how digital transformation influences financial outcomes.

This literature review serves as a vital contribution to the existing literature by analysing only publications that provide empirical evidence of impacts of DT on FP. The need for empirical research in this domain is driven by several factors: Firstly, the outcomes of DT initiatives can vary significantly across different organizations. Factors such as industry context, company size, organizational culture, and implementation strategy can influence the success and financial impact of DT efforts. This literature review can help identify the conditions under which DT is most likely to yield positive financial outcomes. Secondly, limitations and complexities in measuring the impact of DT on FP can be identified. Traditional financial metrics may not fully capture the benefits of digital investments, such as improved customer satisfaction, innovation capabilities, or market agility. Empirical studies can develop and utilize appropriate frameworks and metrics to assess the realistic impact of DT on FP. Thirdly, the benefits of DT may not be immediately apparent. Longitudinal studies are necessary to understand the long-term effects of digital initiatives on FP. Such research can provide insights into the lag between digital investment and financial returns, helping companies manage expectations and plan their digital strategies more effectively.

2. DT and Financial Performance

DT can be defined as 'the process of organizational or societal changes driven by innovations and developments of the information and communication technologies (ICT)' (Bockshecker et al. 2018). It also incorporates manifold changes imposed by ICT in organizations, such as the development or alternation of business models,

sales and communication channels, customer relationship management and the digitization of a firm's offerings (Haffke et al. 2016). Consequently, DT describes the radical transformation of the organization via the formation of new technologies. In this regard, it evokes a holistic perspective that primarily emphasizes the integration of digital technologies in the various elements of the organization, but also includes underlying digitization and digitalization concepts.

Recent studies on DT demonstrate the complexity of this phenomenon and its impact on fundamental elements of companies' value creation, such as business processes (Grab et al. 2019) , technology infrastructure (Nwankpa and Roumani 2016), organizational culture (Pfaff et al. 2023), HR (Hegedűs 2020), products and services (Almaazmi et al. 2021), customer experience (Tolboom 2016), suppliers and partners (Fröhlich and Steinbiß 2020). Digital transformation is recognized as an obvious factor of business competitiveness in the modern business environment.

FP on the other hand, commonly measured through indicators such as revenue growth, profitability, return on investment (ROI), and market share, is a critical metric for evaluating the success of business strategies, including DT initiatives. Although having theoretically established that DT has an impact on FP, very few studies are able to investigate this empirically. There remains a paradox whether DT has a positive or negative impact on firm's FP. Despite having plethora of advantages DT does not guarantee profitability, because it incurs operating and integrating costs (Guo and Xu 2021). Some scholars claim that DT can have positive impact on FP when observed at a longer time span and given that high level of DT intensity is maintained (Gurumurthy et al. 2019, Mahssouni et al. 2023, Yonghong et al. 2023). Contrary to this, some authors argue that DT can have a degrading effect on company financials (Jardak and Hamad 2022, Bughin et al. 2019).

This underlines the need for a systematic literature review to explore and synthesize current research results on the impact of DT on FP of companies. By analysing empirical studies, this contribution aims to provide a holistic understanding of the relationship between DT and various FP metrics. Additionally, it seeks to identify gaps in the current literature and propose directions for future research, offering valuable insights for academics, practitioners, and policymakers.

3. Methodology

A systematic literature review (SLR) was conducted to explore the impact of DT on the FP of companies. The approach ensures a comprehensive, unbiased, and replicable review of existing literature and involves clearly defined stages: identification of relevant studies, selection of studies based on predefined criteria, data extraction, and synthesis of findings. The following research questions guide the literature review: What are the key factors of DT that influence FP? What financial outcomes are associated with DT initiatives?

A comprehensive search strategy was devised to identify relevant academic articles, books, reports, and other sources related to DT and FP. Multiple electronic databases such as Emerald insights, ScienceDirect, Scopus, and Google Scholar were searched using keywords such as 'Digital transformation,' 'Digital maturity,' 'Financial performance,' and 'Business performance and digitalization', 'ROI of digital transformation'. Boolean operators (AND, OR) and wildcards were used to refine and expand the search. Lastly the "snowball" method was used to identify appropriate academic sources by exploring the references of other relevant research. Next, articles were screened based on predefined inclusion and exclusion criteria to ensure their relevance to the research topic. To ensure the relevance and quality of the reviewed studies, the following inclusion and exclusion criteria were applied: Only peer-reviewed journal articles, conference papers and reputable industry or consulting reports, written in English and published after the year 2015 were considered, that focus on the impact of DT on FP. Next, quality assessment of the extracted data was performed. In order to do this, studies were assessed based on their robustness, sample size, relevance as well as quality and type of data.

4. Analysis of Empirical Studies Investigating the Impact of DT on Financial Performance

The SLR delivered a total number of 12 empirical studies from the years 2016-2024, that rely on self-reported data as well as quantitative data, econometric, regression models and a variety of data sources like financial databases and annual reports. Most studies are geographically concentrated, especially in China and Europe, while some target diverse global regions. Their industry focus varies, with some studies focusing on specific sectors like manufacturing, while others cover broader industrial bases. The studies cover varying time frames (e.g., 2009-2019 for Zhai et al. 2022, 2015-2019 for Mahssouni et al.), their sample sizes vary significantly, from 92 observations (Jardak et al. 2022) to 2566 (Liu et al. 2023). Varied indicators and indices are used to measure

the level or maturity of DT (e.g., DESI dimensions, custom indices, Likert scales) as well as different FP metrics (e.g., ROA, ROE, Tobin's Q, profit margin), complicating direct comparisons of results.

Table 1: Analysed studies investigating impact of DT on financial performance

Author	Year	Title	Region	Sample	Time period	DT dimensions (input)	Financial performance metrics (output)	Data Source
(Barba-Sánchez et al. 2024)	2024	Effects of digital transformation on firm performance: The role of IT capabilities and digital orientation	Spain	246 answers from CEOs and owners of SMEs and Micro SMEs in the manufacturing sector	na	Digital orientation; Digital transformation; IT capability	Seven items addressing organisations' financial and non-financial results	Qualitative self-assessment
(Mahssouni et al. 2023)	2023	Dual Perspectives on Financial Performance: Analysing the Impact of Digital Transformation and COVID-19 on European Listed Companies	Europe	2179 cross-sectoral European Listed companies.	5 Years	Connectivity; Human capital; Integration of digital technology; Digital public services	ROA; ROE	Orbis database, DESI Index
(Zhang et al. 2023)	2023	The impact of digital transformation of manufacturing on corporate performance — The mediating effect of business model innovation and the moderating effect of innovation capability	China	255 Answers acquired from Senior and Middle level managers of Micro SMEs, SMEs and Large enterprises in the manufacturing sector.	5 Years	Exploitative DT; Explorative DT	Profit margin; Rate of return of sales; Operational costs; Market share	Qualitative self-assessment
(Liu et al. 2023)	2023	The Effect of Financial Digital Transformation on Financial Performance: The Intermediary Effect of Information Symmetry and Operating Costs	China	2566 cross-sectoral A-share listed companies	9 Years	Application of digital technology; Information system and digital platform; Data governance; Business and financial process reengineering; Smart finance	Tobin's Q; Operating Income; Operating Cash flow; Shareholding Ratio; Asset–Liability Ratio	Annual company reports, China Stock Market and Accounting Research database

Author	Year	Title	Region	Sample	Time period	DT dimensions (input)	Financial performance metrics (output)	Data Source
(Yonghong et al. 2023)	2023	The impact of enterprise digital transformation on financial performance — Evidence from Mainland China manufacturing firms	China	55 A-share listed manufacturing companies	7 Years	Digital IT architecture; Digital inputs; The extent to which digitalization is integrated with the industry	Inventory turnover ratio; Total asset turnover ratio	"Top 100 Value Creation of A-share Listed Companies in China's Equipment Manufacturing Industry" report, Annual company reports
(Jardakund Ben Hamad 2022)	2022	The effect of digital transformation on firm performance: evidence from Swedish listed companies	Sweden	92 observations from 23 listed companies from the Media, Banking and Manufacturing sectors	4 Years	Digital marketing; Digital product experience; e-commerce; e-CRM; Mobile and; Social media.	ROA; ROE; Tobin's Q	"Digital leader's reports", DataStream
(Zhai et al. 2022)	2022	Does digital transformation enhance a firm's performance? Evidence from China	China	Accounting and financial data acquired from 9614 cross-sectoral A-share listed companies	10 Years	Digital technology applications; Business model innovations; Innovation capability	ROA; ROE; Cost (Production cost/Total revenue); Turnover; Leverage; Equity multiplier (total assets/shareholder equity)	Annual company reports, China Stock Market and Accounting Research database
(Teng et al. 2022)	2022	Research on the Relationship between Digital Transformation and Performance of SMEs	China	335 Answers acquired from executive of Manufacturing SMEs	na	Digital technologies; Digital skills; DT strategy	ROI; ROE; Increase in sales; Return on sales; Gross profit; Net profit	Qualitative self-assessment
(Guo und Xu 2021)	2021	The Effects of Digital Transformation on Firm Performance: Evidence from China's Manufacturing Sector	China	2254 Listed manufacturing companies	10 Years	DT Intensity; Industrial DT maturity	Cost of obtaining unit revenues (operating cost + sales expense); ROA; Asset turnover rate; Asset-liability ratio; Equity concentration	Annual company reports, China Stock Market and Accounting Research database

Author	Year	Title	Region	Sample	Time period	DT dimensions (input)	Financial performance metrics (output)	Data Source
(Abou-foul et al. 2021)	2021	The impact of digitalization and servitization on the financial performance: An empirical analysis	USA & Europe	Financial data was acquired from OSIRIS data base and the data on DT was acquired using questionnaire for executives of the same 185 manufacturing companies	3 Years	Servitization; Digitalization	Revenue/Number of employees; Fixed assets turnover; Return on sales; ROI; General profitability of the firm; Market capitalization	Qualitative self-assessment
(Ragu Gurumurthy et al. 2019) Deloitte	2019	Uncovering the connection between digital maturity and financial performance	USA	1200 cross-sectoral organizations with a revenue of at least $250 Mil	na	Flexible, secure infrastructure; Data mastery; Digital savvy, open talent networks; Ecosystem management; Intelligent workflows; Unified customer experience; Business model adaptability	Net revenue; Net profit	Qualitative self-assessment
(Joseph K. Nwankpa und Yaman Roumani 2016)	2016	IT Capability and Digital Transformation: A Firm Performance Perspective	USA	167 Answers acquired from CIOs, VPs of IT and IT executive of cross sectoral Medium and Large sized enterprises	na	IT Infrastructure; IT business spanning; IT proactive stance	Profitability; Customer retention; ROI; Sales growth	Qualitative self-assessment

The comparative analysis of the studies on digital transformation (DT) and its impact on financial performance (FP) reveals a nuanced understanding of how various factors and contexts influence this relationship. In the following, the general approach, findings, and implications of each study are outlined to provide a cohesive overview.

Barba-Sánchez et al. (2024) examined the mediating roles of IT capabilities and digital orientation in the DT-FP relationship within 246 Portuguese manufacturing companies. Using qualitative surveys and multivariate analysis, they found that while DT significantly contributes to FP, its impact is heavily dependent on IT capabilities and digital orientation. Similarly, Nwankpa and Roumani (2016) focused on 167 US companies and discovered that DT mediates the influence of IT capabilities on FP (including profitability, customer retention, ROI, and sales growth) and innovation, underscoring the importance of IT capabilities in leveraging DT for better financial outcomes.

Mahssouni et al. (2023) utilized an econometric model to analyse financial data from 2179 listed European companies (2015-2019). They integrated financial variables (ROA, ROE) and non-financial variables from the DESI

index to capture DT maturity levels. Their findings revealed a 1% increase in digital capacities leading to a 58% improvement in FP, indicating a strong positive correlation. However, they also noted a negative relationship between the price-to-book value ratio and FP, hinting at the complexities of market perceptions.

In a study of 255 Chinese manufacturing companies over five years, Zhang et al. (2023) differentiated between explorative and exploitative DT modes. They found that both modes positively impact business model innovation and FP, highlighting the strategic value of tailored DT approaches. Teng et al. (2022) supported this by surveying 335 Chinese SMEs and finding positive correlations between specific DT dimensions ('Digital Technology', 'Digital Skills', and 'DT Strategy') and FP indicators (ROI, ROE, sales increase, Return on Sales, gross profit, and net profit).

Zhai et al. (2022) used extensive accounting data from Chinese A-Share listed companies (2009-2019) and demonstrated that DT enhances FP through better asset turnover, lower operating costs, and increased innovation success. Their textual analysis of annual reports showed that DT firms had a 0.33% better ROA compared to non-DT firms, translating to a 7.29% higher return. Liu et al. (2023) found similar positive correlations in Chinese companies, with DT improving FP by 1.1% and enhancing information symmetry while reducing operating costs.

Guo and Xu (2021) observed a U-shaped relationship between DT and FP in 2254 listed Chinese manufacturing companies (2010-2020). Their regression analysis indicated initial profitability dips post-DT implementation due to high costs, followed by increased profitability after five years, suggesting that DT benefits accumulate over time. Conversely, Jardak et al. (2022) found that DT negatively impacts FP in 23 listed Swedish companies, with high IT infrastructure investment costs outweighing benefits initially but positively influencing market valuation (Tobin’s Q).

Abou-Foul et al. (2021) explored the role of digitalization in enabling servitization and enhancing FP in 185 manufacturing firms in the USA and Europe. Their analysis showed that digitalization and data-driven solutions significantly improve FP and market offerings. In a broader scope, Gurumurthy et al. (2019) analyzed 1200 US-based companies, revealing a direct positive correlation between DT maturity and FP. Companies with higher DT maturity levels exhibited substantial growth in net revenue, net profit, sales from new products/services, and customer lifetime value, while also reducing costs for new product launches and customer acquisition.

Lastly, Yonghong et al. (2023) studied 55 listed Chinese manufacturing companies (2013-2020) and concluded that while DT positively impacts FP, there is an initial lag. Their multivariate model showed that profitability performance decreases initially, but as DT deepens, improvements in net sales margin, total asset return, inventory turnover, and asset turnover rates become evident.

In summary, while the studies show a general consensus on the positive impact of DT on FP, the extent and immediacy of these benefits are influenced by factors such as IT capabilities, digital orientation, the nature of the industry, and the maturity level of DT implementation. The temporal aspect is particularly critical, as initial costs and investments may obscure the immediate benefits, which tend to accrue more significantly in the long term. These study findings collectively underscore the complexity of the DT-FP relationship, necessitating a strategic and well-supported approach to digital transformation.

5. Discussion of Limitations

Most analysed studies are geographically concentrated, especially in China and Europe, with fewer studies covering diverse global regions. This limits the generalizability of findings across different economic contexts.

The industry focus varies, with some studies focusing on specific sectors like manufacturing, while others cover broader industrial bases, which can lead to sector-specific insights that might not apply universally. Qualitative surveys (e.g. Teng et al. 2022, Barba-Sánchez et al. 2024, Nwankpa & Roumani 2016) rely on self-reported data, which can introduce bias and limit the accuracy of FP assessments. While many studies establish correlations between DT and FP, causality is often implied rather than rigorously tested, leaving room for alternative explanations (e.g., firms already performing well are more likely to invest in DT). Moreover, there is a lack of a longitudinal studies observing the long-term impact of DT on FP. IT investments could take years to materialize and to be captured by performance indicators. Even though a series of studies inherit longitudinal data, they cover varying time frames (e.g., 2009-2019 for Zhai et al. 2022, 2015-2019 for Mahssouni et al. 2023), making it challenging to compare results across different economic cycles and technological advancements. All studies use varied indicators and indices to measure DT (e.g., DESI dimensions, custom indices, Likert scales), leading to inconsistencies in how DT's impact is quantified. Studies such as from Zhang et al. and Barba-Sánchez et al. explore mediating factors like business model innovation and IT capabilities, but more comprehensive models

are needed to understand the complex interplay between DT and various organizational dimensions. Other studies, such from Guo et al. 2021 and Jardak et al. 2022 rely on text analysis of annual firm reports to gain insights into company DT measures. Critical digital actions are never disclosed in these reports, therewith their validity stays ambiguous and needs further verification.

6. Conclusion

In conclusion, this SLR painted a comprehensive picture of the DT-FP relationship. While the positive impact of DT on FP is evident, the extent and timing of this impact are influenced by a variety of factors. Initial costs and market perceptions also play critical roles in shaping the outcomes. Therefore, companies aiming to leverage DT for financial improvement must adopt a holistic approach that considers these mediating factors and prepares for the potential initial costs and time-lagged benefits. By doing so, they can better navigate the complexities of DT and achieve sustainable financial success. The limitations discussed highlight the need for more geographically and sectorally diverse research, standardized measurement approaches, and longitudinal studies to better capture the dynamic effects of DT on FP. Addressing these limitations will provide a clearer understanding of how and when DT investments yield tangible financial benefits.

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Power Outage Perils: Assessing the Impact of Load-Shedding on SMEs in Enoch Mgijima Local Municipality, South Africa

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Abstract: This qualitative case study delves into the profound impact of load-shedding, the deliberate and temporary interruption of electricity supply, on small and medium (SMEs) in the Enoch Mgijima Local Municipality (EMLM) of South Africa. The study, conducted within an interpretive research paradigm and a qualitative methodology, provides a nuanced understanding of how institutional forces shape SMEs' behavior, decision-making, and overall functioning in the face of energy disruptions. The persistent power cuts due to load-shedding have had a substantial toll on the survival of SMEs in the EMLM, with businesses across diverse sectors, including hospitality, beauty, manufacturing, retail, and services, struggling to maintain operations. The study brings to light the multifaceted challenges SMEs face, such as disruptions to daily activities, equipment damage, and significant financial losses. It also presents a concerning trend of layoffs by SMEs in the region, contradicting the National Development Plan's (NDP) employment creation goals. The findings provide valuable insight for policymakers, researchers, and stakeholders, underlining the urgent need for collaborative efforts to develop tailored programs, promote alternative energy sources, and advocate for policies that prioritize the energy needs of SMEs. The study acknowledges limitations related to geographical specificity, temporary constraints, and data source reliance and recommends further research to extend the geographical scope, conduct longitudinal analyses, and incorporate diverse data collection methods. By addressing these limitations, further studies can contribute to a more comprehensive understanding of the broader challenges and potential solutions faced by SMEs amid energy-related crises.

Keywords: Loadshedding, Small and micro enterprises, Business operations, Sustainability, Renewable energy

1. Introduction

Over the past two years, the Enoch Mgijima Local Municipality (EMLM) has found itself under the scrutiny and intervention of the national and Eastern Cape Provincial government, prompted by a series of challenges plaguing its operations. As highlighted by the South African Parliament (2024), these challenges include deficiencies in record-keeping and a lack of robust systems to identify impoverished individuals accurately. Consequently, the municipality grapples with inadvertent benefit distribution to those ineligible, directly impacting its financial well-being.

Adding to the municipality's financial woes is a considerable debt owed to Eskom, as highlighted by the South African Parliament (2024). According to the South African Government News Agency (2024), EMLM bears the weight of a prolonged history of indebtedness, protracted legal battles, and persistent power interruptions. The aging and dilapidated electric infrastructure within the municipality stands out as a major contributor to these ongoing power disruptions (ibid), affecting communities across the board. The resulting struggle to maintain a consistent energy supply has created a ripple effect, hampering the business sector's ability to operate seamlessly and, in turn, impeding local economic development (Tokota, 2023).

Recognising the paramount role of energy in driving economic activities, as emphasised by Tembo et al. (2015), it becomes evident that a steady and adequate energy supply is crucial for any nation's economic development. This point is taken further by Bwalya (2022) who states that most economically productive activities rely heavily on a consistent energy supply. The International Energy Agency (IEA) reported in 2010 that over 20% of the global population, approximately 1.4 billion people, faced limited access to electricity, emphasising the worldwide significance of reliable energy access (IEA, 2010).

While global energy demands surge with increasing population, industrialisation, and economic activities, meeting these needs becomes a complex challenge. According to the World Bank (2017), power utility providers, often government-owned entities in emerging nations, struggle to expand their generation and supply capabilities at a pace matching the soaring energy demands. The obstacles identified by the World Bank (2017) include inadequate generation capacity, transmission and distribution infrastructure, low tariffs, high costs of supplying remote areas, and the financial instability of utility providers.

In the South African context, Eskom's financial concerns coincide with a growing crisis of continued power cuts, posing a substantial threat to the business sector. The repercussions of load shedding are particularly crippling for Small Medium-sized Enterprises (SMEs), which play a pivotal role in sustaining economic development and fostering progress in developing nations (World Bank, 2020). Mbomvu et al. (2022) emphasise the

socioeconomic importance of Small and Medium-sized Enterprises (SMEs) to the South African economy, asserting that their significance cannot be overstated. As asserted by (Maziriri and Chivandi, 2020; Charamba and Ladzini, 2021) these enterprises are increasingly being recognised as catalysts for economic growth, innovation, job creation, and overall development.

The Eastern Cape Socioeconomic Consultative Council (2021) sheds light on the pivotal role played by SMEs in the economy. The promotion and economic contributions of SMEs are rationalised based on three main reasons: serving as incubators for entrepreneurship development, innovation, and risk-taking behaviour; providing viable options for sustainable income in agricultural processing industries; and playing a crucial role in transitioning to agro-led industrial economies (Seda, 2019). Furthermore, SMEs contribute significantly to the development of societal productive capacity, absorbing economic resources at all levels and fostering interconnected, resilient economic systems for both small and large businesses.

2. Problem Statement

Since 2008, Eskom, South Africa's primary energy provider, has implemented power cuts, known as load shedding, attributed to issues such as inadequate and deteriorating infrastructure (Carlsson & Martinson, 2016; Kusakana, 2019; Winkler et al., 2020). This ongoing challenge has far-reaching consequences, extending beyond the realm of household activities to significantly impact business enterprises (Goldberg, 2015). Established businesses often manage these disruptions by resorting to alternative energy sources such as solar panels and wind turbines (Sgqolana, 2023). In contrast, emerging enterprises, particularly SMEs, grapple to secure alternative energy solutions.

An insightful perspective from Viljoen and Struweg (2016) reveals that a staggering 97% of businesses in South Africa are actively operating in the SMME category. These enterprises collectively contribute to over 60% of the national labour force, constituting approximately 45% of the Gross Domestic Product (GDP) (Chumucheka, 2013; Amoros & Moska, 2016; Borat et al., 2018). Thus, as mentioned above, SMEs, predominantly categorized as emerging businesses, hold a pivotal position in the South African economy and are acknowledged as critical drivers of economic growth (Bruwer, 2020). According to Ndiaye (2018) most economies worldwide, especially those in developing countries, depend heavily on SMEs. Hence these business enterprises are significant drivers of economic development. Bizcash (2023) agrees that SMEs are making a great contribution to economic growth as they contribute to economic diversity by bringing a diverse range of goods and services to the market. As a result of this diversification, the economy is less dependent on a small number of major companies and is, hence, more shock resistant.

In the context of the EMLM, the effects of load shedding are negatively affecting SMEs. These business enterprises are under massive strain. This strain affects SMEs in sectors such as hospitality, manufacturing, the beauty industry, construction, agriculture, and many more (Businesses, 2023; Sgqolani, 2023; Emalahleni et al., 2023). The Majority of SMEs in this area are micro and small (Jolingana, 2014). Therefore, they struggle to make an annual turnover of more than R150 000 (Eastern Cape Socio-Economic Consultative Council, 2021). Many of the SMEs purchase generators for the sake of continuing business. But that also costs them, as generators operate with petrol, so their operations have an added fuel expense.

Studies on SMEs exist. However, studies on the impact of load shedding on SMEs in the EMLM are scarce. This study aims to bridge the existing gap by examining the multifaceted effects of load shedding on the daily operations, financial health, and sustainability of SMEs in the EMLM. By shedding light on these intricacies, the research seeks to propose effective strategies and interventions to enhance the resilience and endurance of SMEs, ensuring their continued role as pillars of economic vitality within the local community.

3. Objective of the Study

The objective of this study is to comprehensively assess the socio-economic impact of load shedding on SMEs within the Enoch Mgijima Local Municipality, South Africa, with the aim of identifying challenges faced by SMEs during power outages and proposing viable solutions to mitigate their adverse effects on business operations.

4. Research Question

This study aims to unravel the intricate dynamics surrounding the effects of load shedding on SMEs within the Enoch Mgijima Local Municipality, South Africa. The study specifically answers the following question:

- How does load-shedding impact these enterprises' daily operations?

The research seeks to offer a comprehensive understanding of the challenges faced by SMEs in this specific geographic context. Through this, the study endeavors to contribute valuable insights to inform targeted interventions and strategies. By bridging this knowledge gap, the research aims to empower policymakers, local authorities, and business stakeholders in the EMLM to foster an environment that supports the resilience and growth of SMEs, ultimately promoting economic stability within the municipality.

5. Theoretical Framework

The study on the effects of load shedding on EMLM can be anchored within the Institutional Theory framework. Rooted in sociology and organizational studies, this theory provides a lens through which to understand how external institutional pressures influence the behavior and responses of organizations. In the context of this study, the institutional environment is shaped by governmental policies, regulations, and socioeconomic structures that directly impact the operations of SMEs during load shedding. Drawing on the works of institutional theorists such as Meyer and Rowan (1977) and DiMaggio and Powell (1983), the study explores how the institutional environment, represented by government interventions and energy policies, influences the adaptive strategies and resilience mechanisms adopted by SMEs in response to load-shedding.

Within the Institutional Theory framework, the study investigates the isomorphic pressures that lead SMEs to mimic certain practices and conform to institutional norms during energy disruptions. Additionally, it delves into the role of institutional entrepreneurs, such as local business associations or government agencies, in shaping the responses and strategies adopted by SMEs to navigate the challenges posed by load-shedding. By adopting this theoretical lens, the study contributes to nuanced insights into how institutional forces shape SMEs' behavior, decision-making, and overall functioning in the face of energy disruptions, offering a comprehensive understanding of the socioeconomic context within which these enterprises operate.

6. Methodology

This study employed a qualitative research methodology to comprehensively report on the impact of load shedding on SMEs in the EMLM. Qualitative research methodology in a social context offers a comprehensive view of social processes and human behavior. It also offers a means of learning about things like people's experiences, histories, and cultures (Bange et al.,2018). In the context of social research, qualitative research uses numerous techniques that include observations, focused groups, surveys, interviews, and archival research (ibid). In this study this methodology is justified by its suitability to assist in analysing the specific and current circumstances surrounding SME operation.

Embedded within an interpretivist research paradigm, this study explores the in-depth understanding and experiences of SMEs in EMLM. The foundation of interpretive research as a paradigm is on the idea that human experiences and the social context determine social reality (Rehman and Alaharti, 2016; Shah et al., 2013).

Utilising a case study design, this research aims to construct a thorough understanding of how load shedding impacts SMEs in the ELMM. Kuruppuge et al., (2020) state that researchers can assure methodological rigor in their studies and produce solid and informative findings by utilizing qualitative case study methodologies within an interpretivist paradigm.

This paper adopts an intrinsic case study design, as recommended by Hamilton and Corbett-Whittier (2014), to provide a detailed description of the situation. This approach ensures that the study does not merely serve insights but offers a thorough exploration of the phenomenon. By conducting an intrinsic case study, the researcher was able to acquire a nuanced and detailed understanding of the effects of load shedding on SMEs in the EMLM.

6.1 Population and Sample/Study Group/Participants

This study used a purposeful sampling technique to select the document used to generate data. The sample consisted of five newspapers, of which two were printed, and three were online. One newspaper focuses on the entire Eastern Cape Province, while the other three focus on the Chris Hani District, where the EMLM is situated. This type of purposeful sampling also has attributes of convenience sampling. It is convenient in the sense that the documents are easily accessible and reasonable to acquire.

6.2 Data Collection Tools/Instruments

The data generation tools that were used in this study were achieving and document analyses and observation. Archives that were used to generate data are copies of the local newspapers. While document analysis was

conducted on four online newspapers. In total, five sources were used to generate data. The five sources are the size of the sample for this study. Observations were also conducted for the purpose of collecting data. Observations were conducted at the 2024 Emalahleni Local Municipality Investment Summit; further observations were conducted during the Chris Hani SME forum. Observations allowed me to capture elements of the effects of load-shedding that were not reflected in the online and printed newspapers. Using more than one method of generating data is a form of triangulation. The researcher was able to validate the credibility of the data collected by means of triangulation. Bowen (2009) confirms that triangulation may assist the researcher in providing reliable data while minimizing the possibility of biases in the research.

7. Data Analysis and Ethical Consideration

The collected data underwent a meticulous examination and interpretation process employing content analysis techniques. The data was systematically analysed based on the year and dates of publication of the respective sources. This methodological approach proved effective in mitigating potential risks associated with labelling and coding errors. As Wolfe (1992) emphasised, a systematic and clear organisation of data significantly reduces the likelihood of inaccurate coding and labelling.

Notably, no explicit consent was required to conduct this research; however, the outcomes, feedback, and findings derived from the study will be made readily accessible online. Additionally, comprehensive presentations will be delivered SME forums within both the Chris Hani and Enoch Mgijima Local Municipalities. This proactive dissemination strategy ensures that the insights garnered from the research are not only accessible to a wider audience but are also tailored to benefit and engage the specific communities and stakeholders relevant to the study.

8. Presentation Documentary Data

This section delves into a comprehensive examination of data sourced from various documents, shedding light on the profound implications of power supply challenges, particularly the prevalent issue of load shedding, on Small Medium and Micro Enterprises (SMEs) in South Africa. The significance of this matter is indicated by its emergence as a leading cause of failure for SMEs in recent years (Jolingana, 2014). BusinessTech (2023) and Daily Dispatch (2023) provide corroborating insights, portraying a landscape where load shedding is actively undermining businesses throughout South Africa, affecting SMEs across diverse sectors.

Zooming in on the specific impact within the EMLM, Sgqolani (2023) and The Representative (2020) elucidate the severity of the crisis, detailing how SMEs in this geographical area are grappling with the relentless disruptions caused by ongoing power outages. Komani, a town nestled within the, EMLM emerges as a focal point of concern, as reported by Sgqolani (2023). Small businesses in Komani are navigating the harsh realities of load shedding, struggling to sustain their operations amidst the town's recurrent and pervasive power failures.

In the subsequent sections, we extract and analyse data from these documented sources, providing an in-depth exploration of the challenges specific business enterprises face within the EMLM. These narratives serve as poignant illustrations of the broader impact of load shedding on SMEs, highlighting the urgency for a nuanced understanding and targeted interventions to fortify the resilience of these enterprises in the face of ongoing power supply challenges. The following and the documentary statements:

- Anthony Marriot owns and runs a cleaning detergent business. The business is called Superclean Detergents. Anthony relays that the business is operating in tough situations, and it is difficult to increase prices because of competition. (Document from Sgqolani, 2023). Increasing prices is not an option, as it could drive the customers to the competition, adds Anthony (ibid).
- Darryl Westran, owner of The Repair Centre, said his appliance repair business is heavily reliant on electricity (Document from Schriebers, 2023).
- Rouche House in Komani has been without electricity for two weeks. This is killing the hospitality industry (ibid).
- Seamstresses mention that they have been changing business premises due to power outages. This move had to be made to meet targets and finish orders on time (Document from The Representative, 2020).
- All natural Poultry farms, which are situated at the borders of Enoch Mgijima and Emalahleni Municipalities, are struggling to meet consumer demands due to power shortages. This business has a backup generator, but it still struggles to keep the power due to low capacity of the generator

(Document from Emalahleni Local Municipality, 2023). Many times, rotten meat must be disposed of in this business enterprise. “Loadshedding is destroying the poultry business (Solundwana, 2023).

9. Discussions

It was found that the persistent power cuts due to load shedding in the EMLM have taken a substantial toll on the survival of SMEs in the region (Sqqolani, 2023; The Representative, 2020). This struggle extends across diverse sectors, encompassing the hospitality, beauty, manufacturing, retail, and service industries (Sgqolani, 2023; Chris Hani District Municipality, 2018). The multifaceted impact of load shedding on SMEs becomes apparent, showcasing businesses' widespread challenges in EMLM.

The article aligns its findings with the Institutional Theory framework by explaining how institutional forces shape SMEs' behavior, decisions, and overall functioning in the face of energy disruptions caused by load shedding. Through the lens of Institutional theory, the article provides nuanced insights into the socioeconomic context within which SMEs operate in the Emalahleni Local Municipality.

The study reveals that while some SMEs can afford to invest in generators as a means of power substitution, maintaining these substitutes proves to be a burdensome additional expense to their operations. Moreover, the escalating petrol prices further exacerbate the financial strain on these enterprises (Sgqolani, 2023). Consequently, SMEs in EMLM are compelled to lay off employees, presenting a concerning trend that directly contradicts the National Development Plan's (NDP) ambitious projection of creating 11 million new jobs in South Africa by 2030, with SMEs expected to contribute 60-80% to this target (Seda, 2019). This study, challenges the optimism of the NDP, revealing a stark contrast between its employment creation goals and the current reality in EMLM. The skepticism arises from the observed layoffs by SMEs in the region due to the detrimental effects of load-shedding, a trend that is not isolated and potentially indicative of broader challenges SMEs nationwide face (Sgqolani, 2023). Supporting this perspective, (Bushe, 2019) states that in South Africa, more than 70% of SMEs fail within the first five to seven years of operation, resulting in job and income loss, poverty, social ills, and unemployment.

The challenges contributing to the failures of SMEs are multifaceted, as identified in the findings. These challenges encompass a lack of business drive, limited access to markets, insufficient financial and non-financial support, and non-compliance issues, with the latter posing a considerable threat to the sustainability of these enterprises (Lo Ning, 2023). Thus, the discussion of findings not only sheds light on the direct impact of load shedding on SMEs in EMLM but also delves into the broader challenges that these enterprises grapple with, suggesting a need for comprehensive and targeted interventions to bolster their resilience and viability in the face of such adversity.

10. Conclusion

In conclusion, the study Power Outage Perils: Assessing the Impact of load shedding on SMEs in ENMLM, South Africa, highlights the profound and far-reaching consequences of power outages on the daily operations, financial health, and sustainability of these businesses. The findings emphasize that load-shedding is a significant challenge for SMEs in the region, particularly in sectors such as hospitality, manufacturing, and agriculture. The persistent power cuts have led to a ripple effect, hampering the ability of these enterprises to operate seamlessly and ultimately impeding local economic development. The study underscores SMEs' critical role in the South African economy, contributing significantly to the national labor force and GDP. However, their resilience is being severely tested by the ongoing power disruptions, which are causing significant financial strain and impacting their ability to maintain a consistent energy supply.

11. Recommendations

The research recommends that policymakers and local authorities in the EMLM develop targets and interventions to support the resilience and growth of SMEs. This includes enhancing the institutional environment by improving energy infrastructure and providing alternative energy solutions. Additionally, fostering a culture of innovation and entrepreneurship through initiatives such as training and mentorship programs can help SMEs adapt to the challenges posed by load-shedding. Ultimately, the study emphasizes the need for a comprehensive and multifaceted approach to address the impact of load shedding in the EMLM. By understanding the intricacies of this issue and implementing effective strategies policymakers can help ensure the continued vitality of these businesses and promote economic stability within the local community.

12. Limitations and Further Studies

While this study offers valuable insights into the effects of load shedding SMEs in the EMLM, it is important to acknowledge certain limitations that may have influenced the outcomes:

- Geographical Specificity: The study focused exclusively on EMLM which may limit the generalizability of the findings to other regions. Different economic, infrastructural, or regulatory contexts in other areas could yield varied impacts of load shedding on SMEs.
- Temporary Constraints: The study's scope was constrained by the available data, primarily derived from recent years. A longitudinal analysis would provide a more comprehensive understanding of how SMEs adapt to load shedding over an extended period.
- Data Source Reliance: The study heavily relies on documentary sources, potentially leading to a bias based on the perspectives presented in these documents. A more diverse data collection approach, incorporating interviews or surveys with SME owners and stakeholders, could offer a more holistic understanding.

13. Recommendations for Further Studies

Comparative Regional Analyses: Future studies could extend the geographical scope by comparing the effects of load shedding on SMEs in various municipalities or provinces. This approach would enhance the understanding of how regional disparities influence SME resilience to power supply challenges.

- Longitudinal Studies: Conducting longitudinal studies would enable a more nuanced understanding of the evolving dynamics between load shedding and SMEs over an extended timeframe. This approach could capture trends, adaptations, and the long-term impact on business sustainability.
- Sector-Specific Investigations: Delving deeper into specific sectors affected by load shedding, such as manufacturing, hospitality, or retail, could uncover sector-specific challenges and opportunities for resilience. This targeted approach would facilitate tailored interventions and policy recommendations.
- Policy Evaluation: Assessing the effectiveness of existing policies and support programmes to assist SMEs during power supply challenges could be a valuable avenue for further research. This evaluation could inform policymakers about the efficacy of current interventions and areas for improvement.

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Towards Sustainable Strategies: Uncovering the Impact of Environmental Policies on Innovation Activities of Czech Firms

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Abstract: In recent years, there has been an increased emphasis on sustainable development worldwide, which has prompted governments to adopt environmental policies aimed at mitigating the adverse environmental impacts of economic activities. Among these strategies, the implementation of environmental policies has emerged as a key tool for promoting sustainable development. However, although these policies are created with good intentions, their impact on firms' innovation activities remains a matter of debate and research. The aim of this paper is to examine the impact of environmental policies on the innovation activities of Czech firms, with a particular focus on how these policies shape firms' strategies towards sustainable development. Given the growing emphasis on sustainability and environmental issues, it is necessary to examine how environmental policies can influence firms' overall innovation activities. 412 firms of different sizes were surveyed. And EU emissions trading and energy consumption emerged as the most influential variables with a positive impact.

Keywords: Innovation, Sustainability, Environmental policies, Renewable energy sources

1. Introduction and Motivation

During last 10 years, in addition to strict environmental regulations, the focus has recently shifted to renewable energy sources. Investments in renewable energy technologies such as solar, wind, hydro, biomass, and geothermal energy aim not only to achieve sustainability goals but also to drive significant technological and process innovations (Kiefer et al., 2020). These investments spur firms to develop new operational strategies and product lines that incorporate clean technologies, thereby enhancing both economic and environmental performance. Furthermore, proactive management and measurement of CO2 emissions are crucial in fostering green innovation. Firms that adopt these practices are often leaders in developing new, environmentally friendly technologies and processes (Frondel et al., 2017). The environmental behavior of firms, as discussed by Prokop et al. (2022), underscores the complex and sometimes contradictory nature of these strategies in product innovation, especially in Central and Eastern Europe. Additionally, Kotkova Striteska et al. (2024) emphasize the significant impact of factors such as employee engagement, ownership structure, and diversity on fostering eco-innovation.

Renewable energy sources are pivotal drivers of innovation within firms, as emphasized by Johnstone et al. (2017). Kiefer (2020) supports this view, noting that investments in solar, wind, hydro, biomass, and geothermal technologies not only advance sustainability goals but also stimulate technological and procedural advancements. These investments encourage companies to develop novel operational strategies and product lines that leverage clean technologies. Similarly, proactive management and monitoring of CO2 emissions play a crucial role in fostering eco-innovation within firms (Frondel et al., 2017). Companies committed to reducing their carbon footprint are more likely to pioneer new technologies and processes that enhance environmental performance. This proactive approach aligns with firms creating innovative solutions that meet environmental standards while also providing economic benefits. As explained by Horbach et al. (2018), participation in the EU Emissions Trading Scheme (ETS) exemplifies this dynamic, presenting both challenges and opportunities. Firms participating in the ETS are compelled to innovate in emission reduction technologies, driving them to develop and implement solutions that both comply with regulatory demands and offer economic advantages. The ETS serves as an incentive for firms not only to comply with regulations but also to benefit from the trading scheme through innovative strategies. Ghisetti et al. (2015) point out that compliance with strict energy performance standards often pushes firms towards innovative solutions that improve their energy efficiency. Compliance with these standards pushes firms to develop new technologies and processes that not only meet, but often exceed these standards, thereby increasing their overall innovation performance. In addition, external audits of energy and water consumption, play a crucial role in driving innovation by identifying inefficiencies and comparing performance with industry standards, Carrillo-Hermosilla et al. (2020). Companies respond to audit findings by implementing innovative practices and technologies that significantly improve both process and product efficiency. Against above backdrop, the main motivation of this study is to answer the research question (RQ) as

follows: *RQ: How do a firm's internal environmental activities and environmental policies impact the development and implementation of product and process innovations?*

To address the main research question, this study utilizes data from the 2019 World Bank Enterprise Survey, focusing on a sample of 412 businesses in the Czech Republic. The paper investigates the impact of environmental policies on the innovation activities of Czech firms, including the EU Emissions Trading Scheme (ETS) and energy efficiency standards (Horbach et al., 2018). Certain environmental policies, like the ETS, can drive innovation by providing financial and reputational benefits (Ghisetti et al., 2015). Conversely, other measures, such as stringent audits and performance standards, may hinder innovation by limiting flexibility and creativity in product development (Carrillo-Hermosilla et al., 2020). This study aims to contribute to this discussion by providing empirical insights into optimizing environmental strategies and regulations to promote, rather than impede, innovation.

The rest of the study is structured as follows: next section presents data and methods. Next, results are presented and discussed. In the final part, main implications and limitations are mentioned.

2. Data and Method

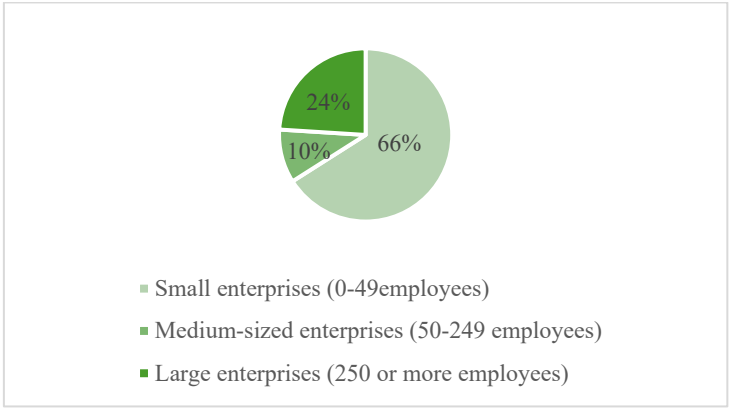
2.1 Data Source

The study relies on data sourced from the 2019 World Bank Enterprise Survey (WBES). This global survey focuses on businesses, offering a representative sample from the private sector of the economy. It provides insights into companies operating in both the manufacturing and service sectors (Pezeshkan et al., 2016). The questionnaire covers a wide range of topics, including general characteristics, expenditures, employees, corruption, innovation, competition, performance measurement, and more (Prokop et al., 2022). Notably, one section of the questionnaire, the "Green module" contains questions pertaining to the environment, environmental policies and regulations, and the impact of business practices on the environment—a section crucial for this study (Prokop et al., 2021). The WBES is commonly utilized for similar types of studies (see Abdu et al., 2018). Firms are selected for the survey through a stratified random sampling approach (multistage sampling), with interviews conducted with business owners or top-level managers. In some instances, accounting and human resources personnel may also participate in the interviews to ensure more accurate responses.

2.2 Description of Selected Country

This study examines data from 412 companies situated in the Czech Republic, a Central European nation. The dataset utilized is from 2019, as more recent survey data was unavailable during the research period.

For Czech Republic, Figure 1 depicts the graphical distribution of companies according to size and economic activity. Size classification follows the European Commission's (2019) categorization, which divides companies into Small and Medium-sized Enterprises (SMEs). Small businesses employ up to 50 individuals, medium-sized enterprises employ 50-249 individuals, and companies with 250 or more employees are considered large. Economic activity classification is based on the ISIC classification, as outlined in the questionnaire. The questionnaire includes the following categories: Manufacturing, Construction, Wholesale and Retail Trade, Hotels and Restaurants, Transport, Storage, and Communication, Information Technology and Related Activities, and Others. Subsequently, the analysis results are interpreted, emphasizing significant determinants.



Source: Own processing based on WBES data

Figure 1: Size structure of companies in the Czech Republic

2.3 Description of Variables

The dependent variables have been selected based on current literature on product and process innovations in firms (Martínez-Ros, 2019). These variables indicate the adoption of product innovation and process innovation within the company over the past three years. To address the research question explicitly, the independent variables representing "internal environmental activities" and "external regulatory mandates" have been chosen. Internal environmental activities include self-supported renewable energy initiatives and proactive management of CO2 emissions. External regulatory mandates encompass participation in the EU Emissions Trading Scheme (ETS) and compliance with energy performance standards. These variables were selected to analyze how internal practices and external pressures influence innovation activities within firms.

- **Product Innovation**: During the last three years, has this establishment introduced new or improved products or services?
- **Process Innovation**: During the last three years, has this establishment introduced any new or improved process? These include: methods of manufacturing products or offering services; logistics, delivery, or distribution methods for inputs, products, or services; or supporting activities for processes?

The dependent variables in the study are binary, with values of either 0 or 1. A value of 1 signifies that the specified measure was implemented by the company within the last three years, whereas a value of 0 indicates that the measure was not implemented. The explanatory (input, independent) variables are also binary and were chosen based on a literature review. The Table 1 below presents the selected determinants.

Table 1: List of Independent Variables

Variable	Description	Category
Own renewable sources	*"Did this establishment use energy from its own renewable sources, such as power plants using solar, wind, hydro, biomass or geothermal energy?"*	yes = 1, no = 0
CO2 emissions	*"Did this establishment measure its CO2 emissions?"*	yes = 1, no = 0
EU emissions trading	*"Did this establishment participate in the EU Emissions Trading Scheme?"*	yes = 1, no = 0
Energy performance standard?	*"Was this establishment subject to an energy performance standard in its operations?"*	yes = 1, no = 0
Audit of energy consumption	*"Did this establishment complete an external audit of its energy consumption?"*	yes = 1, no = 0
Audit of water consumption	*"Did this establishment complete an external audit of its water usage? "*	yes = 1, no = 0
Audit of CO2	*"Did this establishment complete an external audit of its CO2 emissions?"*	yes = 1, no = 0
Energy Consumption	*"Did this firm monitor its energy consumption in the last 3 years?"*	yes = 1, no = 0
Certifications	*"Did this establishment have an internationally recognized quality certification ?"*	yes = 1, no = 0
Internal R&D	*"Did this firm incur expenses on its own research and development activities in the last 3 years?"*	yes = 1, no = 0

Moreover, the model includes the following control variables: Firm size, which has been established in prior studies as a significant determinant of firm eco-innovation. For example, Hojnik and Ruzzier (2016) found a significant relationship between product and process eco-innovation and firm size (Madaleno et al., 2020). The total number of employees is categorized according to the European Commission (2019) as small and medium-sized enterprises (SMEs) with up to 250 employees (assigned a value of 1) and large firms with 250 or more employees (assigned a value of 0).

Given the dichotomous nature of both the dependent and independent variables, binary logistic regression was deemed suitable for the analysis. This method is widely employed by experts in eco-innovation research, such as Marín-Vinuesa et al. (2020) and Moon et al. (2021), as it effectively elucidates the relationship between the dependent variable and a set of independent variables.

3. Results and Discussion

Results of the regression model are presented in the Table 2. The model indicates that own renewable resources have a negative impact on process innovation, while their effect on product innovation is slightly negative but statistically insignificant. These findings imply that transitioning to renewables can pose a burden on firms, primarily in terms of financial constraints, potentially limiting their capacity to invest in new process innovations. This observation aligns with prior research highlighting the initial costs and organizational adjustments associated with renewable integration (Cagno et al., 2015). Similarly, Kiefer et al. (2020) acknowledge the benefits of investing in renewables but underscore the considerable upfront costs involved. Conversely, participation in the EU Emissions Trading Scheme (ETS) positively influences product innovation, corroborating the findings of Horbach et al. (2018). This positive effect may be related to the financial and reputational benefits that participation in the ETS can bring to firms, allowing them to invest in new product innovations and improve their market position. The results show that energy performance standards have a negative impact on product innovation. This can be explained by the fact that energy efficiency standards may limit the flexibility of firms to develop new products as they have to meet specific requirements. This finding supports the need for further research to investigate how energy efficiency standards can be better integrated into corporate strategy to promote innovation instead of constraining it. Overall, this analysis shows that environmental policies and standards can have a mixed impact on innovation activities in the Czech Republic. While certain measures, like participation in the EU Emission trading, may foster product innovation, others, such as energy performance standards and external audits, could potentially hinder innovation. These findings underscore the importance of meticulously considering the design and implementation of environmental measures to effectively bolster firms' innovation potential.

The results indicate that monitoring of energy consumption, alongside energy audits, exhibits a positive albeit weakly significant impact on process innovation. This suggests that firms engaged in diligent monitoring and management of their energy consumption are more inclined towards innovation in process improvement. This finding aligns with previous studies highlighting the significance of effective resource management in enhancing innovation capabilities (Hojnik et al., 2022). On the contrary, findings reveal that conducting water consumption audits exerted a detrimental influence on both product and process innovation, indicating that stringent regulation in water management may serve as a barrier to innovation. This could be attributed to the heightened costs and administrative burdens incurred in complying with such regulations. This conclusion is reinforced by studies such as Costa-Campi et al. (2015), which underscore the potential adverse effects of stringent environmental regulations on innovation activities.

Table 2: The influence of determinants on product and process innovation in the Czech Republic

Determinant	Product Innovations		Process Innovation	
	B (Exp (β))	p-value	B (Exp (β))	p-value
Own renewable sources	-2.18957	0.2987	-0.68539	0.0641*
Measurement of CO2 Emissions	-0.56341	0.04078**	-0.20127	0.4178
EU emissions trading	0.57816	8.05e-05***	0.00549	0.8964
Energy performance standard	-0.37695	0.0024***	-0.05328	0.1180
Audit of energy consumption	1.52324	0.1179	0.518785	0.0825*
Audit of water consumption	-2.34948	0.0313**	-0.51320	0.0746*
Audit of CO2	-0.66400	0.3097	-0.29293	0.1698

Energy Consumption	0.15286	0.0211**	3.53899	0.0612*
Certifications	0.33685	0.7606	0.39488	0.2548
Internal R&D	0.10002	0.8517	-0.00258	0.9896

Legend: * significant at significance level P<0.1; ** significant at significance level P<0.05; *** significant at significance level P<0,01

The response to the research question indicates that both internal environmental activities and external regulatory mandates exert a notable influence on the development and implementation of sustainable product and process innovations in firms. While certain environmental policies, like participation in the EU Emissions Trading Scheme, may facilitate innovation by offering financial and reputational incentives, other regulatory measures could potentially hamper firms' innovation capabilities. For instance, stringent audits and performance standards might limit flexibility and creativity in product development (Ghisetti et al., 2015; Carrillo-Hermosilla et al., 2020). However, it's important to note that neither of the two indicators considered as regulations has a significant impact on process innovation, and regarding product innovations, one exhibits a positive effect while the other a negative one, thus emphasizing the nuanced nature of regulatory influences on innovation outcomes.

4. Conclusions

4.1 Summary of Findings and Implications

This study investigated the influence of various environmental measures on both product and process innovation within firms operating in the Czech Republic. The findings suggest a nuanced impact of these measures on firms' innovation endeavors. While participation in the EU Emissions Trading Scheme (ETS) emerges as a driver of product innovation, attributed to the associated financial incentives and enhanced reputation, internally driven initiatives like self-supported renewable energy initiatives and external water audits seem to impede innovation processes. This hindrance is likely due to the significant upfront costs and administrative complexities involved. Surprisingly, energy performance standards, ostensibly designed to bolster energy efficiency, appear to stifle product innovation, indicating the necessity for their refinement and better alignment with corporate strategies. These findings align with previous research, such as Gerstlberger et al. (2023), underscoring the intricate relationship between environmental regulations and innovation activities. Notably, the adverse impact of external water audits and reliance on renewable resources on innovation processes echoes the observations of scholars like Costa-Campi et al. (2015), who have highlighted the potential barriers to innovation posed by stringent regulatory frameworks.

It is essential for companies to carefully select their environmental strategies and objectives. Developing proactive approaches to adapting to environmental regulations and managing resources effectively is key. Increased investment in research and development, diversification of energy sources, and active involvement in shaping and complying with regulatory standards not only provide companies with innovation opportunities but also reduce the risks associated with energy dependence. With government support for an innovation-friendly environment, these measures enable firms to transition towards more sustainable operations with greater agility and efficiency. Policymakers need to recognize the importance of flexible regulations that stimulate innovation while facilitating a smooth transition to sustainability. This is not an instant but a continuous process. Polities should strive to establish a political culture (Gerstlberger et al., 2024). In addition, offering financial incentives, implementing training programmes and channeling investment into research on sustainable technologies are essential steps. These measures motivate and encourage sustainable operations and promote a culture of innovative thinking and sustainable practices in companies.

In order to effectively navigate and leverage environmental regulations, firms are advised to significantly enhance their investments in research and development (Krkošková, 2019). This will help to develop new technologies and processes that comply with environmental standards while encouraging innovation. his strategic move is supported by Prokop et al. (2019), who demonstrate that stringent environmental regulations can serve as a catalyst for innovation, enabling firms not only to comply with these regulations but also to gain

a competitive edge. This aligns with the Porter (1996) Hypothesis, which suggests that proactive environmental strategies can lead to dual benefits: regulatory compliance and economic gains through innovation.

In addition to prioritising regulation compliance and innovation, companies should diversify their energy sources. Horbach (2018) stresses the importance of mitigating the risks associated with the volatility of renewable energy sources by incorporating different types of energy. This strategy not only stabilizes energy supply but also reduces dependence on fossil fuels, thereby increasing energy security and sustainability. In addition, it is essential to invest in staff training in environmental management. According to Smith and others (2020), well-trained employees play a key role in successful sustainable practices, enhancing a company's environmental performance and aligning with its sustainability goals. Moreover, proactive environmental compliance is a way for companies to gain strategic advantage. Jones et al. (2021) point out that companies that anticipate and adapt to environmental regulations are better positioned to take advantage of new market opportunities arising from these regulatory changes. This proactive approach helps firms avoid penalties and take advantage of opportunities for innovation that arise as a result of new or evolving regulations. Finally, forming partnerships to support the development of sustainable technologies is essential. Zhang et al. (2023) discuss how collaboration with academic institutions and start-ups can facilitate cost sharing and risk mitigation in the development of new technologies. These partnerships can accelerate the adoption of sustainable technologies and practices, leading to a faster transition to sustainable operations.

It is imperative to approach this issue from the standpoint of policymakers, who must implement measures that not only encourage innovation but also ensure environmental sustainability, given the pressing challenges the world faces in terms of sustainability and environmental protection. Consequently, the following recommendations are formulated based on the findings of this study. The primary recommendation emphasizes the necessity of introducing flexible regulatory frameworks. Aghion et al. (2019) demonstrate that flexible regulations can stimulate innovation by providing firms with the leeway to experiment with new technologies without the looming threat of severe penalties. This approach is further validated by the analysis of Bento et al. (2017), which underscores that flexible regulation enables firms to adapt to evolving market dynamics and technological advancements.

Another thing policy makers could do is to provide financial incentives and support for companies investing in renewable energy and energy efficiency. According to a study by Gillingham et al. (2018), financial incentives such as reduced tax rates and subsidies can significantly increase investment in sustainable technologies. This view is supported by Zheng et al. (2020), who show that public funding of R&D plays a key role in accelerating the adoption of clean technologies. At the same time, global policy makers should launch campaigns to promote sustainability education and start supporting more of an innovation ecosystem that allows smaller companies to become involved in innovation processes, for example in conjunction with universities (Peterkova et al., 2022). Whitmarsh et al. (2018) highlight that education and awareness are key to changing public perceptions and behaviour in favour of more sustainable practices. Educational programmes can raise awareness of the importance of sustainability and motivate innovative thinking on environmental technologies.

The last recommendation concerns support for R&D. According to a study by Acemoglu et al. (2018), investments in research institutions and universities that focus on the development of sustainable technologies are essential to generate new solutions and innovations. This view is supported by research from Balsalobre-Lorente et al. (2018), who highlight the importance of collaboration between academic institutions and industry. For these reasons, it is clear that a combination of flexible regulations, financial incentives, investment in education, support for research and development, and the creation of platforms for knowledge sharing can contribute significantly to sustainable development and innovation in environmental technologies. Policy makers should consider these aspects when formulating strategies that address current and future environmental challenges.

4.2 Limitations and Future Research

This study has several limitations that future research could address. Firstly, the reliance on data from a single country, the Czech Republic, may limit the generalizability of the findings. Future studies could expand the scope to include multiple countries to enhance the robustness and applicability of the results. Secondly, the binary nature of the dependent variables used in the logistic regression model simplifies the complex nature of innovation activities, which may involve varying degrees of innovation intensity. Future research could employ more nuanced measures of innovation to capture these subtleties. Additionally, the study primarily focuses on the direct impacts of environmental policies on innovation, potentially overlooking the mediating effects of organizational culture, market conditions, and technological capabilities Yang et al. (2019). Future studies could incorporate these factors to provide a more detailed understanding of the mechanisms through which

environmental policies influence innovation. Lastly, as environmental policies and technologies evolve, ongoing research will be necessary to continually assess their impacts on business innovation, ensuring that findings remain relevant and that policy recommendations are based on the latest evidence.

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Drivers of Intrapreneurial Innovation: A Study of Individual Innovative Behaviour in Organisations

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Abstract: Organisations can gain a competitive edge through Intrapreneurial Behaviour (IB) by swiftly innovating and adapting to market changes. Research indicates that intrapreneurship plays a crucial role in the banking sector in achieving a competitive advantage. Organisations can enhance their intrapreneurial capability by leveraging Individual Innovative Behaviour (IIB). However, innovation in the banking sector is often constrained by strict regulations, high safety requirements, and a fundamental need for trust and stability. Therefore, it is important to embrace and stimulate factors that encourage and enable innovation. To our knowledge, research on how intrapreneurship can be stimulated and measured in the Dutch banking sector is currently lacking. Thus, developing indicators and metrics for measuring intrapreneurship in Dutch banks is essential. This study investigates the factors affecting IIB using a quantitative survey. Building on the connection between IB and IIB, IIB is treated as a dimension of IB. The perceived work context, comprising an organisation's entrepreneurial orientation and innovative climate, can empower employees' IIB in the digital era. This context encourages them to generate new ideas and engage in collaborative innovation without fear of failure, thus fostering IIB. Our study explores factors driving IIB, empowering employees to act as intrapreneurs through organisations perceived Entrepreneurial Orientation (EO) and Innovative Climate (IC), with Digital Maturity (DM) as a moderating variable. Data were collected in 2021 from the three largest Dutch banks, which hold over 43% of the market share. A snowball sampling method was used to reach Dutch bank managers knowledgeable about the study's key constructs. This method involved initial contact with human resources departments and managers within these banks. The survey was administered to 167 managers, yielding 125 usable responses (75% response rate). Results indicate that employees in the banking industry with high DM are more likely to engage in IIB when firms support EO strategies and IC, and when employees adopt self-leadership skills.

Keywords: Individual innovative behaviour, Entrepreneurial orientation, Intrapreneurship, Innovative climate, Digital maturity, Self-leadership

1. Introduction

The digital transformation has intensified competition (Nambisan, 2017), forcing organisations to adapt and innovate (Zhao et al., 2021). In this dynamic environment, intrapreneurship – fostering entrepreneurial activities within existing organisations – has become a cornerstone of innovation. Chen and Huang (2009) argue that organisational innovation hinges on the human capital of intrapreneurs, the individuals who fuel the creative process. Intrapreneurial innovation, driven by employee efforts, is essential for maintaining a competitive edge. Individual innovative behaviour (IIB) directly contributes to an organisation's success (de Jong and den Hartog, 2010). In complex sectors like banking, continuous improvement and adaptation are crucial to survive sudden changes (Shalley et al., 2004).

Despite the significant research interest in factors influencing IIB, a gap remains in understanding the specific individual and contextual motivators. Kör (2016) emphasises this need, echoing calls by Pratoom and Savatsomboon (2012) to identify the drivers of IIB. Our study aims to bridge this gap by examining the interplay between individual and organisational factors that influence IIB. We will explore how perceived Innovative Climate (IC), Entrepreneurial Orientation (EO), Digital Maturity (DM), and Self-Leadership (SL) skills interact to promote innovative behaviour. Furthermore, we investigate how perceived EO and DM influence the perceived IC, accordingly, fostering IIB.

An organisation's willingness to innovate is captured by its EO (Covin and Slevin, 1988). EO encompasses the strategic processes that guide entrepreneurial decisions and actions (Lumpkin and Dess, 1996). This strategic posture emphasises innovativeness, proactiveness, and risk-taking (Covin and Slevin, 1988). Employees who perceive a strong EO in their work environment are more likely to exhibit IIB (Amo, 2006; Kang et al., 2016; Kör et al., 2021). An additional driver of IIB is an organisation's IC. Li and Zheng (2014) and Bos-Nehles and Veenendaal (2017) highlight how such a climate fosters innovative behaviour by encouraging the sharing of diverse perspectives on practices, procedures, and behaviours. When organisations embrace creativity, innovation, and risk-taking, employees feel empowered to exhibit innovative behaviour themselves (Bos-Nehles and Veenendaal, 2017).

Digitally maturing organisations are more likely to foster environments conducive to innovation by encouraging and testing new ideas at all levels (Laužikas and Miliūtė, 2020). DM reflects a company's digital transformation status, involving innovation across all organisational levels through the adoption of digital technologies (Chanias and Thomas, 2016). Additionally, in today's fast-paced business environment, employees need to take greater ownership and make quicker decisions. This necessitates empowering self-directed individuals and teams, emphasising SL (Kör, 2016).

The rest of this article is organised as follows: the "Literature Review and Hypotheses Development". Subsequently, the method and results are presented. The final section discusses the findings, conclusions, limitations, and suggestions for future research.

2. Literature Review and Hypotheses Development

2.1 Intrapreneurship Top-down and Bottom-up Process

Studies (Revuelto-Taboada et al., 2023; Alamur and Gümüştekin, 2022) highlight the importance of intrapreneurship in the banking sector for achieving a competitive advantage. Intrapreneurship drives innovation, crucial for survival in fast-evolving markets. Despite strict regulations and safety requirements, fostering intrapreneurial innovation remains essential for the sector's success.

Intrapreneurship was first introduced by Pinchot (1965) and then by Drucker (1986), who highlighted the link between new opportunities, organisational growth, and economic prosperity. More recent studies have examined the relationship between intrapreneurship and firm performance (Neessen et al., 2019; Hornsby et al., 2013; Rauch et al., 2009) and its impact on innovation (Sinha and Srivastava, 2013). Bosna et al. (2013) claim innovation arises when employees contribute and implement new ideas. Antoncic and Hisrich (2000) describe intrapreneurship as an entrepreneurial activity, while Stevenson and Jarillo (2007) define it as a process initiated by individuals within an organisation. The former emphasises a top-down approach, focusing on the organisation's role, while the latter views it as a bottom-up activity driven by individual employees. Research indicates that intrapreneurship is crucial for gaining a competitive advantage in the banking sector (Revuelto-Taboada et al., 2023; Alamur and Gümüştekin, 2022).

Given that intrapreneurship contains an element of innovation (Rigtering and Weitzel, 2013), which in turn enhances competitiveness in today's digital age, and that innovation can be driven both top-down and bottom-up, there is a need to develop metrics and indicators to measure intrapreneurship. Additionally, it is important to explore whether an organisation's DM level influences these intrapreneurial initiatives.

2.2 Individual Innovative Behaviour

Employees are vital in generating and implementing new ideas to enhance products, services, and processes (De Jong and den Hartog, 2007). This concept, known as IIB, involves the creation, introduction, and application of new ideas within a work role (West and Farr, 1989). Key dimensions of IIB include idea generation, exploration, promotion, and realisation (De Jong and den Hartog, 2010; Scott and Bruce, 1994). Self-leadership (SL) is another critical factor influencing innovative behaviour; it refers to the process by which individuals guide, motivate, and direct themselves toward achieving desired goals (Kör, 2016).

SL empowers individuals to take ownership of their work and drive innovation (Jain, 2015). Research by Carmeli et al. (2006) shows a positive correlation between SL and innovative behaviour, as it enables individuals to take charge of their actions, thoughts, and behaviours (D'Intino et al., 2007; Heiss et al., 2010), ultimately boosting innovation and performance (Manz and Neck, 2004). Given the growing importance of SL in the digital age and its link to innovation and intrapreneurship, this study investigates the following hypothesis:

***H_1**: SL is positively related to IIB at work.*

2.3 Bottum-Up Process of Intrapreneurship

Antoncic and Hisrich (2003) classified the different concepts and definitions of intrapreneurship by distinguishing between EO (bottom-up) and corporate entrepreneurship (top-down). Gawke et al. (2019) state that an EO occurs when employees show initiative, develop innovations, and take certain risks for the company. Employees' EO makes organisations more agile, allowing them to better respond to external and internal changes in the company (Gawke et al., 2019). This type of intrapreneurship, based on employee behaviour, offers new insights that can lead to a sustainable competitive advantage. In addition, EO can help to create a dynamic, flexible, innovative, and competitive organisational structure, thus shaping the work

environment that leads to both organisational success (Zahra, 1986) and individual outcomes (Amo, 2006), such as innovative behaviour (Kang et al., 2016; Kör, 2016; Kör et al., 2021). In such a work environment (i.e., encouraging innovation, proactivity, and risk-taking), openness to change and support for innovative activities can be developed (Kör et al., 2021), in line with employees who are inspired by entrepreneurial organisations to be more innovative. Because they understand that being innovative is a desirable image and that exhibiting innovative behaviour will increase their status (Yuan & Woodman, 2010). In line with these arguments, it is hypothesized that:

H_2: *Perceived EO is positively related to individual innovative behaviour at work*

2.4 Top-Down Process of Intrapreneurship

A supportive work environment that fosters creativity is essential for organisational success (Imran et al., 2010). This environment, known as an IC, is influenced by employees' perceptions (Siegel and Kaemmerer, 1978). IC encourages behaviours like idea generation, collaboration, and participation (Patterson et al., 2005). When employees feel valued for their innovative contributions, they are more likely to engage in innovative behaviours (Bos-Nehles and Veenendaal, 2017). This positive perception encourages initiative, enhancing overall innovation (Runfeng, 2011). Thus, IC empowers employees to innovate, improving performance. This study examines the perceived innovative climate's impact within organisations, leading to the following hypothesis:

H_3: *Perceived IC positively related to IIB at work.*

Building on existing research linking perceived IC and IIB (Scott and Bruce, 1994; Ibrahim et al., 2018; Kruft et al., 2018), this study goes further by proposing that perceived IC mediates the relationship between perceived Entrepreneurial Orientation (EO) and IIB. While direct effects of EO and IC on IIB are hypothesized (Hypotheses 2 and 3), this study examines the indirect influence of EO through IC. Organisations with a strong EO encourage innovation by promoting risk-taking and creativity (Covin and Slevin, 1988), countering bureaucratic constraints that hinder innovation (Yuan and Woodman, 2010; Kör, 2016). When employees perceive a strong EO, it fosters a supportive IC where innovative thinking and participation are valued (Malik and Wilson, 1995), encouraging risk-taking and creativity, which ultimately enhance innovative behaviour (Bos-Nehles and Veenendaal, 2017). Therefore, we propose:

H_4: *Perceived innovative climate mediates the relationship between perceived EO and IIB at work*

2.5 Digital Maturity as a Moderator of Intrapreneurship

Companies that invest in and manage new technologies effectively outperform competitors (Fitzgerald et al., 2014). DM, the ongoing process of digital transformation, is not a one -time achievement but rather a continuous journey (Chanias and Thomas, 2016). Digital technologies are transforming businesses, fostering creativity, innovation, and competitiveness (Waheed et al., 2019). DM capabilities generate valuable ideas, promote innovation, and enable flexible working models. This, in turn, enhances the organisational climate and fosters innovative activities (Zhao et al., 2021). We propose that DM strengthens the relationship between perceived EO and IC. Essentially, digitally maturing organisations can leverage their capabilities to unlock the full potential of a strong entrepreneurial spirit, leading to a more innovative work environment.

H_5: *The effect of perceived EO on perceived IC moderated by perceived DM*

3. Methodology

3.1 Data Collection

This research takes a quantitative approach to understanding factors driving IIB. Data were collected from Dutch banks due to their critical role in supporting the nation's economy, which is highly digitalised and export-oriented (Kempen, 2021). The pandemic amplified the sector’s adaptability and need for innovation, making it essential to explore factors driving IIB to enhance digital maturity and economic resilience (Kempen, 2021; Marcu, 2021).

A survey in English was distributed in 2021 to employees at the three largest Dutch banks, covering over 43% of the market share (Statista, 2023). Using snowball sampling, initial seeds were selected from various departments and management levels to enhance diversity. Clear inclusion criteria were set for HR and managers to ensure a broad range of knowledgeable participants.

The survey, containing 45 Likert-scale questions (1-5), measured key constructs based on established scales. Distributed to 167 managers, the survey yielded a 75% response rate (125 usable responses). Participants included associates, managers, and senior managers, and were randomly selected with informed consent. Anonymity and confidentiality were assured throughout the study. The study used a survey with a five-point Likert scale (strongly disagree to strongly agree) for all constructs except demographics. Existing, validated scales were used in English (i.e., de Jong and den Hartog, 2010; Houghton et al., 2012; Covin and Slevin, 1988; Patterson et al., 2005; Rossmann, 2018).

The sample consisted of 50.1% females (n = 63) and 49.6% males (n = 62). Most respondents were aged 18-29 (36%), with an educational background of an undergraduate degree (52.7%), followed by a master's degree (40.2%) and Ph.D. (7.1%).

4. Analysis and Results

Data collected from the survey were analysed using SPSS Version 25.0. Before hypothesis testing, reliability and validity checks were performed. The study's hypotheses involved multiple regression, mediation, moderation, and moderated mediation effects. Conditional process modeling was conducted using Hayes' Process macro for SPSS (Hayes, 2017) to test these effects.

Mediation (Model 4) and moderation (Model 1) analyses were conducted using Hayes' PROCESS macro. The mediation model (Figure 1) quantified total, direct, and indirect effects using bias-corrected nonparametric bootstrapping with 5000 bootstrap samples (Preacher and Hayes, 2004). This robust method, recommended by Mackinnon et al. (2004), provides high power and accommodates smaller sample sizes without normality assumptions.

4.1 Reliability and Validity

To ensure construct validity, internal consistency, convergent, and discriminant validity were assessed (Table 1). Cronbach's α exceeded .7, composite reliability and average variance extracted were above .88 and .5, respectively, and factor loadings were above .5 with inter-construct correlations below .9. These results confirm the measures' accuracy in capturing the intended constructs.

Table 1: Cronbach's α, AVE, composite reliability and factor loadings

Construct	Cronbach's Alpha	AVE	CR	Factor Loading
SL	.73	.60	.91	.58 - .86
IIB	.85	.50	.88	.50 - .78
EO	.87	.54	.90	.55-.83
IC	.85	.65	.94	.72 - .93
DM	.86	.60	.92	.55 - .86

4.2 Testing of Hypothesized Direct and Indirect Effects

We analysed the data using multiple regression to test our hypotheses (Table 2). The results show significant positive relationships between perceived EO (β = .518, p = .000), perceived IC (β = .307, p = .000), and SL (β = .461, p = .000) on IIB at work, supporting hypotheses 1 to 3.

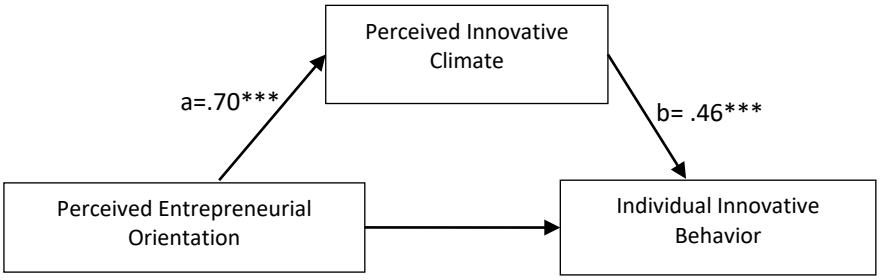
Table 2: The results of the regression analysis

Path	β	t	p	Adjusted R2	Hypothesis Results
SL →IIB	.433	5.326	.000***	.181	H1 Support
PEO → IIB	.340	4.016	.000***	.109	H2 Support
PIC → IIB	.475	5.984	.000***	.219	H3 Support

Notes: *p<.05; **p<.01; ***p<.001. PEO: Perceived EO, PIC: Perceived IC

Figure 1 shows the results of the mediation analyses using bias-corrected bootstrapping, as recommended by Hayes (2017); detailed results are in Table 3. Following Baron and Kenny's (1986) full mediation model, the independent variable indirectly affects the dependent variable through the mediator. The indirect effect of perceived entrepreneurial orientation on innovative work behaviour via perceived innovative climate (.33) was

significant (95% CI: LL .1706, UL .4716), supporting H4. Sobel's test confirmed full mediation by perceived innovative climate (z = 3.330, p < .001).



Direct effect, c'= .016, p>.05 after adding mediator

Indirect effect, c= .33

Notes:*p<.05; **p<.01; ***p<.001

Figure 1: The proposed mediator model

Table 3: Mediation Analysis

Variable / Effect	β	SE	t	p	95% Confidence Interval	
					LLCI	ULCI
PEO→IIB	.016	.112	.1429	.887	-.2049	.2367
PEO→PIC	.70	.064	10.8659	.000***	.5723	.8273
PEO→PIC→IIB	.46	.112	4.1576	.000***	.2429	.6845
Direct	.16	.112	.1429	.887	-.2049	.2367
Indirect	.33	.0763			.1706	.4716
Total	.34	.0848	4.0159	.000***	.1727	.5083

Note: Based on 5000 bootstrap samples, *p<.05; **p<.01; ***p<.001.

Our study examined how DM moderates the relationship between PEO and PIC (H5). Figure 2 illustrates this interaction using Hayes' process moderation. The analysis (model 1) revealed a significant interaction effect (β = .13, p = .005), indicating that the influence of PEO on PIC depends on the level of perceived DM. As shown in Figure 2, higher DM strengthens the positive relationship between EO and IC, supporting hypothesis 5.

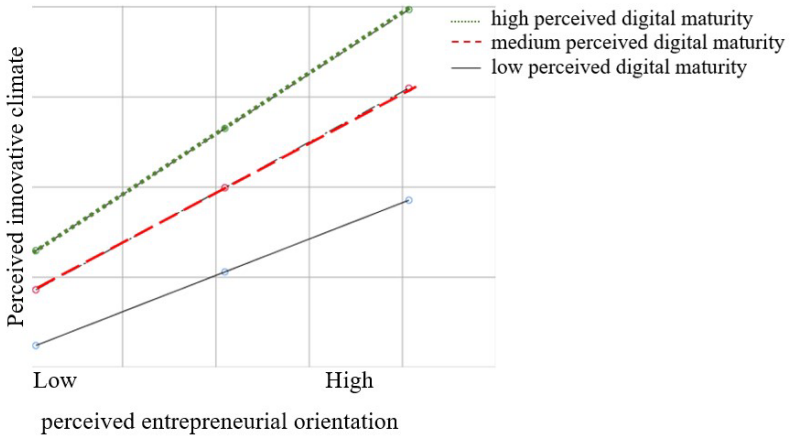


Figure 2: Moderation effect

5. Conclusion and Limitations

This study explores factors influencing IIB within organisations, especially in today's rapidly evolving digital landscape. The findings reveal a positive relationship between perceived EO and IIB. Employees who perceive their organisation as valuing innovativeness, proactiveness, and risk-taking are more likely to engage in

innovative behaviours. This finding aligns with previous research suggesting that entrepreneurial environments encourage "thinking outside the box" and proactive participation in the innovation process (Kör, 2016). Therefore, organisations should foster an environment that encourages these traits to boost innovation and proactive employee participation. The study also highlights the significant impact of perceived IC on IIB. IC leads to an increased positive perception of the employees on the innovative ideas and plans of the organisation (Kang et al., 2015). Organisations should create a supportive environment that values innovation, encourages open dialogue, and rewards proactive contributions. This can be achieved through strategic initiatives such as revising company policies, promoting collaboration, and recognising innovative achievements.

This study contributes to individual innovation research by investigating SL skills as an antecedent of IIB at work. Innovative behaviour is largely motivational in nature (Amabile, 1988; Tian and Sanchez, 2017), and, as such, likely to be stimulated by SL skills. According to Neck and Manz (1996), individuals can be trained to adapt and enhance their SL skills in order to improve their work outcomes, such as IIB (Carmeli et al., 2006). The findings show a positive relationship between SL skills and IIB at work. This finding is in agreement with the studies of Carmeli et al. (2006), DiLiello and Houghton (2006), and Kör et al. (2021), which found that IIB is influenced by the individuals' SL skills. Thus, the practice of SL strengthens the desired behaviour necessary for innovativeness within the organisation. During the COVID pandemic period, some of the employees have to work remotely, organisations need to motivate their employees in the way they would have done on the work floor. This is especially crucial in hybrid or remote work settings where self-motivation is key. Workshops, mentoring, and resources on self-leadership can empower employees to take initiative and drive innovation independently. Furthermore, the study reveals that perceived digital maturity strengthens the relationship between perceived EO and perceived innovative climate. The COVID-19 pandemic has underscored the critical role of digital solutions in banking, highlighting the need for both innovation and digital transformation (Yıldırım and Erdil, 2023). Our findings suggest that a high level of DM acts as a catalyst, amplifying the positive influence of a strong entrepreneurial spirit on fostering a culture of innovation. In essence, digital transformation strengthens the link between an organisation's entrepreneurial drive and its ability to create an innovative work environment.

This study offers valuable findings, but limitations exist. It relies on Dutch banking data, limiting generalisability. Snowball sampling was chosen due to challenges in accessing specialised respondents. To reduce biases, seeds were selected across departments and levels with clear inclusion criteria. Interviews could provide richer insights. Additionally, the data is from a single time point and sector. Future research should include a broader sample across industries and cultures. Despite these limitations, the framework can be applied in service, manufacturing, and automotive sectors.

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Artificial Intelligence and Managerial Decision-Making in International Business

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Abstract: Management in the age of artificial intelligence (AI) presents unique challenges and opportunities, especially in the international landscape. The technology is constantly evolving, and managers need to adapt to the new landscape that is emerging to harness its potential while considering and anticipating the risks involved. AI can disrupt traditional leadership models by automating specific tasks and decision-making processes. This challenges managers to align with this new reality and use AI to drive innovation and productivity. In addition, managers must navigate and adapt to the evolving regulatory environment, understanding but also complying with regulations around AI, data protection, and privacy, while advocating for responsible and fair governance. While AI significantly impacts management processes, the academic literature on the subject is still emerging. This study aims to explore the challenges posed by AI and how international business managers can use this technology to drive decision-making and benefit their organizations. Ten interviews were conducted with senior executives from a range of industries to collect qualitative primary data. The findings show that AI can help with decision-making, automate many processes, and improve efficiency. Top managers can use AI tools to address many challenges more effectively, but they need to understand the ethical implications and concerns that continue to arise. The findings provide theoretical implications and practical recommendations for top managers using AI technologies. Senior executives should develop AI-focused strategies; as AI becomes more prevalent across industries, managers need to understand how to integrate AI technologies into their organizations successfully.

Keywords: Decision-making, Artificial intelligence, Technological innovation, Management challenges, International business

1. Introduction

Management in the age of artificial intelligence (AI) presents unique challenges and opportunities, especially in the international landscape. As innovation is an important part of modern business (Agoraki et al., 2024; Pistikou et al., 2024), technology is constantly evolving (Deirmentzoglou and Deirmentzoglou, 2020), and leaders must adapt to the emerging landscape to harness its potential while considering and anticipating its risks. AI can disrupt traditional leadership models by automating certain tasks and decision-making processes. This challenges leaders to adapt to this new reality and leverage AI to drive innovation and productivity. In addition, leaders must navigate and adapt to the evolving regulatory environment, understanding but also complying with regulations around AI, data protection and privacy, while advocating for responsible and fair governance (Peifer, 2022).

A primary concern is the ethical implications of AI. Managers should focus on understanding the potential risks and establishing guidelines to ensure that AI is developed and implemented in a responsible and inclusive manner (Jobin et al., 2019). Additionally, leaders need to develop a digital mindset in order to lead effectively in the AI era. This includes gaining knowledge and understanding of AI technologies, their potential applications, and their limitations. It also requires cultivating a culture of continuous learning and embracing change to adapt to the evolving AI landscape (Singh et al., 2022).

Managers need to consider the potential impact of AI on the workforce. AI may automate routine tasks. To ensure workers remain relevant in a technology-based economy, managers must anticipate changing skill requirements and provide opportunities to refresh and upgrade skills (Watson et al., 2021). In addition, effective managers will leverage AI technologies themselves. A.I. can help managers make decisions, automate administrative tasks, and improve workflow efficiency. By embracing AI tools, leaders can be more strategic, innovative, and better equipped to tackle complex challenges (Peifer, 2022).

While AI is having a significant impact on management processes, the academic literature on the subject is still emerging. The purpose of this study is to explore the challenges posed by AI and how international business managers can use this technology to drive decision-making and benefit their organizations. To achieve this, ten interviews are conducted with senior international business executives from a variety of industries to collect qualitative primary data. This study provides theoretical implications and practical recommendations for leaders using AI technologies.

2. Literature Review

Artificial intelligence (AI) is a major human effort to create machines that can act like a human. To achieve a refinement effort needs a contribution of many sciences such as psychology, philosophy and others, so that it can provide answers and solutions to questions and problems. AI is increasingly becoming a necessary tool for many organizations to be more competitive, efficient, and agile relative to their competitors, and to stay current in an ever-changing external environment. Most organizations use AI to optimize the quality of decisions, to gather new information and data, and to automate certain processes. Therefore, and according to the above, AI brings a new model to the work environment, as more and more organizational leaders are using it to make critical and important decisions.

A key concern of many researchers on AI is whether it will be able to make decisions on its own and replace human leadership. Some believe that a machine will never be able to replace the human mind, human nature, because these machines are still far from emotions. Therefore, leaders who use AI as a means to make decisions add empathy, so they can understand the emotions of those in command to make the best decision possible. What AI still lacks is critical thinking, as sometimes idiosyncratic problems arise that only the human mind in particular can successfully address (Jones, 2018).

The use of AI is causing significant changes for employees and managers alike, but it is also creating new challenges. These challenges fall into three main categories. 'strategic transformation process', 'skills and competencies', and 'culture and human-AI interaction' (Peifer, 2022). Leaders face significant challenges, as they need to be retrained to use it, to ensure transparency of AI, but also to form an ethical profile, as AI brings to a work environment the creation of new skills, which requires retraining of leaders, as well as the use of transparency, which creates a climate of trust between management and those managed. Having said all this, it is worth mentioning that in order to achieve the above, a leader with an open and evolving mind to the future changes that are increasingly invading everyday life is needed, as the use of AI is a necessity for the sustainability of an organization in a competitive environment (Smith and Green, 2018).

The use of AI has had a particularly significant impact on the way an organization is organized and operates. This continuous technological development logically has a significant impact on the modern leader. The functions of AI and its specificity to collect and process a large amount of data, helps to optimize decision-making in the areas of marketing, sales, production, understanding and human resource management by executives in charge of managing an organization (Canals, 2020).

The use of AI and new technologies in general is not enough to transform an organization. For a thoughtful and smooth transformation of an organization, an appropriate environment for employee adaptation should be created by the leader with the help of training for both the leader and the employees (Watson et al., 2021). Therefore, it can be understood that the role of the leader is becoming increasingly challenging due to the constant changes as management becomes more specific and complex (Heukamp, 2019).

Modern managers have to emphasize the constant development of new technological data, and the constant updating of his knowledge in the field in which he is located. They still have to acquire knowledge using AI for data exploration (Smith and Green, 2018). Then, they have to place significant emphasis on ethical issues that are increasingly arising as the use of AI becomes established in a work environment. Finally, it is clear that managers must be prepared to deal immediately with any internal or external crisis that may arise (Watson, 2021).

3. Methodology

To explore the challenges posed by AI and how international business managers can use this technology to drive decision-making and benefit their organizations, ten interviews are conducted with senior international business executives from a variety of industries in the European Union to collect qualitative primary data from a descriptive scope. Through semi-structured interviews, we gave interviewees the opportunity to elaborate

on their experiences and express their personal views on each question. The questions addressed the significance of AI in contemporary leadership and on managerial decision-making in international business.

In terms of the characteristics of the respondents, one individual is involved with the health sector, specifically a company related to health quality assurance and holds a senior management position. Two respondents are from real estate companies and hold CEO positions. One individual is from a global financial organization and holds a managerial position. Two respondents are from the tourism industry and hold senior management positions. One individual is from a real estate development and engineering company with a CEO title. There were also two respondents who hold senior management positions in a legal services consulting firm and an asset management accounting firm. The last respondent holds a senior management position in a public relations firm.

4. Findings

Data analysis was carried out in the native language of the survey participants to prevent any ambiguity or misinterpretation. Initially, the interviews were individually examined using an inductive approach (Thomas, 2006) before being compared with each other. The emerging themes were documented and summarized. The findings were grouped according to the following emerging themes.

4.1 Challenges and Opportunities Arising From the Integration of AI Technologies Into Management

The integration of AI technologies into management practices creates several challenges as well as unique opportunities. Some of the positives identified from its use include the ability for managers to deal with multiple crises simultaneously. However, there is a reluctance to synchronize AI systems with human resources, as more and more training is needed, which must evolve as fast as the technological data. The educational part to overcome the challenges, but also as an opportunity for staff training, is seen as a key element by all respondents. Of course, there are also some concerns, such as ethics, protection of personal data, but also managing the perception that members of a group have of artificial intelligence.

One of the challenges is to ensure that AI systems are reliable. AI technologies are heavily data-driven, and if the data used to train these systems is biased or incomplete, it can lead to incorrect decisions. Therefore, it is critical to carefully curate and validate the data used to train AI systems to ensure fairness and accuracy. Another challenge is the potential for job displacement. As AI technologies become more advanced, there is concern that some tasks traditionally performed by executives and crisis managers could be automated. This could lead to job losses and require individuals to upskill or retrain to adapt to the changing landscape.

However, there are also many opportunities arising from the integration of artificial intelligence technologies into leadership and crisis management practices. Artificial intelligence can provide leaders with valuable insights and predictive analytics, enabling them to make more informed decisions. For example, AI algorithms can analyze large amounts of data to identify patterns and trends, helping leaders anticipate and mitigate potential crises. They can also use AI technologies to improve communication and collaboration in crisis situations. Chatbots and virtual assistants can provide real-time information and support to people affected by a crisis, freeing up human resources to focus on more complex tasks. In addition, AI-powered tools can help coordinate response efforts, optimize resource allocation, and facilitate effective communication between different stakeholders.

AI can also assist executives and crisis managers with scenario planning and risk assessment. By simulating different crisis scenarios, AI systems can provide insight into possible outcomes and help leaders develop robust contingency plans. In summary, while there are challenges to be overcome, the integration of AI technologies into leadership and crisis management practices offers significant opportunities for improved decision-making, better communication, and more effective crisis response. It is important to approach integration carefully, ensuring ethical considerations and using AI as a tool to augment, rather than replace, human capabilities.

> *"The biggest challenges are around ethics, data privacy, and managing team members' perceptions of AI." (R1)*

> *“Ability to manage several crises at the same time - modern environment, constant updating of new technologies, integration, development and training of human resources, difficulty of human resources to adapt to constant changes and increasing speed of information and increasing workload due to constant need to train them.” (R2)*

4.2 The Impact of AI on Leadership Practices in Crisis Management

After an extensive analysis of all the responses, there is a positive sign in the use of artificial intelligence by leaders, but with caution. As for the positive elements, the extraction and analysis of a large amount of information and data in a short period of time, with a limitation of human error during the data analysis process. Improved predictive capabilities, such as the creation of realistic simulations and "scenario" planning, which allow organizations to better prepare for various scenarios and enhance their crisis management capabilities. which allow early detection of potential crises and risks. Again, there is a reluctance to invest in the education and training required to use new technologies. In all cases, however, there is talk of human leadership giving direction to management and decision making and leaving the analysis to artificial intelligence.

It is important to note, however, that while AI can provide valuable support, it should not replace human leadership in crisis management. Human judgment, empathy, and intuition are still critical to navigating complex and unpredictable crisis situations. AI should be seen as a tool to augment and enhance leadership practices, rather than a substitute for human decision-making. In conclusion, the impact of artificial intelligence on leadership practices in crisis management is significant. AI can enhance situational awareness, support decision-making, and facilitate resource allocation and coordination. By harnessing the power of artificial intelligence, leaders can be better equipped to effectively manage crises and mitigate their impact.

> *"AI enhances leadership and crisis management by providing powerful tools for data analysis, decision making, automation, and proactive planning. By leveraging AI technologies, leaders can more effectively navigate challenges, respond to crises with agility, and optimize various aspects of organizational management." (R7)*

4.3 The Extent to Which AI is Integrated Into Crisis Management Strategies and the Implications for Managerial Effectiveness

The key practices and strategies relate to basic understanding of AI, ongoing training, and how to integrate AI into a strategic plan in a safe and functional manner. Organizations can develop effective managers able to navigate the challenges and opportunities presented by AI by blending leadership development practices (e.g., training, adaptability, flexibility, communication) and crisis management strategies (e.g., regular testing and evaluation, crisis communication plan, post-crisis evaluation and learning).

When it comes to crisis management, AI can be used for a variety of purposes. For example, AI-powered chatbots can provide immediate and accurate information to the public during an emergency, helping to alleviate panic and provide guidance. AI algorithms can also analyze social media data to detect early warning signs of crises, such as natural disasters or public unrest, allowing authorities to respond proactively.

In addition, AI can help with resource allocation and logistics planning during crises. By analyzing historical data and current conditions, AI algorithms can optimize the distribution of resources, such as medical supplies or emergency personnel, to areas of greatest need. This can help improve response times and save lives. When it comes to leadership effectiveness, AI can provide valuable support to leaders in crisis situations. AI algorithms can analyze data from multiple sources, including sensor networks, social media, and news reports, to provide real-time situational awareness. This allows leaders to make informed decisions based on accurate and up-to-date information.

> *"Organizations can cultivate effective leaders capable of navigating the challenges and opportunities presented by AI by combining managerial practices (e.g., training, adaptability, flexibility, communication) and crisis management strategies (e.g., tactical testing and evaluation, crisis communication plan, post-crisis evaluation and learning)." (R4)*

4.4 Assessing Managers' Adaptability to Technological DevelopMents in the age of AI

In this rapidly evolving digital landscape, leaders must be open-minded and willing to embrace new technologies, including artificial intelligence. They should understand the potential benefits and challenges that AI brings to their organizations and industries. Adaptability in this context refers to a leader's ability to understand and leverage AI to drive innovation, efficiency, and growth. It involves being open to change, constantly learning about new technologies, and being willing to experiment and take calculated risks.

A key aspect of adaptability is a growth mindset. Managers should be willing to learn and unlearn, as AI technologies may disrupt traditional ways of doing things. They should be open to exploring how AI can

improve decision-making processes, automate routine tasks, and enhance customer experiences. In addition, leaders must foster a culture of innovation and encourage their teams to embrace AI. This includes providing resources and training to help employees develop the skills necessary to work with AI technologies. It's important for leaders to create an environment that encourages experimentation and learning from failure, as the implementation of AI may not always go smoothly.

It's worth noting, however, that adaptability does not mean blindly embracing every AI trend. Managers should also be critical thinkers and assess the ethical implications, potential biases, and risks associated with artificial intelligence. They should ensure that AI is used responsibly and in a way that aligns with their organization's values and goals. In summary, leaders' ability to adapt to technological developments, especially in the age of artificial intelligence, is critical to remaining competitive and driving innovation. It requires a growth mindset, a willingness to learn and experiment, and a focus on creating a culture of innovation. By embracing AI and harnessing its potential, leaders can position their organizations for success in this rapidly evolving digital age.

> *"The main challenges are: combining AI with the company's human resources, training employees in AI systems, proper use of AI, safety nets to protect the company's sensitive data, developing systems so that AI can be used. The above challenges can be addressed through training in AI and a full understanding of the risks involved." (R8)*

4.5 Identifying the Skills and Competencies Needed for Managers in the age of AI

From the analysis of the responses, it should be mentioned that managers should have a deep understanding of all the positive and negative aspects of artificial intelligence. In any case, as has been observed, there is a need for training and understanding of artificial intelligence by managers, as they will be asked to evaluate and choose to what extent and in what areas they will use this technology. They also need training to know how to use new technologies to increase efficiency and effectiveness. Managers need a solid understanding of the capabilities, implications, and ethical considerations of AI. Educating and training leaders in AI is integral to building a foundation of knowledge, skills, and ethics necessary for effective crisis management.

While AI can automate many tasks, managers need to connect with their teams on a human level. Emotional intelligence, including empathy, communication and collaboration skills, will be even more important in the age of artificial intelligence to foster trust and build strong relationships. Managers need to think strategically about how AI can be integrated into their organization's overall goals and objectives. They should identify opportunities where AI can add value, streamline processes, and improve the customer experience.

Artificial intelligence is a rapidly evolving field, and leaders need to be lifelong learners. They should keep up with the latest developments, attend conferences, participate in training programs, and work with experts to expand their knowledge and stay ahead of the curve. Implementing artificial intelligence often requires organizational change. Leaders should be skilled at managing change, including communicating the benefits of AI, dealing with resistance, and ensuring a smooth transition for employees. Overall, leaders in the age of AI will need a combination of technical expertise, adaptability, ethics, emotional intelligence, strategic thinking, continuous learning, and change management skills to effectively harness the power of AI and move their organizations forward.

> *“Managers must be technologically literate to make informed decisions about the adoption, integration, and governance of AI. Educating and training leaders in AI is essential to building a foundation of knowledge, skills, and ethics necessary for effective crisis management.” (R7)*

4.6 The Importance of Modern Leadership and Crisis Management in the age of AI

During the 4th industrial revolution, strong leadership is necessary that will redefine the meaning of the work of the human potential and through their continuous education will lead them to join creative groups that will pursue and achieve common goals. Modern managers will be called upon to face many crises, which they will achieve only through the practice of modern management methods. Artificial intelligence has the potential to help companies grow in depth. It provides the possibility of a more efficient utilization of resources. Modern leadership and crisis management are essential in the age of artificial intelligence. Artificial intelligence technologies are rapidly transforming our entire world, including industries, affecting the way organizations operate, make decisions and respond to challenges. Artificial intelligence can provide many benefits at the level of analysis and prediction. Managers who possess a combination of technical literacy, ethical acumen,

adaptability and strategic vision are able to harness the benefits of AI while effectively addressing the challenges and ensuring the responsible and sustainable use of these technologies.

> *"AI has the potential to help companies grow in depth. It offers the possibility of a more efficient use of resources and therefore the possibility of improving efficiency and effectiveness. The positives that AI brings will come at the cost of a reduction in human resources, which leaders should be able to manage as painlessly and effectively as possible. Developing systems, improving existing rules and practices, and protecting data are essential elements in the transition to the AI era." (R3)*

5. Discussion and Conclusion

This study demonstrates that AI is becoming increasingly useful for companies that utilize large amounts of data. However, it also creates significant opportunities and numerous challenges (Peifer, 2022). A significant challenge is the management and coexistence of AI with the workforce (Naqvi, 2017). According to the results of our research, the necessity of human leadership is evident because AI lacks human empathy. The deployment of AI will result in the creation of new job roles in the absence of human labor, a phenomenon that has been observed in recent years for a number of reasons. Furthermore, the utilization of AI can be considered an advisory tool for the leadership of an organization.

Moreover, our research shows that today's managers need to be properly trained in the use of AI machines, but they also need to stay abreast of new developments (Naqvi, 2017). Furthermore, the use of AI is particularly important in the operations of organizations for crisis prediction and management (Unhelkar and Gonsalves, 2020). Artificial intelligence has the potential to support decision-making and facilitate resource allocation. By harnessing the power of artificial intelligence, managers can be better equipped to effectively deal with crises that may arise.

This research has significant managerial implications as today's leaders need a combination of technical expertise in many areas to effectively harness the power of artificial intelligence and lead their organizations to success. Modern managers in international business will have to adapt to AI machines, with the caveat that the survey participants said they will use the machines in the right way to analyze data and treat human resources properly.

Future research can focus on more aspects related to AI and management. For example, future research can be conducted on the impact of cultural aspects) on managerial decisions (Agoraki et al., 2024; Deirmentzoglou et al., 2024) regarding AI, the role of organizational culture (Deirmentzoglou et al., 2020), and aspects regarding customer satisfaction (Deirmentzoglou, 2022). Finally, this research focuses on qualitative data, therefore, future research can utilize quantitative data.

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Instagram as Part of SMM Innovation in Educational Institutions

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Abstract: The use of Instagram as a social media marketing tool in educational institutions is gaining more and more attention. This article explores the relationship between school size and a school's Instagram presence, activity, and engagement. Specifically, the investigation focuses on answering the question of whether larger schools are more likely to have an Instagram account, post more frequently, and generate higher levels of interaction. The paper examines the role of Instagram in social media marketing within educational institutions, focusing on the relationship between school size and a school's presence, activity and engagement on Instagram. The research addresses three main hypotheses. Namely, that schools that have higher pupil numbers are more likely to have an Instagram account, schools with higher pupil numbers are more likely to post on Instagram, and schools with higher pupil numbers experience higher overall interaction (in the form of likes and comments) on their Instagram posts. An empirical quantitative research method was used. Statistical validation was carried out using Pearson's correlation coefficient and data from 444 schools were analysed. The results confirmed significant correlations between the number of pupils and the likelihood of having an Instagram account, frequency of posts and overall interaction. The paper further explores the effect of post frequency on follower numbers, finding a relationship that the more posts the higher the engagement, this does not necessarily lead to higher follower numbers. In addition, the study examines the link between the number of followers and the number of posts published by Reels, revealing a correlation. This suggests that a larger number of followers predicts a larger number of posts by Reels. Nevertheless, this highlights the need for a balanced content strategy. The above findings provide important insights into effective social media marketing strategies for educational institutions. The value of this study lies in its practical implications for school administrators and marketing professionals aiming to strengthen their institution's social media presence. The study concludes by highlighting the key role of Instagram in educational marketing and offering evidence-based recommendations for optimizing social media strategies to achieve better engagement and visibility.

Keywords: Educational institutions, Social media marketing innovation, Instagram innovation, Innovation strategies, Educational institutions marketing

1. Home

In today's digital environment, where social media plays a key role in the complexity of marketing communications, Instagram is emerging as an essential tool for commercial businesses. Private educational institutions are facing escalating competition and increased expectations from both students and their parents, requiring a rethinking and adaptation of marketing communication strategies. Particularly in digital marketing, where there is constant innovative progress. Instagram, as a platform predominantly defined by visual content, offers educational institutions the opportunity of diverse content options. Successful communication through SMM and especially Instagram requires not only the creation of quality and consistent content, but also the implementation of follow-up analytics and continuous evaluation of success. Subsequently, it is possible to adjust marketing strategies in line with the preferences and behaviours exhibited by the target audience. The aforementioned adaptability of the entity responding to changes in a highly competitive digital environment is crucial for the success of entities, especially if they are private educational institutions.

2. Social Media Marketing (SMM)

In general, the use of social media in contemporary marketing communications involves a diverse interplay of advantageous opportunities and challenges, requiring a sophisticated and differentiated approach to differentiate oneself from the competition. In an ever-evolving landscape of algorithmic change and content saturation, marketing managers must maintain a state of readiness to adapt to diverse conditions (Khan et al., 2023). Marketing managers must create compelling content while maintaining user trust in business entities and moral principles. Leveraging real-time engagement, the capacity for viral content distribution, and the precision of targeting specific audiences present significant opportunities for extensive brand reach and active engagement, facilitating improved community relationships across market segments. Authors Vinayaka and Manik (2017) examined how Instagram influences marketing strategies. Their findings define that Instagram enables brands to establish and maintain communication with their target audience through engaging visual media. The authors further found that Instagram has a large target audience of users in which businesses can

find their supporters and create communities. Alhabash and Ma (2017) ranked Instagram first in terms of duration and intensity of app usage in their investigation, surpassing competitors such as Snapchat, Facebook, and X. One of the challenges facing marketers today relates to the widespread problem of content oversaturation. The proliferation of content creation across the population has led to an overwhelming influx of information that inundates consumers on a regular basis. The proliferation of posts, images and videos on social media platforms necessitates gaining a competitive advantage and creating content that effectively engages the target audience. To effectively address this challenge, according to the authors, marketers are required to not only deliver compelling and tailored content, but also demonstrate a deep understanding of the preferences, behaviors, and cultural propositions that define their respective target audience cohorts (Khan et al., 2023). Instagram, which serves as a social media platform, functions as a channel that facilitates the dissemination of personal information across public networks while also serving as a tool to promote business growth. The platform is expected to soon reach 3 million posts in a single day, highlighting its significant advertising market capacity estimated at US$350 billion (Siregar & Puspasari, 2023). One of the options that can be published on Instagram are the so-called reels, which are short videos produced on the platform, their main proposition being to grab attention as quickly as possible and to provide quick and engaging content. The target group of learners often watch said reels to pass the time or to relax, as these brief formats can instantly fulfill their quest for entertainment (Menon, 2022). Instagram itself offers various features for users, such as the ability to upload photos and videos, create short videos up to one minute long, use the "@" symbol to connect with other users by tagging their Instagram accounts, provide photo captions and captions for context, geotag posts to show location, use hashtags to facilitate content discovery and association, and use the "like" feature to acknowledge posts on the platform (Iva Fikrani Deslia et al, 2022, Krajčovič, 2024). Instagram allows to reach a wide audience in different locations without time or space constraints. The costs are reasonable compared to television advertising. Instagram can quickly spread messages and influence users and spread from one person to another. It influences behavior in personal satisfaction, usability, socialization, product awareness, and entertainment. There are risks to using Instagram for marketing, such as the rapid spread of negative messages. The high interactivity of social media, similar to comments, can pose challenges in marketing through Instagram (Deslia et al., 2022, Hudakova, 2023). Consumer engagement on Instagram is context-specific, with "likes" indicating engagement with brand posts. "Likes" are considered as a new indicator of user engagement with branded content, not just as a metric. The number of "likes" on a brand's Instagram page reflects its popularity among users. Studies show that "likes" can indicate consumer engagement behavior. The authors consider "likes" as acts of approval and sharing. Encouraging "likes" and sharing may maximize consumer engagement. This may lead to discovery of branded content in newsletters and continued "liking" of brand pages (Kim et al., 2021). Anagnostopoulos et al. (2018) have highlighted the role of Instagram in user interactions in marketing campaigns and enhancing an organisation's reputation through engagement, particularly likes and comments. They found that product-related engagement attributes were more significant than non-product-related attributes. According to the authors, Instagram is defined as an important social media platform offering unique visual experiences (Budge 2020; Özdemir and Çelebi 2017). Image platforms are valuable for communication and promotion on social media due to their ability to easily create visually appealing content (Rodríguez-Vera et al. 2024; Chábyová, Galera Matúšová, and Kubovics 2024).

2.1 SMM in Educational Institutions

Social media marketing has become an integral part of the marketing strategies of educational institutions and significantly influences the direction of that segment. The use of social media platforms such as Instagram, Facebook, and X allows educational institutions to communicate with a wider target audience, including younger age cohorts or international audiences, which can potentially improve brand perception and attract potential students (Barus, 2023). The integration of social media into education is not limited to promotional activities, but also extends to and connects with educational content. Project-based learning (PBL) methodologies in marketing education have shown that social media can be effectively used to build influencer brands, thereby increasing student motivation and engagement (Demirci et al., 2023). According to Wang's (2023) investigation, social media platforms such as TikTok have also demonstrated significant potential in marketing communications in terms of the content and interactions produced by educational institutions. Moreover, when used appropriately, they also offer social impact or competitive advantage to the entity. The content on social media should match the focus of the educational institution, which led to interaction with users according to the research of Sari and Muhammad (2024). Variety of content has been shown to be very useful in online marketing communication as it allows the engagement of a diverse target group, thus promoting user interaction and community development (Maryani et al., 2023). Diverse social media platforms highlight the multifaceted opportunity for their use in educational institutions, ranging from objectives such as increasing brand awareness

to empowering individuals in the form of employees through targeted campaigns and content. The authors of the studies conclude that social media marketing of educational institutions is a communication tool that can increase engagement, create and strengthen community as well as the overall image of the institution. The findings confirm that larger educational institutions tend to be more engaged on social media platforms due to their larger student populations, leading to increased user demand for information and communication activities. Specifically, the study by Weiss et al. (2018) highlights various characteristics of school size and structure that may indicate higher levels of engagement on social media in the form of platforms such as Instagram Based on the findings of the Pew Research Center (2022), we add to the findings that larger educational institutions tend to exhibit higher levels of engagement on social media platforms in order to foster more effective communication with larger audiences comprised of students and their parents. Research further shows that adolescents in the 15-17 age group are more likely to use smartphones and interact on social media, potentially leading to increased activity by the institution on social media platforms such as Instagram (Massarat, 2022). The authors define that media users on Instagram are predominantly high school age. That demographic represents a relatively elevated age group, with a significant portion using the popular social media platform Instagram. When examining this phenomenon, it is evident that categorizing individuals into distinct generational groups presents a challenge. Based on defining characteristics, generational cohorts are typically divided into six categories: veteran generation (1925-1946), baby boomers (1946-1960), generation X (1960-1980), generation Y (1980-1995), generation Z (1995-2010), and generation alpha (2010-present) (Amanda et al., 2024). Individuals belonging to Generation X were born during a pivotal era marked by rapid technological and informational advances. Conversely, Generation Alpha, who were born in an era characterized by ubiquitous digital technologies, exhibit a strong affinity for such tools.

3. Methods

The aim of the present study was to investigate how different factors related to the number of students and activity on schools' Instagram accounts affect the level of user engagement. The literature review involved a comprehensive search and a thorough critical analysis of existing academic sources to elucidate the key concepts of SMM with emphasis on the private educational institutions segment, to recognize current trends and to explore their linkages in the said segment. This was accompanied by a careful selection of mainly highly relevant database (Web of Science and Scopus) sources, their analysis and subsequent synthesis of the identified information. Scientific sources were used as secondary sources, which included peer-reviewed articles, academic publications, monographs, empirical studies and statistical databases. For the purpose of our scholarly study, we conducted quantitative research, focusing our attention on engagement rates in relation to the number of pupils, the number of posts and the number of followers on the schools' Instagram accounts. Using Zoomsphere, an analytics tool that provided us with comprehensive user interaction data, we examined 444 profiles of private educational institutions and collected information about their interactions on different types of posts. We collected data from the profiles over a period of one year from March 2023 to March 2024. We obtained the database of schools from the Statistical Office of the Slovak Republic. We created a list of educational institutions indicating their type (kindergarten, primary school, secondary school), number of employees and number of students. For the purpose of this research we used only data on the number of pupils and the type of educational institutions. We hypothesised that schools with larger numbers of pupils would have more active Instagram accounts.

We formulated the following hypotheses:

H1a: A school with more students is more likely to have an Instagram account. (Weiss et al., 2018), (Massarat, 2022)

H1b: A school with more pupils will have a higher number of posts on its Instagram account. (Dennen et al., 2020)

H1c: A school with more students will have a higher overall number of interactions (likes, comments) on its Instagram account. (Jiang & Monica, 2018)

H2: More posts on a profile lead to more followers (Ull et al., 2024).

H3: A larger number of followers on a profile leads to a higher number of Reels posts (Davaasuren et al., 2024).

Variables used:

- Number of pupils (numerical value) - cardinal variable

- Instagram account - possible yes/no answers (values were transcoded to 1 and 0), nominal variable
- Number of posts on Instagram profile - (numerical value) cardinal variable
- Number of interactions on Instagram profile included - (numerical value) cardinal variable

Statistical processing of the results was performed using SPSS 29 and MS Excel. Statistical methods were used, namely sum and mean were used in descriptive characteristics. The normality according to the values of the variables was verified by histogram and Gaussian curve fitting. Based on the results, Pearson's correlation coefficient was selected and used to verify the relationships because the nature of the variables was nominal and cardinal. The Pearson correlation coefficient uses the following verbal reasoning for the variable p: 0 - 0.1 - none - trivial relationship, 0.1 - 0.3 - weak relationship, 0.3 - 0.5 - moderate relationship, 0.5 - 0.7 - strong relationship, 0.7 - 0.9 - very strong relationship, 0.9 - 1 - perfect relationship - the variables are identical (Utheim Grønvik et al., 2016).

4. Results

The following section provides detailed results of our research findings. The results are systematically arranged and presented in a clear form to make them as easy to understand as possible. For better orientation and interpretation of the data, we have prepared a visualization, which is shown in Table 1. The first hypothesis was tested through Pearson's correlation coefficient. The value of Pearson correlation coefficient is p = 0.337 and Sig = 0.000. This is a positive (positive) moderate relationship, which means that there is a direct proportionality between the variables. The more students a school has the more likely it is to have an Instagram account. As the score of one variable increases, the other variable also increases. We accept the hypothesis H1a. The second hypothesis was equally tested through Pearson's correlation coefficient. The value of the Pearson correlation coefficient in testing hypothesis H1b was 0.224 and Sig = 0.005. The result indicates a positive (positive), weak relationship which means that there is a direct proportionality between the variables. As the school has a larger number of students the frequency of Instagram posts increases. As the frequency of one variable increases, the other variable also increases. H2b hypothesis by income. The third hypothesis was tested using Pearson's correlation coefficient. The value of Pearson's correlation coefficient was 0.271 and Sig = 0.003 in testing hypothesis H1c. From the result, a positive (positive), weak relationship can be concluded, which means that there is a direct proportionality between the variables. As the school has a larger number of students the total number of Instagram interactions increases. As the frequency of one variable increases, the other variable also increases, we accept the hypothesis H1c.

Table 1: Impact of pupil numbers on the Instagram component of schools' SMM activities

		Do they have Instagram?	Number of contributions	Total number of interactions
Number of pupils	**Pearson Correlation**	0.337**	0.224**	0.271**
	Sig. (2-tailed)	0. 000	0.005	0.003
	n	444	157	122
**. Correlation is significant at the 0.01 level (2-tailed).				
b. Cannot be computed because at least one of the variables is constant.				

The fourth hypothesis defines that the greater the number of posts on a profile the greater the frequency of followers on the profile. Verification was done through Pearson's correlation coefficient. The value reached the level of 0.271 and Sig = 0.01. The result indicates a positive (positive), weak relationship, which means that there is a direct proportionality between the variables. The more posts on the profile the greater the number of followers. As the frequency of one variable increases, the frequency of the other variable also increases. We accept the hypothesis H2.

Table 2: Impact of number of posts per profile and number of followers per profile

		Number of followers per profile	Number of contributions
Number of followers per profile	**Pearson Correlation**	1	0.205*
	Sig. (2-tailed)		0.010
	n	168	157
Number of contributions	**Pearson Correlation**	0.205*	1

		Number of followers per profile	Number of contributions
	Sig. (2-tailed)	0. 010	
	N	157	157
*. Correlation is significant at the 0.05 level (2-tailed).			

The fifth hypothesis defines that the higher the number of Reels posts the higher the number of followers on the profile. The verification of the chosen hypothesis was done through Pearson's correlation coefficient where the p-value reached 0.231 and Sig = 0.012.The result indicates a positive (positive), weak relationship, which means that there is a direct proportionality between the variables. The greater the number of Reels type posts, the greater the number of followers per profile. As the frequency of one variable increases, the frequency of the other variable also increases. We accept the hypothesis H3.

Table 3: Impact of the number of Reels posts on the number of followers per profile.

		Number of followers per profile	Post Type - Reels
Number of followers per profile	**Pearson Correlation**	1	0.231*
	Sig. (2-tailed)		0. 012
	n	168	117
Post Type - Reels	**Pearson Correlation**	0.231*	1
	Sig. (2-tailed)	0.012	
	N	117	117
*. Correlation is significant at the 0.05 level (2-tailed).			

5. Discussion

The results of the investigation reveal interesting insights regarding the use of Instagram in SMM of educational institutions. The analysis of the study provides empirical evidence that substantiates the defined hypotheses and as a result introduces new perspectives into the current trends of social media marketing of educational institutions. We tested the relationship between student enrollment and an educational institution's Instagram presence (H1a) and our results indicate a moderate positive correlation between student enrollment and the likelihood of a school having an Instagram account. The evidence we find suggests that larger schools exhibit higher Instagram activity. The result is consistent with sources analyzed that suggest larger educational institutions may have more resources to manage social media, which increases their ability to communicate effectively with their target audiences (Foroughi et al., 2022). Hypothesis H1b, a school with a larger number of pupils will have a higher number of posts on its Instagram account achieved a confirmatory positive result in the evidence, albeit a weak relationship between pupil numbers and frequency of Instagram posts. The weaker correlation implies that while the number of pupils influences Instagram activity, there are other factors such as the right content strategy or proper targeting that can influence the frequency of posts (Dennen et al., 2020). The number of students and the number of interactions in the relationship mediated the testing of hypothesis H2c. The analysis suggests a positive, weak correlation between the number of students and total interactions on the Instagram accounts of educational institutions. The result is consistent with previous research that finds that larger schools may receive more interactions due to the higher number of active students and parents on these platforms (Jiang & Monica, 2018). Another significant finding under Hypothesis H2 is that a higher number of profile posts correlates with an increased number of followers. The result complements and supports the claim that other factors such as a consistent strategy and content quality within content posting , which may ultimately increase engagement and expand profile visibility, are also at work (Li et al., 2021). Hypothesis H3 a larger number of followers on a profile leads to a higher number of Reels posts. The data analysis revealed a true statement that there is a positive weak correlation between the number of Reels posts and the number of profile followers. The finding suggests that interactive and visually appealing content such as Reels can help in increasing the number of followers in line with the importance of visual content in digital marketing communication (Hancerliogullari & Ceylanoglu, 2023; Wang, 2021). The analysis of the above sources shows that Reels with educational content are currently quite widespread. They offer attractive and entertaining content for the target audience. In the context of innovation, content in the form of Reels is one of the options for educational institutions. In doing so, it represents a way to reach the target group of learners on platforms where they spend a considerable amount of time. Our research defines the innovation potential in publishing Reels

mainly because they offer educational institutions the opportunity to present, for example, their unique culture, achievements and values in a way that is attractive to the target group. A limitation of the above study is its exclusive focus on private educational institutions. Subsequent research could expand the scope to public schools for a more comprehensive understanding of the use of social media in various educational sectors. In addition, the study's reliance on one platform (Instagram) presents a limitation that could bias the results. Future investigations should include different platforms such as Facebook, X, or TikTok, which could build on Krajčovič and Madleňák's (2024) research. Despite these limitations, the study provides valuable insights into the associations between student numbers, social media engagement and levels of user interaction, offering practical lessons for educational institution profile managers and digital marketing professionals.

6. Conclusion

The investigation provided valuable perspectives on the correlation between the amount of students and activity on the Instagram profiles of private educational institutions and their impact on user engagement rates. The results suggest that larger educational institutions are more likely to have an Instagram profile along with a higher number of posts and interactions. Equally, the findings suggest that a higher number of publications results in an increased number of followers and that Reels-style publications have a positive impact on expanding profile followers. These findings are consistent with previous findings and offer to add to the theoretical apparatus, as well as having potential implications for the practical realm in SMM educational institutions seeking to increase their social media presence and engagement. Despite the limitations of this study, it offers significant perspectives for educational institution profile managers and digital marketing practitioners and initiates opportunities for further exploration in this area.

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Innovative Content Production in Marketing Communication Through AI

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Abstract: The integration of artificial intelligence (AI) into marketing communications has changed the way businesses communicate with their customers. The present paper explores the potential of AI-driven systems to automate content creation, highlighting the role of AI in increasing customer engagement and strategic decision making. AI offers significant benefits by leveraging customer data to predict their behaviour, optimize marketing strategies, and personalize content. By systematically creating and evaluating content, AI enables marketers to customize messages to specific audiences, increasing the effectiveness of campaigns. The research employs a mixed methods approach that combines qualitative and quantitative analyses to assess the potential use of AI in content marketing. The qualitative aspect involves a thorough review of existing literature, identifying key trends and relationships in the use of AI for marketing communications. On the other hand, the quantitative aspect of the study involves a process of experimental validation using Python and APIs such as OpenAI and Graph APIs to automate content creation and measure its effectiveness. The findings confirm that AI can be utilized to personalize content using the input data in the form of brand-voice, target group, and the evaluation of current communication. The iterative process allows for continuous improvement of quality and relevance of content, which is important in the dynamic environment of marketing communications. The study highlights the importance of accurately defining the target audience and brand-voice, as the effectiveness of AI depends heavily on the accuracy of the input data. However, the study also acknowledges limitations such as the potential inconsistency of the content generated through AI and the challenges associated with maintaining a coherent brand-voice. Future research should focus on developing advanced machine learning methods to better understand context and improve the alignment of content with brand values and customer expectations. In conclusion, the integration of AI into marketing communications offers a powerful tool for businesses to optimize content creation, increase customer engagement, and achieve strategic goals in an increasingly competitive digital environment. AI's ability to create, evaluate and refine content in real-time provides a significant advantage and ensures that marketing communications remain adaptive and effective.

Keywords: Artificial Intelligence in marketing, AI-driven content creation, Personalization in marketing, Automated content optimization, Brand-voice integration

1. Introduction

The integration of artificial intelligence (AI) into marketing communications has revolutionized the way businesses communicate with their customers. By leveraging customer data, AI enables the prediction of future purchases and improves the overall customer journey (Brobbey et al., 2021). AI as a transformational technology offers the potential for partial automation of marketing communications that aligns and integrates the organization, thereby improving organizational performance (Allen et al., 2023). In addition to the above, AI solutions play a key role in marketing decision-making at different stages of the marketing process, offering valuable insights and improving strategic planning (Ljepava, 2022).

1.1 Target Group

According to authors Chaisatitkul et al. (2024), the target group plays a key role in generative AI content creation, such as ChatGPT and Dall-E. The research clarified that the focus group had a positive response to AI-generated stories and storyboards, finding them impartial and effective. The favourable perception substantiates the importance of integrating target audience feedback into the methodology of developing and evaluating AI tools in marketing. On the other hand, according to the authors of Ramos (2023), the correct specification of the target audience in the generation is paramount because AI depends on how well the target audience is defined and understood. Adequate segmentation of the target group allows AI to customize marketing outputs and ultimately improve the impact of campaigns. The authors agree that in the absence of a comprehensive understanding of the target group, AI would not be able to effectively personalize the customer experience and increase marketing effectiveness. Davenport et al. (2020) add to the complexity, stating that the target group is overall a key component of the effective application of artificial intelligence (AI) in marketing. AI can significantly increase the predictive capabilities and customization of marketing methodologies, but only if the target audience is accurately defined and researched. In the absence of a comprehensive understanding of the intended demographic, AI would be unable to produce relevant outputs and its marketing decisions would lack sufficient effectiveness.

1.2 Brand-Voice

The beginning of AI data-driven decision-making dates back to 1992 (Nagamachi et al., 2018). The fusion of AI and brand-voice is currently the future of social media marketing. AI tools, exemplified by Chat GPT, can significantly speed up the content generation process; however, it requires careful review and working with specialists to ensure that the content produced is aligned with the brand's core values. Maintaining the right brand-voice while using AI is critical for formulating effective marketing strategies (Murár et al., 2024). Defining the brand-voice is essential when developing content created with AI. The brand persona is an essential element that helps to ensure that the AI creates content that is consistent with the brand and its principles, preventing it from being vague and non-specific. The study highlights that in the absence of a well-defined brand-voice, AI-generated outputs can exhibit inconsistency, thus undermining brand communication and potentially leading to confusion among the intended audience (Hariri, 2023).

1.3 Content Production with AI

In the context of predictive content creation, AI capabilities extend to a real-time content management systems that can be instrumental in promoting and improving marketing communication strategies (Gupta et al., 2020). In addition, AI and machine learning-based prediction models, particularly deep neural network architectures, have shown potential in predicting and mitigating adverse crisis situations in business entities. Likewise, the defined models provide information to predict user behaviour on social networks, thus assisting business entities in targeting the intended group of users (Ronaghi et al., 2022). The application of AI in marketing communications is consistent with the broader spectrum of AI capabilities including prediction, recommendation, classification, recognition, natural language processing, and autonomous systems processing (Ballesteros, 2019). Creating personalized content is critical to establishing trust and customer engagement. It requires the right combination of strategy, creativity, and technology to engage users through generated content. The aforementioned capabilities are currently offered by AI (Dwivedi et al., 2021). The use of AI and machine learning for content generation can significantly increase the accuracy and personalization of recommendations as well as satisfaction of the target audience. The combination of ratings, metadata, and visuals such as book covers has been shown to improve the effectiveness of prediction patterns. This methodology optimizes the content generation process and increases user satisfaction, which is particularly important in the digital realm and online book transactions. It is clear from the findings of the source analyses that the customization of content is key to building reliability and customer engagement. An appropriate combination of tactics, ingenuity, and technology is essential to acquire high-quality customer perspectives and create content that meets customer requirements and inclinations (Lee et al., 2023). Prior to the full commercial deployment of sophisticated generative AI, the available options for content generation were limited. One example of this is SoMin.ai platform, which was able to generate potential targeting improvements based on exploring users' personality traits, which could potentially increase the effectiveness of marketing campaigns (Farseev et al., 2021). The sum of the findings is the recognition that current innovative AI technology could potentially target generative content creation in network marketing communications. Moreover, previous findings define that the generated outputs can effectively correspond with different user personality profiles and thus increase user interest and engagement. This underscores the versatility and adaptability of AI in addressing various marketing challenges and opportunities. In conclusion, the integration of AI into marketing communications has tremendous potential for predictive content creation, customer engagement and strategic decision making. By leveraging the predictive analytics and deep learning capabilities of AI, businesses can gain a competitive advantage in understanding consumer behaviour, optimizing marketing strategies, and responding effectively to dynamic conditions of the market. AI has greatly influenced the creation and management of content in marketing, proving its pivotal role in modern marketing communications. With the increasing amount of content across media, there is an increased need for its personalization, which is effectively resolved with the help of AI. It also enables the creation of content recommendation systems that improve the accuracy and relevance of marketing messages (Chintalapati & Pandey, 2022). AI enables marketers to quickly generate high-quality content, improving personalization and relevance while saving resources. Through the use of AI, marketers are able to personalize live customer encounters, increasing the likelihood of engagement and transformation, especially increasing the effectiveness of digital marketing methodologies. Incorporating AI into marketing communications facilitates sophisticated data exploration and focused communication, leading to improved customer engagement and more intentional decision making (Abdelmoneim & Feast, 2024). According to Senyapar (2024), AI's content creation capabilities enable the generation of consistent and compelling content in line with brand’s tone and goals, which speeds up the content production process. Incorporating AI into content production allows marketers to pinpoint relevant content for their audience and create a

personalized and captivating encounter without laborious manual content management. Personalizing marketing communications with AI increases customer engagement and satisfaction by delivering customized content and communications that are aligned with individual inclinations and activities. AI is revolutionizing content marketing by facilitating the generation of narrowly targeted content, leading to increased interaction and conversion rates. By exploring a vast data set, AI offers actionable analysis of effective content, enabling continuous improvement of marketing strategies and content creation. Examples of reputable companies showcase the effective application of AI-driven tactics to improve consumer interaction and create loyalty to the brand (Vasundhara et al., 2024).

2. Methods

The methods used are of mixed research design. The aim of this paper is to assess the structure of an AI-based system for automated training in the field of marketing communications with respect to social media. The theoretical framework was composed of mainly qualitative methodologies such as induction, deduction, and contribution analysis. The analysis of contributions involved a systematic review and evaluation of the existing literature to outline key concepts, emerging trends, and interrelationships related to the application of AI in marketing communications. The analysis was conducted in a systematic manner that involved careful selection of relevant sources, their critical evaluation and synthesis of the findings. Scholarly sources including peer-reviewed articles, academic publications, monographs, research papers and statistical databases were used as secondary sources. These materials provided the necessary theoretical structure and background for understanding and interpreting the phenomena and issues under study.

Based on the theoretical background, the following research question and hypotheses emerged:

RQ: *How can the use of AI in content marketing support the process of content creation and evaluation on social networks? (Huang & Rust, 2021)*

> ***H1:*** *The use of AI in marketing communications can provide a systematic approach to content creation, allowing content to be better tailored to the target audience based on data analysis and feedback. (Bashang & Puttanna, 2023)*
>
> ***H2:*** *The systematic deployment of AI in social content creation enables automated content generation based on predefined criteria and data from the target audience. (Gao et al., 2023)*
>
> ***H3:*** *Integrating AI into the process of evaluating and optimizing social content will ensure continuous improvement of content quality and relevance in line with current trends and needs of the target audience. (Haleem et al., 2022)*

The practical part includes quantitative approaches. In the context of the empirical research, a business entity from the e-commerce segment was selected for the analysis, with particular emphasis on the sale of book publications. The business provided the basic data required to conduct the experiment, which included comprehensive knowledge regarding the target demographic, the defined brand-voice, and access to the Facebook profile via an application programming interface (API). The data regarding the target group included both demographic and psychographic attributes, which were used for accurate segmentation. The brand-voice was defined in accordance with established criteria and the company's core values, ensuring consistency and authenticity of all communication outputs produced by the AI. Providing access to Facebook's social networking service via an API facilitated the automated collection of performance data on published posts.

Experimental testing of the model was conducted by using the Python programming language. Furthermore, APIs (Graph API, OpenAI API) have been used. The following section presents the results of the investigation.

3. Results

Based on the theoretical underpinnings and previous research the following diagram was defined to show a sophisticated and iterative process that clarifies the research question of the possibility of using AI in content marketing, and whether it has the potential to support the process of content creation and evaluation on social networks. The diagram begins by examining data derived from social networks and completes the cycle by evaluating the effectiveness of the content produced by leveraging AI. Each stage of the process is linked to the next, creating a cycle of continuous improvement of marketing outputs.

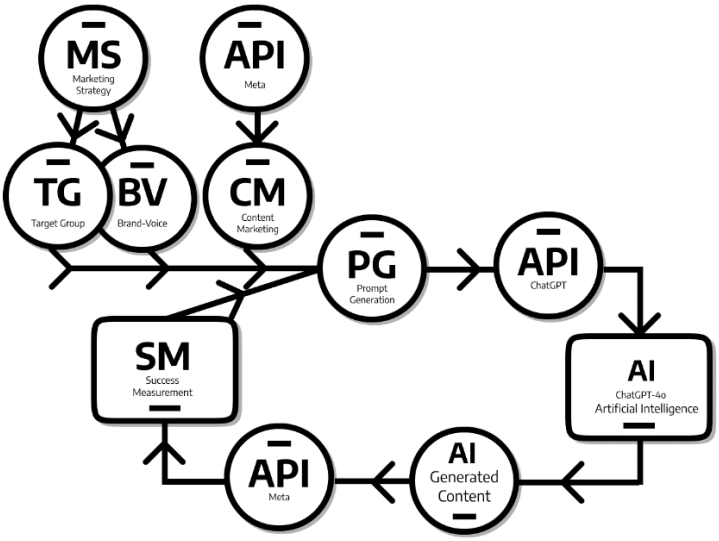


Figure 1: Diagram of the content generation process using artificial intelligence

The description of the individual parts is given in the following section, the defined diagram starts in the upper left part with the label target group (TG). The definition of the target group in this case is realized through the use of information obtained from the administration of social platforms, or from the documents of the currently selected strategic marketing plan. The result is the formulation of the most detailed description of the target group. For further processing, demographic data, such as age, gender, and geographic information, psychographic insights including interests, values, and lifestyle preferences, and behavioural patterns such, as purchasing tendencies and engagement with online material, need to be included in the formulation. Accurately defining the target demographic plays a key role in effectively modifying and creating content, thereby increasing the likelihood of successful conversions and active engagement. The following section discusses the theoretical underpinnings of brand-voice (BV). Brand-voice is addressed to the business and plays a key role in maintaining consistency in communication. The process involves defining tone, whether formal or informal style, including informative, entertaining, or inspirational, and values such as reliability, innovation, and sustainability. A coherent brand-voice fosters trust among the target audience and ensures that all content is easily identifiable and consistent with the core brand identity. The next part is the analysis of social media data in the context of content marketing (CM). The above step involves retrieving and reviewing data from social platforms through an API that can store the aforementioned available data. Said data include details of the posts that have achieved the highest number of reactions such as engagement, shares, and comments. The primary goal of this section is to understand what content and structure is getting the most response from the audience. By analysing the above stored data, it is possible to define the key elements of successful posts, preferred topics, and ideal time publications. The given section reflects H1 hypothesis, which can be positively supported on the basis of definition and experimental confirmation. The results suggest that a systematic and iterative approach allows for better customizing of content to the target audience based on data analysis and feedback. Contributions are part of conte nt marketing, which at its core involves the creation and dissemination of valuable, relevant, and coherent content, with the aim of engaging and retaining a specific target audience. Data analysis can yield the frequency and success rates of content types, such as text, images, videos, and other social media posts. The output is a textual form of the defined strategy, including what content is relevant. It is adapted to different platforms and channels to best align with the target audience's preferences. The next part is the generation of the prompt (PG), which is defined based on the data collected and the set objective. From the results of the data analysis and the set objectives, a prompt is formulated which acts as a proposition for content production through the use of AI. Prompts, by their nature, should be carefully designed to include precise and as detailed as possible instructions for the AI system. The next part, that is directly related to the prompts created and then sent to the AI, is defined by the description of the API that is used to communicate with the AI (e.g., ChatGPT). The defined prompt is sent through the Application Programming Interface (API) to establish communication with the AI. The API acts as a conduit to facilitate data transfer and verify that the AI has generated all the necessary data to create the content. The next section is devoted to content generation based on the input. After it is sent through the API, the AI generates the result in the form of content. For this reason, the next part of the diagram is named as AI generated content. AI such as ChatGPT has the ability to generate a variety of

content formats on social media. The output results in shareable content. The content material produced is then stored on specified social networks, for example Facebook, Meta's Instagram, using an API that also provides feedback and analytics regarding the effectiveness of the material. Data that can be analysed include metrics such as engagement rates (e.g. likes, comments, shares). The output of the above analysis provides valuable perspectives to refine the AI assignment in post-processing. Comprehensively, the above section in the diagram is presented as a success measurement (SM). The iterative process facilitates continuous improvement and refinement of content creation through AI by leveraging the analytical information and feedback obtained. Incorporating social networking and AI application programming interface (API) into the content generation and evaluation process ensures efficiency and relevance. Continuous updating in the form of a constant strategy and adapting content in line with prevailing trends and target group preferences are key elements of thriving marketing campaigns.

3.1 Experimental Validation

The process of developing and programming a system for content generation and evaluation using AI was as follows. According to the diagram, the process was followed chronologically. The first part focused on the analysis of the target audience. In the first step, relevant data sources such as social networks and internal marketing materials of the business entity were identified. From these sources, a baseline was extracted in the form of demographic and psychographic data of the target group. Subsequently, the brand-voice of the business entity was also defined. In accordance with internal materials and in collaboration with the marketing manager, a brand-voice was defined that encompassed the tone, style, and core values of the business entity. Afterwards, using the Python programming language, an interface was prepared in cooperation with the social network API. Specifically, the Graph API from Meta was used and connected to the business entity's profile. A script was developed to systematically collect data from the profile. The Python programming language was used to perform a thorough analysis. The metrics tracked were regarding engagement, the most effective types of posts, and the time preferences of the target audience. The summarized information was then used to generate a prompt. Next, prompt templates were defined, which were derived from the authors' previous analyses and predetermined parameters adapted to different content generation contexts. The textual content of the status was experimentally selected. An automated framework in Python was prepared to produce specific prompts dependent on the current target audience data, brand-voice and specifications of the content. The system used predefined templates and guidelines to formulate the prompts, which were then passed to the AI through an API (OpenAI API). The results show that the systematic deployment of AI enables automated content generation based on predefined criteria and data of the target group. The results provide sufficient evidence to support H2 hypothesis. Scripts were created to transmit the prompts and record back the generated texts. After receiving the responses from the AI, the texts were processed to comply with the established criteria for content that can be posted to social networks. All editing was done automatically. After the AI system created the content, it was then published to the Facebook platform using Meta's Graph APIs, which were integrated into the script. After the content was uploaded to the social network, the effect was then measured after 24 hours in the form of storing data metrics, including engagement. The engagement was evaluated via a specific number of reactions, such as likes and comments, which were used to get feedback on the performance of the content. Subsequently, the data were saved and the methodology of generating the creation commands could be improved again to enhance the overall system. As a result, according to the experiment, the model was validated. Based on the findings, it can be concluded that AI integration ensures continuous improvement of content quality and relevance in line with the current trends and needs of the target audience. The results of the investigation provide sufficient evidence to support H3 hypothesis.

4. Discussion

One premise of the investigation was the finding of authors Utku and Selcuk (2016). They defined content marketing as one of the most notable methodologies currently within corporate marketing practices in connection with AI. Consequently, the results of the present study support the stated research question and hypotheses that the integration of artificial intelligence (AI) into marketing communications provides significant benefits for the creation and evaluation of content on social networks. The analysis confirms that AI can provide a systematic and iterative approach to content creation, thereby enabling better tailoring of content to the target audience based on data analysis and feedback, which is also confirmed by Huang and Rust (2021). Gao et al. (2023) confirm that the implementation of AI in the content creation process allows for automated generation that aligns with the set criteria and data from the target group. The findings are in line with the conclusions of authors such as Allen and et al. (2023) who highlight the transformative potential of AI in marketing communications. Subsequently, the results of the experiment supported H2 hypothesis, which presumed that

systematic deployment of AI enables automated content generation based on predetermined criteria and data from the target group. Authors Ramos et al. (2023) add that the effectiveness of marketing campaigns can be increased in addition to the possibility of automation. They also add the need for precise definition of the target audience for successful implementation of AI in marketing. H3 hypothesis, which focuses on the continuous improvement of content quality and relevance through AI integration, was also supported. Analysis of the results shows that using AI to continuously optimize content based on retrospective data leads to improved marketing outcomes, which is consistent with the findings of Ronaghi et al. (2022) on the predictive capabilities of AI in crisis management and content creation. Despite these findings, some limitations should be noted. One is the relationship of the effectiveness of AI to the quality of the input data and the accuracy of defining the target group. As Chaisatitkul et al. (2024) state, AI can only produce content that positively resonates with audiences if the target audience is well defined, and their needs are accurately understood. The need for a comprehensive understanding of the target audience has also been highlighted in the work of Davenport et al. (2020), who warn of the risk of ineffective content personalization when demographics are insufficiently researched. Another limitation is the potential inconsistency in the content produced, especially when it comes to maintaining brand-voice. Murár et al. (2023) and Hariri (2023) point out that if the brand-voice is not clearly defined, AI may generate content that is not fully aligned with core values of the brand. In that context, it is crucial that future AI research and development include mechanisms to systematically verify the quality and relevance of the generated content. As Utku and Selcuk (2016) state, the future of marketing is likely to depend on AI's ability to not only generate content, but also to evaluate its effectiveness and optimize it in real time. This includes the need for advanced machine learning and natural language processing methods to enable AI to better understand context and adapt content to align with brand goals and customer expectations. Nevertheless, further research efforts are needed, for example, in the inclusion of additional variables on inputs and other parts of digital marketing, as well as technical improvements. This will ensure that AI is able to not only generate but also continuously improve content in line with the dynamic needs of the market and the expectations of target audiences.

5. Conclusion

The objectives of the study were met. This paper provides an assessment of the structure of an AI-based system for automated training in marketing communications with regards to social media. Research has proven that AI integration into marketing communications is possible and has the potential to influence future content creation in marketing communications. AI currently enables businesses to better understand their customers' needs and preferences and adapt their marketing strategies. Additionally, the dynamic approach that results from the use of AI, which involves real-time adjustments to content based on immediate customer feedback, ensures that marketing communications remain flexible and responsive to changing market conditions. The integration of AI in content marketing brings significant benefits to businesses. It enables better prediction, personalization, and optimization of marketing campaigns, ensuring greater efficiency and competitiveness in the digital era.

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The Possibilities of Artificial Intelligence Usage in Loyalty Programs

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Abstract: From the year 2022, when the GPT 3 model became publicly available, Artificial intelligence (AI) has been a buzzword in marketing. To say it still is influencing the field would be an understatement with new models and technologies continuously emerging and existing ones getting better and better. Loyalty programs as a sales promotion tool have also undergone big changes in recent years and AI is bringing new opportunities and challenges to the field. In this paper, we investigate the possibilities of artificial intelligence usage in loyalty programs. We aim to showcase the diverse opportunities through which AI can enhance loyalty program experiences. Among those usage opportunities we put specific attention on AI personalization and predictive modelling. By harnessing AI capabilities, organizations can possibly find new ways to enhance customer engagement, satisfaction, and build stronger loyalty. In this paper we are also looking at the current state of loyalty programs in the selected market and the way AI is being used in them. It is important to note that we approach the topic from two points of view – customers` and brands`. That means that we are trying to highlight how certain AI technologies can possibly improve customers` experience as well as how AI may be a helpful tool for businesses who want to manage loyalty programs. The final part of our article includes information on the suggested ways AI technologies may be implemented into loyalty programs based on the information provided in previous parts of the paper. Suggested implementation strategies are also appropriate as a starting point for further research, where every single technology would be researched more in detail. The main goal of this article is to provide readers with a comprehensive overview of the possibilities of how Artificial Intelligence can be used in the context of loyalty programs today. The article is theoretical-empirical and is based on external information from trustworthy sources as well as our own research of certain AI technologies in the context of loyalty programs.

Keywords: Artificial Intelligence, Loyalty programs, Personalization, Predictive modelling, Marketing communication

1. Introduction

In recent years, Artificial Intelligence (AI) has significantly influenced the landscape of marketing, and among other fields that have been affected are loyalty programs. AI's implementation into various marketing tools has turned it from an operational tool into a powerful force that has an opportunity to enhance customer interactions and operational efficiencies. The capabilities of AI in general and in marketing are giant, extending from simple automation of repetitive tasks up to analysing giant sets of information in real-time and providing deep insights into customer behaviour (Mirwan et al., 2023). In today's marketing environment it seems increasingly important to not leave AI technologies out of sight, but rather to explore its possibilities and increase the competitiveness of the brand on the market by rapidly reacting to technological advancements.

For brands in the current marketing environment strategic deployment of AI into their marketing strategies is not only about increasing the efficiency of the workers, but also about understanding their customers in-depth, up to an individual level, and thus providing personalized experiences and better customer experience in general. This is particularly present in loyalty programs, where AI's ability to analyse vast datasets can be used to personalize offers and communications that may be uniquely appealing to each customer, thereby enhancing engagement and loyalty. Workers of the marketing departments are now expected to leverage AI tools to fulfill their work more efficiently and develop a deeper understanding of market dynamics and consumer behavior, ensuring that their outcomes are as relevant as they may be. As AI continues to evolve, its integration into marketing strategies, especially loyalty programs, is expected to deepen, making it a necessary tool for researching, implementing and business growth. In this paper we aim to focus on AI in loyalty programs. Among the topics we want to research are AI capabilities in the context of loyalty programs, benefits brands and customers may get by using them and case studies of current AI usage in loyalty programs on the selected market.

2. Theoretical Background

Loyalty programs as a sales promotion tool have undergone many changes over the last decade. Those were mainly caused by external factors, mainly changes in customer behaviour, technology and data analytics. From basic punch cards that may be printed on a thick carton to complicated multilevel systems, loyalty programs today have become widely used tools that have the goal of increasing customer satisfaction, customer loyalty and return purchases. Since technologies have advanced profoundly, data analysis has become another

important part of loyalty programs, which lets businesses to better understand and foresee customer behaviour and actions. As a result, this provides brands with the opportunity to personalize those programs and personalize their parts according to individual preferences. We can also trace this approach becoming more and more used in other parts of marketing and marketing communication, making it not limited to loyalty programs, but rather a general trend to the changes in customer behaviour and expectations (*The value of getting personalization right—or wrong—is multiplying*, 2021). In recent years, progress in new technologies like AI and machine learning has pushed this trend even further, making it possible to create flexible programs and be more reactive to customers' needs.

It is important to discuss some basic aspects of AI as a technology in the communicated context. At the basis of the AI there is machine learning (ML) and its subset named deep learning (DL). Machine learning is the ability of the AI model to learn, predict or choose something based on the algorithm provided based on the data that it has to work with (Hamdan et al., 2023). The main idea of deep learning is to involve neural networks with different complexity levels with the goal of simulating the complicated decision-making of the human brain (Hosain et al., 2024). By leveraging these technologies AI models are capable of creating truly outstanding results and constantly keep evolving. However, another feature widely used in order to provide such results is natural language processing or NLP. It allows machines, and AI in our example to understand and interpret human language. By its usage, AI models are able to understand the sentiment or intents of the messages and thus provide an outcome that would take those things into account (Sharp et al., 2017). With the constant development of AI models, today many of them are also capable of computer vision which allows machines to see and interpret images in a similar way to humans, thus making it possible to appropriately work with not only textual, but also visual data inputs. These basics clarify how artificial intelligence works at a basic level and now we can look into how these technologies could be applied within a loyalty program setting.

3. AI Technologies in Loyalty Programs

Based on the technologies we mentioned in the previous chapter it is safe to assume that loyalty programs can benefit greatly from the usage of AI. Firstly, it opens the possibilities of creating loyalty programs that just wouldn’t be possible without an AI. By this we mean that due to the possibilities of data analysis and natural language processing that AI brings, unique, highly personalized loyalty programs based on a deep understanding of the customers may be created, which was much harder, or even impossible, to operate before. By personalizing the loyalty program itself, as well as its rewards, activities, tiers or other parts brand gets the possibility of making the relationship with the customers more personal, increasing their engagement and ultimately building loyalty which would make the customer come back over and over again to the brand. Additionally, AI can make the various operational parts of loyalty programs more efficient and user-friendly. As an example, it may help in handling reward distribution, gathering feedback, or better optimizing those processes, which leads to cost savings and better productivity.

Moreover, AI can assist in decision-making processes by analysing giant amounts of information and providing high-quality insights based on this information. For example, methods like predictive personalization enable brands to increase personalization levels at every step of a customer funnel, even without the exact data about the exact customer (Bhaskar et al., 2009). Thus, marketing activities, loyalty programs incentives and even marketing campaigns can achieve better results. Among other things, AI may play a crucial role in fraud detection within loyalty programs by leveraging its abilities to analyse data, mark certain activities as suspicious or fraudulent and communicate this in real-time with the brand in order to minimize the risks.

In this chapter, we want to describe in detail two of the potential AI usages in loyalty programs that, in our opinion, have the most usage potential as of today. Those two categories are personalization and predictive modeling. Starting with personalization, we find it important to mention customer segmentation as a closely connected term. In order to personalize the offer, many brands first need to segment their customers into appropriate groups (Allaway et al., 2014). Of course, the ultimate goal of AI in loyalty programs may be to create a unique personalization for every single customer, however, such a solution is very hard to implement, organize, and put into practice, and even if possible, for most brands such a solution will most likely not be the optimal one since it would require too much effort. On the other hand, AI may help to segment customers into relatively narrow groups with similar segmentation criteria, which allows brands to personalize on a broader scale while still keeping it personalized. It ensures that activities, incentives, promotions and messages are directed at certain customer segments, matching their requirements and interests.

On a general level, loyalty programs may use personalization to match experiences, offers, rewards, incentives and communications to the customer`s preferences based on the information collected about the customer. It

is important to note that personalization can be present in various ways, from a very simple personalized greeting to highly personalized offers at a certain time of the day. The goal is to make every customer feel special and appreciated. Personal touch may improve customer engagement with the brand and thus build a closer relationship (Bilal et al., 2024). In the context of loyalty programs, information up to a depth of scroll, or time spent on a specific part of the application can be analysed and used as valuable insights. Using machine learning algorithms can help in offering personalization instantly to the customers, for example, a customer who typically buys a certain type of product on a certain day or time of the day may be recommended another similar item or offered a discount on their next visit at this day or time. Another example can be, if the AI algorithm finds that a specific customer usually buys gifts at the start of May, then the loyalty program could proactively suggest gift options and unique offers during April. This way, not only customer needs are matched, but at the same time, the overall experience with the brand can be very positive, leading to building deeper connections and a feeling of mutual understanding. At the same time, such activities provide value to the customer at the right time, which increases the chance of purchase.

The second technology we`ve mentioned is predictive modelling. This technology takes advantage of using historical data collected from different sources, in our case mainly from loyalty programs to forecast the most probable future customer behaviours and preferences (Nsakanda et al., 2011). By leveraging this technology brands have unique opportunities to enhance strategic marketing and customer engagement efforts. Predicting future customer behaviours also mean it provides brands with an opportunity to predict customer churn, making it possible for brands to react swiftly to different triggers that may cause it, enabling them to intervene proactively, for example with personalized offers to retain those customers. Another possible implication is lifetime value prediction with the help of AI technologies, which may help brands estimate the long-term value of certain customers or groups of customers, as well as products or product categories, so the brands may focus their efforts on the most profitable products or groups of customers.

Another part that can be used in predictive modelling is sentiment analysis. In the online environment, it takes into account customer feedback, customer reviews, and even social media posts and sentiments used in them, which makes it possible for brands to adjust their strategies and communication in real-time in order for communication to be appropriate to the current customer sentiments (Liberati & Camillo, 2014). To summarize, the combination of personalization and predictive modelling in loyalty programs helps to enrich customer experience and improve the effectiveness of marketing campaigns. By accurately predicting and addressing customer needs, brands have an opportunity to develop targeted strategies that enhance customer satisfaction, increase retention rate and boost overall profitability.

4. Benefits to Brands and Customers

In this part of our paper, we want to briefly mention the ways in which AI usage in loyalty programs may benefit brands and customers. Firstly, we want to list the primary benefits for businesses, among which are:

- **Increased interaction and customer retention:** Based on the information provided above, it is safe to assume that personalization and other AI technologies are capable of increasing interaction, and, as a result, customer retention. Since in today's world customers expect personalization, its greater level can also cause a higher customer lifetime value, as well as loyalty improvements.
- **Operational efficiency:** AI, even in its current state is capable of automating many tasks within loyalty programs, from customer segmentation and incentives division to customer complaint service management. There are many tasks that may be automated by AI and thus reducing the need for manual work and funds required for it.
- **Data-based decision-making:** Since AI is capable of analysing giant datasets, it is capable of providing unique and in-depth insights into anything connected to brands` marketing activities. Based on those insights, brand managers can make better assumptions, and ultimately more profitable decisions that reflect the current state of loyalty programs.
- **Fraud prevention:** AI is useful in stopping fraud by recognizing and preventing fraudulent activities with the help of its data analysis and potential for harmful patterns detection, making sure that loyalty programs stay as safe and trustworthy for customers as possible.

It is also important to mention what benefits may AI in loyalty programs bring for the customers. Among them are:

- **Customized experiences:** Implementation of AI can offer customers personalized deals, suggestions and rewards matched to their individual tastes and buying preferences. Mostly it is the result of the above-mentioned ability of AI for in-depth personalization.
- **Greater convenience:** Since certain AI models are capable of not only working with text input but also visual or audio, technologies like voice control or visual assistance can bring greater convenience for their users.
- **Improved satisfaction:** If the purchasing process is more personalized and in the case a customer needs help there is a tool that is capable of providing it immediately, it is safe to assume that the general customer satisfaction would grow higher over time.
- **Trust and security:** Since AI is capable of fraud detection, it may provide a feeling of safety not only to the brands but also to the customers, since they would know that their information is stored safely.

AI in loyalty programs is beneficial for both brands and customers, with the advantages overlapping in enhancing engagement and efficiency. Brands gain from the operational efficiencies and strategic insights provided by AI, which result in cost savings as well as improved customer retention. Customers on the other hand may get the benefit of interactions that are more personalized and satisfying to make their experiences more rewarding. The inclusion of AI within loyalty programs gives a kind of win-win situation for both sides of B2C relations.

5. The Current State of AI Usage in Loyalty Programs on the Selected Market

We found it interesting to look at the examples of AI usage in loyalty programs on the selected market, and we decided to choose the US market as an object of our interest. In the United States, AI integration into loyalty programs is particularly advanced, with many leading brands leveraging this technology to enhance customer engagement and operational efficiency. The application of AI in loyalty programs typically involves different approaches, from personalization strategies, and predictive analytics to customer data management. In this chapter, we want to look at specific examples of how brands use AI in their loyalty programs.

Generally speaking, Starbucks approaches AI as the future of their marketing communication and tries to embed it into various activities of the brand. Deep Brew has become the center of this strategy, and mainly it is using AI capabilities for data analytics and to provide personalized customer experiences, including personalized marketing messages and personalized menu recommendations. This approach of making data-driven decisions is also used in their Starbucks Rewards program, in which, with the help of an AI, they are capable of identifying customer preferences and providing rewards that have a higher chance of being appropriate. Thus, they also aim to encourage return visits, enhance customer lifetime value and ultimately, build a strong loyalty towards the brand (Zaytsev, 2024).

The information they do analyse is not being used only for personalization purposes, but also serves as a great insight for their menu management or updating product offers. Most of their newest products, whether included in the regular menu or as a part of seasonal offers are created based on the information collected and analysed in order to make them as appropriate to the general public as possible. According to Kotorchevikj, the company has discovered from its data analytics that approximately 43% of tea drinkers prefer not to add sugar to their tea, while approximately 25% of users don't add milk to their iced coffee while drinking at home. Based on these results, two new products were created, that were aimed at customers with the above-mentioned preferences (Kotorchevikj, 2021).

As we can see, Starbucks is one of the companies that truly leverages the possibilities of AI and tries to take advantage of the technology in whichever form it is present today. It is also possible to find information about Starbucks planning or actively using AI while deciding on the new store location, employers management or drive-thru experience personalization. All of this makes this brand an interesting one to follow on the topic, and further research can be useful and insightful as an example of AI usage in a brand.

Another example of AI usage in loyalty programs can be found in Wyndham hotels & resorts. Their approach was a little different than in our previous example since they first decided to make a full renovation to make the loyalty program architecture fully cloud-native. They made it in order to automate various different systems they had in use, so they could be made more efficiently and with more precision. They also noted that previously, since their operations were related to manual data processes there was more space for potential human errors or inefficiency, which was eliminated by automation. This rework of the loyalty program also brought many benefits to their customers. They started using not only in-depth data analytics but also techniques of predictive modelling to anticipate not only customers' needs at this exact time but also what

they may search for in the near future. According to PwC, after automation was put in place, the satisfaction rate on both sides got bigger, with fewer issues appearing and their faster resolution (PricewaterhouseCoopers, n.d.).

The last example of AI usage in a loyalty program we want to mention in this part of our paper Is from Lyft, a ride-sharing service operating in the US. In their loyalty program Lyft rewards they started using AI algorithms in order to be able to detect fraudulent or potentially dangerous activities and to prevent them. Mostly they focused on analysing rider behaviours and trip data, and in case there were data inconsistencies with normal usage patterns, algorithms noticed that. Among such unusual behaviours were, for example, many rides taken from the same location or usage of multiple accounts with the goal of misusing promotions. After the algorithms noticed such activities, Lyft team was notified, had to look at the case, check its details and, if needed, take appropriate actions. This way, the company was able to ensure the loyalty program and its benefits stay effective as well as protect themselves from potential financial losses from misusing parts of it (Thurman, 2023).

While not part of a loyalty program as of yet, Lyft is another company that puts a big emphasis on AI usage in many parts of its business. For example, as of 2023, they have already used AI technologies for getting and providing more accurate times of arrival thanks to machine learning combined with real-time data analysis, optimizing ride routes based on the real-time information on other drivers' behaviours and events happening, predicting the drive destinations based on machine learning of previous information and coordinating rider pickup in the places it may not be so evident (Conlisk, 2023). Some of these technologies may be pushed even further and be implemented within loyalty programs. For example, predicting the ride destination may provide loyal customers with specific new recommendations based on the data about specific customers, their preferences, preferences of similar users etcetera. As of today, we find Lyft to be an interesting example of creative AI usage and a brand that deserves further research in this context.

As we can see, in our case examples were mainly connected to the hospitality industry, which was not defined in advance. However, this raises the room for further research on AI usage in loyalty programs in various industries and comparisons between them. Those examples emphasize how AI technologies are being effectively utilized to not only personalize customer experiences but also improve operations and data management in loyalty programs. The use of AI allows brands like Starbucks, Lyft and Wyndham to maintain a competitive edge by adapting to consumer needs rapidly and efficiently.

6. Challenges and Considerations

Since the adoption of AI into loyalty programs is still in its early stages and not much research has been done in this narrow context, it is natural that many challenges and considerations may occur. One of such challenges are ethical concerns, since the question of regulating AI technologies is still to be solved. Also, since many AI use cases in loyalty programs are centered around data analytics, machine learning and predictive modeling, concerns about data privacy and security of data handling are also present (Mogaji et al., 2020). If certain program collects more personal or sensitive data from the user, concerns about how ethical it is to use such information are also present. Last but not least, there is a risk of bias in AI algorithms, since many of them are making decisions based on the information collected and certain offensive or even discriminative decisions can be made on such basis.

Difficulties in adding AI to loyalty programs also lie in the technological factor - especially in making new AI technologies work well with present systems (Kutz et al., 2022). While currently, many AI tools offer their services on a subscription basis and only require input from a customer while all the computational work is done by the company itself, this solution may not be appropriate in our researched context. If the company wants to manage certain AI technology internally, it may become very expensive and hard to operate, making it a huge barrier, especially for small and medium companies that may not have enough resources at their disposal.

Often, a company's change aversion from inside its own structure can slow down the adoption process too. This could be because workers and management need time to adapt to new processes or technologies being introduced within their workplace, as well as the need for employees to learn new skills and optimize their work routine in the context of AI presence.

To effectively address these challenges, it is crucial to:

- **Practice AI transparency and collect customer consent:** It is crucial for brands to clearly explain the ways in which customer data is being used, analysed, and processed in any way, and the first step should be gaining their approval, which helps to establish trust, make the whole process clear, allow those, who don't want there data to be processed to do so and adhere to privacy laws which are constantly evolving.
- **Provide employee training and management corrections:** AI systems are influencing the work routines of professionals in different fields, and marketing is not an exception. Providing the employee team with thorough training and assistance may help them to get all the necessary skills and thus make the adoption process less complicated.
- **Manage AI systems audit:** Setting up periodic checks to make sure that AI systems are running free from prejudice and following moral rules seems to be crucial in the modern context of AI.
- **Choose scalable and integrable solutions:** Today, AI is the field that is developing very rapidly and new solutions are being created constantly. Selecting AI solutions that are able to grow along with the business, fitting in smoothly with the current structure as well as the vision of the brand may reduce future disturbances and increase the effectiveness of those AI solutions.

7. In Conclusion

In this paper, we tried to present the topic of how Artificial Intelligence can enhance loyalty programs through its various opportunities like data analysis, personalization and predictive modelling. We covered basic theoretical background on the topics of loyalty programs and artificial intelligence, usage of AI in loyalty programs, its benefits for brands and customers, the current state of AI usage in loyalty programs on the United States market, as well as challenges and considerations that companies face in the context of AI implementation into loyalty programs. We can state that the topic of AI usage in loyalty programs has not been researched enough yet, which provides many opportunities for further research. At the same time, in practice, some brands leverage AI capabilities on a decent level, while others may struggle to implement one due to the limitations or scepticism of new technologies.

However, in our opinion, it is clear that in the following years, the role and impact of AI on loyalty programs will only grow bigger, especially through new technological advancements and improvements in machine learning, natural language processing and real-time data analysis. There is also a possibility of more independent AI systems appearing, managing all parts of activities within the loyalty program on an automated basis. While it is hard to predict which direction this development will take in the future, it is clear that the technology is here to stay, and further research on the topic would be essential for its better understanding.

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The Influence of Artificial Intelligence on Modern Marketing

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Abstract: This paper explores how Artificial Intelligence (AI) is reshaping the marketing landscape, using data primarily sourced from Statista. By analysing global trends up to March and July 2023, we aim to provide a clear understanding of AI's impact on marketing strategies and outcomes. We begin by examining the rapid growth of AI in marketing, including its market size, revenue, and the preferences of users worldwide. We also highlight the popularity of leading AI text tools among users, giving insights into their market dominance and adoption rates. In addition, we investigate the funding landscape for AI marketing-related startups, showcasing the industry's investment trends and innovation potential. Furthermore, we identify the most effective ways marketers are using AI and marketing automation, offering practical insights for professionals seeking to leverage these technologies. Our study also looks at where AI is being used in marketing, revealing the diverse applications that are shaping strategies globally. We delve into the tools and platforms driving AI integration in marketing and advertising, as well as the main tasks undertaken by professionals using generative AI. A key focus is on AI-assisted writing, where we outline how marketers are employing AI for content creation and its impact on efficacy. We also explore the perceived benefits of AI tools according to marketing professionals, providing actionable insights for decision-making. Lastly, we assess the effectiveness of chat-based search advertising, particularly among paid search marketers in the United States. Through a concise summary of our findings, this paper aims to offer a comprehensive view of AI's transformative role in marketing, providing practical insights for industry stakeholders navigating this evolving landscape. In conclusion, this research serves as a roadmap for marketers, entrepreneurs, and industry professionals, guiding them through the integration of AI technologies into marketing strategies and operations. By understanding the current trends and potential benefits of AI, stakeholders can adapt and thrive in an increasingly AI-driven marketing environment.

Keywords: Artificial intelligence, Marketing, Marketers, Text tools, Trends

1. Literature Background

Artificial intelligence (AI) in marketing is getting popularity due to the practical impact it will have in both the current business and the industry of the future. It is essential to conduct research studies with a wider scope and coverage on the application of AI in marketing, and it is also essential to conduct meta-analyses of previously conducted studies in order to determine the routes that future research should go. In the most recent decade, the development of artificial intelligence has contributed to an increase in the complexity of marketing. The utilisation of technology to its fullest potential in order to provide a superior experience for customers is the goal of artificial intelligence marketing, says Pathak et al (2022). In marketing, AI can be used to analyze data, identify patterns, predict outcomes, and automate processes. In today's world, every aspect of our lives is influenced by technology. The marketing industry is no exception. With the advent of technology, artificial intelligence (AI) has become an integral part of the marketing industry think Vlačić et al (2021 and add that AI is a set of algorithms and intelligent computer systems that can learn, think, reason, and perform tasks that typically require human intelligence. The role of AI in marketing is constantly evolving and its potential to provide businesses with an insightful competitive edge cannot be overemphasized. The authors Reddy et al (2023) understand that artificial intelligence (AI) Marketing produces automatic judgments relying upon information gathering and analytics, as well as other insights about population or socioeconomic tendencies which could impact promotional strategies. Artificial intelligence (AI) is widely used in advertising initiatives when efficiency becomes crucial. AI solutions understand how to successfully connect with consumers depending on information and consumer histories, then provide customized communications at the appropriate moment eliminating the requirement for promoting crew involvement guaranteeing maximum profitability. Lakshmi et al (2023) claim AI has several applications in marketing, such as: Personalization AI can help businesses create personalized experiences for customers by analysing their behaviour and preferences. AI algorithms analyse browsing and purchasing history, as well as other behavioural data points, to create a unique profile for individual. From there, these programs can curate content, advertisements, and recommendations tailored specifically to interests. While this may seem like a small convenience, it has the potential to revolutionize the way we interact with technology by creating a more intuitive and personalized experience.

Based on Haleem et al (2022) future marketers can use AI to create personalised experiences for their customers and develop marketing analytics techniques to target potential customers. Every interaction a prospect or consumer has with a product or solution is recorded and used to improve the product or service in

the future. There will be a better time for marketers to start experimenting with AI strategies to help them create highly personalised experiences for their customers. With AI poised to continue growing across all industries and segments, marketers should dedicate time and resources to experiment with strategies and ensure their marketing organisation is set up for continued success, both now and in the future. Kastenholz (2024) claims that despite initial concerns, AI has proven to be an invaluable asset in influencer marketing strategies. Rather than stifling creativity, AI has allowed marketers to focus more on strategy and innovative content by handling data analysis and trend forecasting. AI and human creativity complement each other, leading to more impactful and strategically sound campaigns. Moving forward, the successful integration of AI into influencer marketing will depend on brands and marketers balancing new technologies with ethical considerations and a commitment to transparency and authenticity. Achieving this balance can empower marketers and creatives, making their work more efficient and data-driven while enhancing engagement and innovation at the intersection of technology and human creativity. Lucas (2024) see that the integration of AI into marketing and advertising is fundamentally transforming how businesses engage and connect with their target audiences. AI has introduced a paradigm shift by infusing data-driven insights, predictive analytics, and personalized experiences into strategic decision-making, moving beyond traditional marketing approaches. This evolution goes beyond conventional outreach methods, allowing businesses to create more meaningful and tailored connections with their audiences. By processing vast datasets in real-time, AI provides a deep understanding of consumer behaviors, preferences, and emerging trends. This nuanced comprehension enables businesses to craft campaigns that are not only targeted but also intricately personalized, fostering a resonance that transcends generic messaging.

2. Methodology

The aim of the present paper is to determine the current state of artificial intelligence, specifically in the area of use by marketers, based on data from respondents. The data is drawn from Statista https://www.statista.com/, from year 2023. Figures and tables were processed and presented to illustrate key trends and findings, offering insights into the impact of AI on enhancing efficiency, creativity, and strategic optimization in marketing and advertising. The data presented in this analysis is derived from a comprehensive survey conducted in 2023, targeting marketing and advertising professionals globally. The survey aimed to explore the adoption and applications of generative artificial intelligence (AI) within the industry. In the first part of the paper, we focus on current views and knowledge in the field of artificial intelligence and marketing. This is followed by a brief methodology of the paper and the statement of the research questions. We then look at specific survey results, which we describe and outline possible future developments in the area under study.

Research questions set for the purpose of these paper are as follows –

Is ChatGPT the most used AI text tools?

Exploring whether ChatGPT is the most utilized AI text tool is vital due to its relevance in current marketing trends. With AI increasingly shaping marketing strategies, understanding ChatGPT's prevalence provides crucial insights into the dominant tools driving AI adoption in marketing contexts

Is ChatGPT the most used AI tool for marketers?

As AI becomes increasingly integrated into marketing strategies, understanding ChatGPT's prevalence offers valuable insights into its role as a primary tool in content generation and customer interaction.

What are the biggest benefits of using AI tools for marketers?

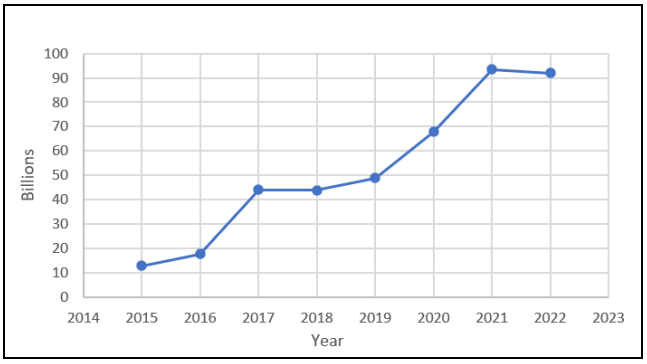
Exploring the biggest benefits of using AI tools for marketers is essential to capture the forefront of industry advancement. With AI rapidly transforming marketing practices, understanding its key advantages provides critical insights into maximizing its potential.

What are the most common tasks that marketers outsource for AI tools?

Investigating the most common tasks that marketers outsource for AI tools is vital to comprehend the evolving dynamics of marketing operations. As AI continues to revolutionize the industry, understanding which tasks are commonly delegated to AI tools provides valuable insights into workflow optimization and resource allocation.

3. Results

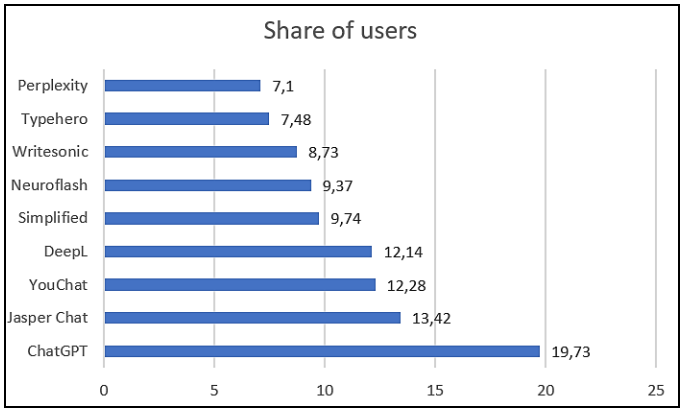
In this section, we take look into the results of a comprehensive survey conducted in July 2023, on the widespread adoption and diverse applications of generative artificial intelligence (AI) in the marketing and advertising landscape. Marketing and advertising professionals worldwide have embraced AI tools for a multitude of tasks, ranging from content creation to strategy optimization. The data presented here reflects the evolving role of AI in streamlining workflows and enhancing creativity within the industry. This analysis will delve into the specifics of how professionals are leveraging AI, including the leading AI tools used, the main tasks undertaken, and the benefits reaped from AI integration. By exploring these results, we gain valuable insights into the transformative impact of AI on modern marketing and advertising practices.



Source: Own processing based on https://www.statista.com/statistics/941137/ai-investment-and-funding-worldwide/

Figure 1: Global total corporate artificial intelligence (AI) investment from 2015 to 2022 (in billion U.S. dollars)

Global corporate artificial intelligence (AI) investment has seen a remarkable rise from 2015 to 2022. The data reveals a consistent upward trend, starting at 12.75 billion USD in 2015 and rising to 17.7 billion USD in 2016. A significant leap occurred in 2017, with investment reaching 44.08 billion USD. This trend continued with 43.81 billion USD in 2018 and 48.85 billion USD in 2019. In 2020, investment surged to 67.85 billion USD, followed by a peak in 2021 at 93.5 billion USD. Despite a slight decrease, 2022 remained strong at 91.9 billion USD. These figures illustrate the increasing significance of AI in corporate strategies, with the industry attracting substantial investments globally. This growth reflects a broader trend of businesses recognizing AI's potential to drive efficiency and innovation. The data underscores the importance of staying abreast of these investment patterns for companies seeking to remain competitive. The continued rise in AI investment suggests a bright future for the industry, with potential implications for various sectors of the global economy. Release date - April 2023, region – worldwide, survey time period - 2015 to 2022.

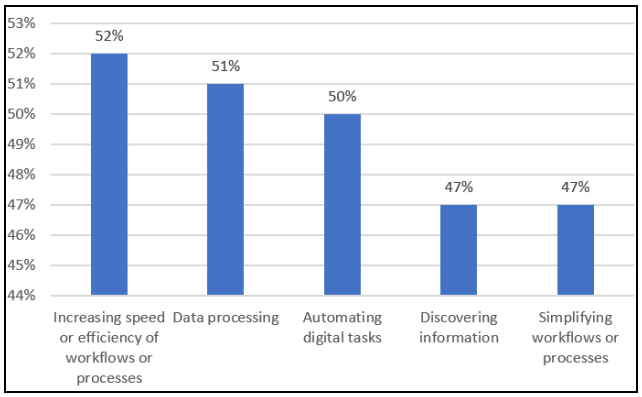


Source: Own processing based on https://www.statista.com/forecasts/1423975/world-generative-ai-text-tool-market-share

Figure 2: Leading generative artificial intelligence (AI) text tools market share of users globally in 2023

In 2023, the market for leading generative artificial intelligence (AI) text tools showcased a diverse landscape of user preferences globally. ChatGPT claimed the largest market share, with 19.73% of users opting for its

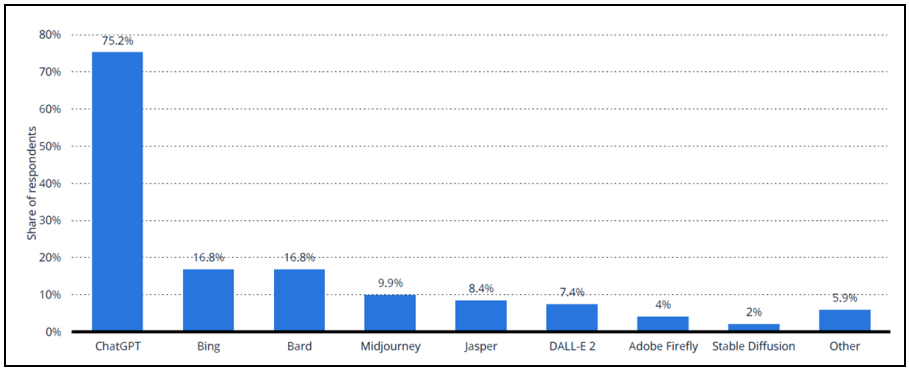
capabilities, followed by Jasper Chat at 13.42% and YouChat at 12.28%. DeepL, known for its translation prowess, held a notable share of 12.14%, while Simplified and Neuroflash attracted 9.74% and 9.37% of users respectively. Writesonic secured an 8.73% share, appealing to those seeking user-friendly AI text solutions. Typehero and Perplexity held shares of 7.48% and 7.1%, catering to specific user niches. This distribution highlights varying user preferences, with ChatGPT's leading position indicating widespread trust and adoption. DeepL's significant share underlines its reputation for accurate translations, while Writesonic's share reflects its user-centric approach. Overall, this market snapshot reveals a dynamic landscape shaped by innovation and a diverse range of user needs in AI text tools.



Source: Own processing based on https://www.statista.com/statistics/1364767/ai-ml-usage-company-benefits-us/

Figure 3: Leading benefits of using artificial intelligence (AI) tools according to marketing professionals in the United States as of June 2023

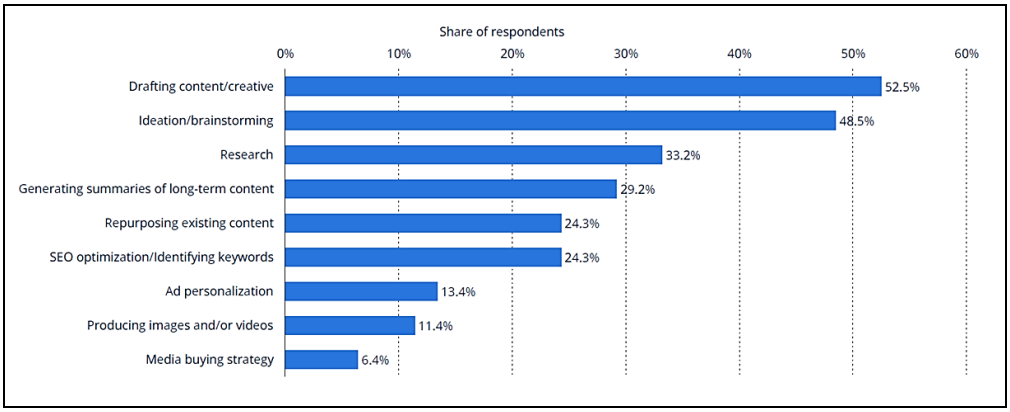
According to marketing professionals in the United States as of June 2023, several key benefits of using artificial intelligence (AI) tools have been identified. The leading benefit, reported by 52% of respondents, is the ability of AI to increase the speed or efficiency of workflows and processes. Close behind is data processing, cited by 51% of professionals, showcasing AI's role in handling and analyzing vast amounts of data efficiently. Automating digital tasks is another highly valued benefit, with 50% of respondents recognizing AI's capability to streamline repetitive tasks and improve productivity. Furthermore, 47% of professionals highlighted AI's role in discovering valuable information, indicating its capacity to sift through data and extract actionable insights. Simplifying workflows or processes was also cited by 47% of respondents, underlining AI's role in making complex tasks more manageable and user-friendly. The data suggests that marketing professionals value AI for its ability to enhance operational efficiency, data management, and task automation. The high percentages across these benefits indicate a strong recognition of AI's transformative impact on marketing operations. Marketing professionals are increasingly leveraging AI to optimize their workflows, process data more effectively, and automate tasks that would otherwise be time-consuming. Release date of the survey July 2023, region - United States, survey time period - June 2023, number of respondents - 281 respondents, age group - 18 years and older.



Source: https://www.statista.com/statistics/1405052/gen-ai-tools-used-marketing-advertising/

Figure 4: Leading generative artificial intelligence (AI) tools and platforms used in marketing and advertising worldwide as of July 2023

As of July 2023, the landscape of generative artificial intelligence (AI) tools and platforms used in marketing and advertising worldwide is dominated by ChatGPT, with an impressive share of 75.20% of respondents utilizing its capabilities. Following ChatGPT are Bing and Bard, both with equal shares of 16.80%, indicating their significant presence in the market. Midjourney and Jasper follow suit with shares of 9.90% and 8.40% respectively, showcasing their relevance in the AI tools space for marketing tasks. DALL-E 2, known for its image generation abilities, holds a share of 7.40%, demonstrating its niche within the market. Adobe Firefly, with a 4% share, and Stable Diffusion with 2%, cater to specific user needs within the marketing and advertising sector. The "Other" category, representing a variety of AI tools not specified, accounts for 5.90% of the respondents' choices. These figures highlight the dominance of ChatGPT as the preferred AI tool for marketing and advertising tasks globally. Its widespread adoption suggests a high level of trust and effectiveness among users. Bing and Bard's equal shares indicate a competitive landscape where multiple platforms are sought after for various functionalities. Midjourney and Jasper's shares suggest a moderate but significant usage among marketing and advertising professionals, possibly for their specialized features. DALL-E 2's presence underscores the importance of visual content generation in marketing strategies. Adobe Firefly and Stable Diffusion, although holding smaller shares, cater to specific needs within the industry, providing users with targeted solutions. The "Other" category's 5.90% share hints at a diverse range of AI tools and platforms utilized by marketing and advertising professionals for their unique requirements. Release date July 2023, region North America, Europe, Central and South America, survey time period - July 2023, number of respondents - 202 respondents.



Source: https://www.statista.com/statistics/1404764/gen-ai-uses-marketing-advertising/

Figure 5: Main tasks in which marketing and advertising professionals used generative artificial intelligence (AI) worldwide as of July 2023

In July 2023, marketing and advertising professionals worldwide utilized generative artificial intelligence (AI) for a variety of tasks, reflecting the diverse applications of AI in the industry. The most common task, reported by 52.5% of respondents, was drafting content and creative materials. This indicates a widespread use of AI in generating written content, such as articles, social media posts, and ad copy, to streamline the creative process. Ideation and brainstorming followed closely behind, with 48.5% of respondents utilizing AI for generating ideas and concepts. This suggests that AI tools are not only used for execution but also for the initial stages of content creation, aiding professionals in developing innovative strategies. Research emerged as another significant task, with 33.2% of professionals leveraging AI to gather information and insights efficiently. This indicates that AI is instrumental in processing vast amounts of data to extract valuable findings for marketing strategies. Generating summaries of long-form content was cited by 29.2% of respondents, showcasing AI's role in condensing complex information into digestible formats. Repurposing existing content, reported by 24.3% of professionals, demonstrates AI's ability to recycle and adapt content for different platforms and audiences. AI's role in search engine optimization (SEO) optimization and identifying keywords was noted by 24.3% of respondents, highlighting its importance in enhancing online visibility and content relevance. Ad personalization, mentioned by 13.4% of professionals, indicates AI's use in tailoring advertisements to individual preferences and behaviors. Producing images and videos, though lower on the list with 11.4%, signifies AI's role in creating visual content efficiently. Finally, media buying strategy, reported by 6.4% of respondents, shows that some professionals utilize AI for optimizing their advertising spending and placement decisions. Release date - July 2023, region - North America, Europe, Central and South America, survey time period - July 2023, Number of respondents - 202 respondents.

4. In Conclusion

This paper has provided a comprehensive overview of the landscape of generative artificial intelligence (AI) tools and their applications in marketing and advertising as of July 2023. The data presented reveals that ChatGPT stands as the undisputed leader among AI text tools, with an impressive 75.20% share of respondents utilizing its capabilities. This dominance reflects its widespread adoption and effectiveness in aiding marketing professionals worldwide. The analysis also shed light on the significant benefits of integrating AI tools into marketing strategies. The top benefits identified include increasing workflow efficiency (52%), data processing (51%), and automating digital tasks (50%). These findings underline the pivotal role of AI in enhancing operational efficiency and providing marketers with innovative solutions to navigate the complex landscape of modern marketing. Looking towards the future, the possibilities for AI in marketing are vast. As technology continues to evolve, AI is poised to play an even greater role in areas such as personalized customer experiences, advanced data analytics, and predictive marketing strategies. Marketers can leverage AI to gain deeper insights into consumer behaviour, optimize campaigns in real-time, and create highly targeted and relevant content.

In the evolving landscape of marketing, AI is driving transformative changes across various fronts. AI-driven content creation and curation are revolutionizing personalized customer experiences, allowing marketers to tailor content to individual preferences for heightened engagement and loyalty. Enhanced data analytics and predictive modelling empower more effective targeting and campaign optimization, ensuring that marketing efforts are precisely directed toward the right audience segments. The increased adoption of AI-powered chatbots and virtual assistants is reshaping customer engagement, providing personalized interactions and 24/7 support. Moreover, the integration of AI into social media marketing enables sentiment analysis and trend prediction, allowing marketers to stay ahead of the curve with real-time insights. As the industry progresses, there is a growing emphasis on AI tools for SEO optimization and keyword identification, reflecting the need to leverage AI's capabilities for enhanced visibility and relevance in digital landscapes. These trends collectively signify AI's profound impact on modern marketing strategies, offering unprecedented opportunities for efficiency, personalization, and strategic innovation. Possible recommendations for Marketers could be

- utilize AI tools like ChatGPT for drafting content and creative materials, enabling efficient and diverse content creation,
- explore AI platforms for ideation and brainstorming sessions, enhancing creativity and generating innovative campaign ideas,
- integrate AI tools for workflow efficiency, data processing, and automating digital tasks to streamline marketing operations,
- enhance data analytics capabilities by investing in AI-powered tools for deep insights into consumer behaviour and trends,
- continuously monitor AI trends and advancements in marketing technology to remain competitive and innovative in a rapidly evolving landscape.

Four research questions were set for the purpose of the paper -

Is ChatGPT the most used AI text tool?

ChatGPT is indeed the most used AI text tool according to the data, with an impressive share of 75.20% of respondents utilizing its capabilities. This signifies its widespread adoption and dominance in the market among marketing and advertising professionals worldwide.

Is ChatGPT the most used AI tool for marketers?

ChatGPT is the most used AI tool for marketers, specifically in the realm of generative artificial intelligence (AI) tools and platforms. Its share of 75.20% indicates its significant preference among marketing and advertising professionals globally.

What are the biggest benefits of using AI tools for marketers?

The biggest benefits of using AI tools for marketers, based on the data, are:

Increasing speed or efficiency of workflows or processes, data processing and automating digital tasks.

What are the most common tasks that marketers outsource for AI tools?

The most common tasks that marketers outsource to AI tools, as indicated by the data, are drafting content/creative, ideation/brainstorming and research.

The paper underscores the significant benefits of integrating AI tools into marketing strategies, with top advantages including increased workflow efficiency, data processing, and task automation. Looking forward, AI holds immense potential in revolutionizing personalized customer experiences, advanced data analytics, and predictive marketing strategies. Marketers are encouraged to leverage AI for content creation, ideation, workflow optimization, data analytics, and staying abreast of evolving trends to remain competitive and innovative in the dynamic marketing landscape. The paper also addresses four key research questions, confirming ChatGPT's dominance, its role as the most preferred AI tool for marketers, the significant benefits of AI tool utilization, and the common outsourced tasks to AI tools, providing valuable insights for industry practitioners.

Limitations of the research are as follows –

- The data and findings are based on information available as of year 2023. The fast-paced nature of AI and marketing technologies means that the landscape may have changed significantly since then. New tools and platforms may have emerged, altering market shares and the benefits derived from these technologies.
- The sample sizes for some of the surveys are relatively small (e.g., 202 respondents for global generative AI tool usage). This may not be fully representative of the entire population of marketing and advertising professionals.
- The research primarily focuses on quantitative data (e.g., market shares, percentages of usage).
- Since the secondary data were used the research part does not provide detailed information on the survey methodology, such as how participants were selected, the survey distribution channels, or the response rates.

Paper does not represent the final research, but the primary analysis which will lead to detailed researching in this area. Future research can minimize current limitations by conducting longitudinal studies to track AI adoption and impact over time and expanding sample sizes for broader representation. Enhancing survey methodologies with detailed design transparency and mixed-method approaches will provide deeper insights. Comparative analyses of AI tools, focusing on features, performance, and user satisfaction, will highlight why certain tools are preferred. Addressing technological limitations and ethical implications, including data privacy and algorithmic fairness, will ensure a comprehensive understanding. Detailed ROI analyses and cost-benefit studies will elucidate the financial implications of AI adoption. Providing empirically backed future predictions and scenario analyses will offer grounded insights into AI's potential developments. Incorporating detailed case studies and user experience research will showcase practical applications and highlight best practices.

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Entrepreneurial Spirit Paving the way for Successful AI Deployment in Knowledge Work and Organizations

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Abstract: The rapid advancements in Artificial Intelligence (AI) have significantly shifted the landscape of work, altering the roles of experts and knowledge workers across various domains (Humala et al. 2023). This paper explores the pivotal role of key competencies – self-efficacy, job crafting, and proactivity – in navigating the technological transformation brought about by AI in work settings. The three key competencies were previously identified as the main building blocks of the entrepreneurial spirit that is necessary for the successful use of AI in knowledge work and organizations (Humala & Lahtinen 2023, Ruohonen & Humala 2022). The research paper draws insights from a quantitative nation-wide survey that was carried out among knowledge workers in Finland. The survey was conducted during February-March 2024, with the insights gained from 474 informants. The research was funded by The Finnish Work Environment Fund and conducted by Haaga-Helia University of Applied Sciences based in Helsinki. Results show that while the integration of AI in knowledge work environments generally supports self-efficacy, job crafting, and proactivity, the effects are varied, showing both enhancement and, in some cases, diminishment. The findings indicate that AI's positive influence is most pronounced among those engaged in high levels of knowledge-based tasks and who maintain a positive outlook toward new technologies. This research also highlights some disparity in experiences between different groups, particularly between younger and older knowledge workers with early- and late-careers as well as those in different work positions, pointing to the need for tailored organizational support to ensure equitable benefits from AI technologies. The research reveals that AI can significantly foster proactivity in the workplace, particularly when employees are equipped with sufficient information and resources. Ultimately, this exploration aims to provide insights into developing AI-supported business models that not only leverage the human entrepreneurial spirit but also foster an inclusive environment that enhances organizational competitiveness and innovation.

Keywords: Artificial intelligence, Knowledge work, Self-efficacy, Job crafting, Proactivity,Eentrepreneurial spirit

1. Introduction

Rapid advancements in Artificial Intelligence (AI) have transformed the work landscape, offering substantial opportunities to enhance efficiency and productivity, and altering the roles of knowledge workers. These workers are crucial to core and support functions within organizations and externally, linking and managing tasks, stakeholders, and interest groups, and their roles often require multidisciplinary collaboration across functions such as HR, communications, IT, and administration. Yet, research on factors influencing AI adoption in knowledge work remains limited (Aunimo et al 2023), and the effective digital transformation depends on adept change management (Alasoini et al 2022). The perceptions and communications of knowledge workers about AI critically influence its organizational integration (Kärnä et al 2020).

Central to this are self-efficacy, job crafting, and proactivity, which have been identified as essential for successfully integrating AI in work settings (Humala & Lahtinen 2023; Ruohonen & Humala 2022), and that affect the roles of self-directed change agents of knowledge workers (Kärnä et al. 2021; Ruohonen & Humala 2022). These competencies foster entrepreneurial spirit and enhance AI use.

This research investigated how these competencies manifest among Finnish knowledge workers in relation to AI use, analyzing survey data from 474 employees across multiple sectors. The research question was as follows: To what extent does the use of AI a) impact knowledge workers' experiences of self-efficacy in the workplace, b) enable or restrict job crafting within organizations, and c) affect employees' proactivity in the work community?

The research was part of the "AIE – Artificial Intelligence as a Promoter of Equality" project by Haaga-Helia University of Applied Sciences. The paper discusses related work (Section 2), methodology (Section 3), research results (Section 4), the implications of findings for research and management practice (Section 5).

2. Related Work

AI refers to a machine's ability to mimic and utilize skills traditionally associated with human intelligence, such as reasoning, learning, planning, or creating (European Parliament 2023). Practically, AI involves advanced analytics based on machine learning combined with automation. Its applications are widely relevant for

knowledge work and include, for example, AI-enhanced predictive analytics, sales forecasting, customer segmentation, legal document analysis, automated financial advising, personalized educational platforms, project management optimization, and data-driven research analysis.

The discourse has primarily centered on the transformation brought about by automation in manufacturing contexts (Leesakul at al 2022). However, the landscape is now expanding as AI technologies facilitate the automation of tasks traditionally performed by knowledge workers (Coombs 2020; von Richthofen, Ogolla & Send 2022). AI impacts the daily tools that are in use of knowledge workers, such as in Microsoft Office applications, email, and the human-like text production in ChatGTP or similar interaction software. Moreover, AI implicates wider changes in knowledge work, as it already skillfully mimics skills traditionally associated with human intelligence, such as reasoning, learning, planning, and even creating.

The term "knowledge work" lacks a uniform definition. It is frequently used to contrast with manual labor, emphasizing roles that rely on specialized expertise and knowledge (Nonaka, I., Toyama, R. & Konno 2000; Pyöriä 2005). Knowledge workers process, analyze, and apply information to produce and develop services (Drucker 1999). Various definitions of knowledge work compiled by Pyöriä (2005) emphasize the multifaceted skills required, the complexity of the tasks, the handling of abstract information, extensive education, and continuous on-the-job learning. For the purposes of the present research, knowledge work was interpreted to involve activities related to the creation, modification, processing, and dissemination of information and knowledge (von Richthofen, Ogolla & Send 2022).

Recognizing and enhancing the competencies, agency, and collaboration of knowledge workers is essential for leveraging AI to create value and support operational effectiveness in organizations (Kärnä et al. 2023). Knowledge workers have a cross-disciplinary business, technological, and social expertise (Jalonen et al. 2019), which is especially important in technology adoption. Understanding, helping, and empathetic capabilities are key – besides technological skills (Frey & Osborne 2017; Kilpi 2016).

The entrepreneurial spirit is linked to the concept of intrapreneurship, which refers to an entrepreneurial approach within an existing organization (Heinonen 2001). An entrepreneurial approach enables individuals and groups to initiate, develop, and successfully manage changes and innovations involving uncertainty and complex situations, thereby achieving personal satisfaction (Heinonen 2001). The entrepreneurial spirit, deeply rooted in internal entrepreneurship, naturally extends to embrace three key competencies: self-efficacy, job crafting, and proactivity. Previously, Humala & Lahtinen (2023) identified these skills as fundamental components of the entrepreneurial spirit required for successful AI implementation in knowledge work and organizational settings. Moreover, these competencies enable knowledge workers to act as self-directed change agents within their organizations, as discussed by Kärnä et al. (2021) and further elaborated by Ruohonen & Humala (2022). As a result, these competencies are vital for knowledge workers as they integrate AI into their roles and navigate the technological shifts in their work environments.

Research by Humala & Lahtinen (2023) demonstrates that the self-efficacy of knowledge workers is enhanced under certain conditions. These include access to training and receiving positive, constructive feedback, which bolsters confidence. Clarity in job roles, adequate resources, and reliable support from the community also play crucial roles in fostering this empowerment. This increased self-efficacy manifests as a boldness towards adopting new technologies such as AI. Utilizing AI allows these workers to customize their tasks, minimize redundancy, and engage in projects that are both personally rewarding and advantageous to their teams.

Moreover, fostering proactive behavior in knowledge workers proves more effective when their abilities are acknowledged, they are encouraged to think independently, and their contributions are actively sought and valued. The cultivation of three critical "super competencies" can inspire individuals and introduce new aspects to their roles, shaping how their employment evolves with the integration of AI (Humala & Lahtinen 2023).

The present research built on these previous discoveries and advanced the understanding of the role of the entrepreneurial spirit – investigated via self-efficacy, job crafting and proactivity – in AI deployment.

3. Methods

3.1 Research Design

A quantitative survey was designed to gain insight into the research question via three hypotheses. First, it was hypothesized that the use of AI in organizations improves the sense of self-efficacy among knowledge workers as they learn to adapt and utilize new technology in their work (hypothesis 1). Second, it was proposed that

the use of AI increases the possibilities for job crafting as routine tasks are automated, freeing up time for more creative and personally inspiring tasks (hypothesis 2). The third hypothesis was that the use of AI promotes proactivity among employees, and the information and resources provided by the organization support anticipatory and independent work (hypothesis 3).

The five dependent variables were Likert-scale variables that measure the hypotheses 1 - 3. Independent variables were person-related variables, such as work position, education, gender, and age. Organizational size was an additional organization-related variable.

3.2 Data Collection

The data was collected through an online survey during the period between 14 February 2024 and 22 April 2024. The Webropol survey tool was used, and the survey was available in both Finnish and English languages. The survey link was distributed among the members of several trade unions employing knowledge workers in Finland and among employers known to employ knowledge workers in office settings.

Furthermore, the contact details of private and public organizations were compiled from Selector's company database, employing a wide selection criterion to include micro-, small-, medium- ja large-size organizations across different sectors. In this manner, the survey was distributed to 28,724 employees within the database.

As a result, 484 responses were gathered. The public link to the survey form and data can be obtained by contacting the authors. Out of 484 responses, 10 subjects were excluded from the analysis, as they were retired, full-time students, on parental or caregiving leave or unemployed. The remaining 474 were included in the analysis as they were at present active in work life.

3.2.1 Demographics of respondents and their involvement with knowledge work

Out of 474, 92.0% reported having a full-time job, 4.9% were entrepreneurs or self-employed, and 3.2% were working part-time. The demographics of the informants is described in Table 1. As can be observed, 64.6% of respondents were female, and the biggest age group is that between 51 and 64 (40.7%), followed by the age group of 41 - 50 (35.4%). The most common levels of education were a higher university degree (master) and university of applied sciences (bachelor) – both represented by 32.7% respectively.

Table 1: Descriptive statistics of the demographics of the respondents.

Variable	Frequency	Percentage
Gender		
Male	150	31.6 %
Female	**306**	**64.6 %**
Other	4	0.8 %
Prefer not to say	14	3.0 %
		Age
30 and younger	21	4.4 %
31-40	87	18.4 %
41-50	168	35.4 %
51-64	**193**	**40.7 %**
65 and older	5	1.1 %
Education		
No vocational education	1	0.2 %
Vocational course or similar (6 months - 2 years)	3	0.6 %
Lower secondary vocational qualification (e.g., vocational school or trade school)	40	8.5 %
Upper secondary vocational qualification (e.g., nursing school, business school, technical institute)	43	9.1 %
University of applied sciences (e.g., Bachelor of Business Administration, Bachelor of Engineering)	**155**	**32.7 %**

Variable	Frequency	Percentage
Higher university of applied sciences	58	12.2 %
Lower university degree (e.g., Bachelor of Arts)	11	2.3 %
Higher university degree (e.g., Master's degree, MBA, Master of Engineering)	**155**	**32.7 %**
Postgraduate education (Licentiate, Doctorate)	8	1.7 %
Position		
Manager (supervisor)	145	30.6 %
Specialist (senior expert)	75	15.8 %
Professional (expert)	**197**	**41.6 %**
Clerical support worker	42	8.8 %
Service and sales worker	7	1.5 %
Other category of worker	8	1.7 %

The respondents were categorized according to their reported involvement with knowledge work. Most informants identified as knowledge workers (51.7%), whose work involves processing, analyzing, and managing information. 19.6% were specialized knowledge workers, whose work is deeply concentrated on the expertise of a specific field of knowledge and its application. Knowledge work pioneers (12.9%) perceived themselves as experts, who promote the use of information in innovative ways and serve as an example to others in knowledge work. 14.8% were partial knowledge workers, with knowledge work being a small part of their job, but not the main task. The remaining five respondents (1.0%) did not see their job essentially being related to processing, analyzing, or managing information.

3.2.2 Respondents' personal innovativeness in IT

The scale for personal innovativeness in IT (Tran et al 2021) was employed to establish behavioral attitudes towards and acceptance of new technologies, as this has been shown to impact behavioral intentions to adopt AI. The results were observed across four variables.

Variable 1 measured the general awareness and interest in emerging technology products. Most respondents (48.5%) agreed that they keep an eye on emerging technology, with an additional 18.8% strongly agreeing, suggesting a high level of interest in new technologies. Variable 2 focused on the proactive adoption of new technologies. Here, responses were more evenly distributed across the spectrum, with 30.6% agreeing and another 31.0% somewhat agreeing that they try out new technology products earlier than others. However, a notable 5.7% strongly disagreed, indicating some reluctance.

Variable 3 assessed the willingness to accept new technological innovations. This item showed a strong positive response, with 55.5% agreeing and 34.8% strongly agreeing that they are generally willing to accept new technologies, reflecting a very favourable attitude towards technology adoption. Variable 4 explored proactive behaviours toward learning new technologies. Nearly half of the respondents (46.4%) agreed that they would look for ways to operate a new technology product upon hearing about it, and 10.8% strongly agree, indicating a proactive approach towards understanding and utilizing new technologies.

Overall, the results suggest that the informants displayed a relatively high level of personal innovativeness in IT, with a strong inclination towards adopting and engaging with new technologies.

3.2.3 Respondents' use of AI at work

Language, text, and speech recognition tools were the most widely used AI applications, with 75.5% of respondents indicating their usage. These tools, which include technologies like ChatGPT, Google BARD/Gemini, and Grammarly, help in understanding, translating, and creating text from inputs or speech. Visual content design tools were used by 40.1% of the respondents, including applications like Canva, Adobe Firefly, and Dall-E, which assist in designing and producing images, patterns, and videos. Predictive data analytics tools were utilized by 35.7% of participants, with tools such as Google Analytics and IBM Watson Analytics offering support in data analysis, providing insights and forecasts that enhance decision-making processes.

AI-based applications developed internally within organizations or tailored for specific organizational needs were used by 24.9% of respondents. Customer service and experience tools were employed by 23.6% of respondents. Recruitment and HR management tools were used the least (5.1%). Other AI Applications were mentioned by 4.2% of respondents, which might include niche or less common AI tools not listed in mainstream categories.

No experience with AI-based applications was reported by 12.4% of respondents, highlighting that despite the widespread adoption of AI, a notable fraction of the workforce remains unexposed to or unaware of the use of these technologies.

3.2.4 Organizations represented by informants

The typical informant was employed by a large private company (51.5%). The second-largest body of informants worked for medium-sized companies (23.4%). Small companies were represented by 11.8% of informants and micro companies by 13.3%.

The respondents represented approximately 247 different organizations. This was inferred from the number of different domains of the emails voluntarily given by 262 respondents. Among the 262 responses, there were 137 different corporate domains (not including Gmail, Hotmail and similar services). Thus, it can be inferred that among the total sample of 474, there were approximately 247 different organizations. The exact figure is not available due to the anonymity of the respondents.

The informants represented over 16 different industries, with a large proportion of the service sector, both in miscellaneous category (13%) as well as specialized services, such as education (12%), information and communication (11%), financial and insurance activities (10%), administrative and support services (9%) and others. Manufacturing companies (12%) were also well-represented.

3.3 Data Analysis Methods

In comparative data analysis, the researchers applied subgroup means, crosstabulations and Spearman's rank correlations (r) because the dependent variables were measured on ordinal scale (Likert). The significances of the relations were tested with non-parametric tests and Spearman's rank correlation test. Significance level (p) was set to 5.0% in statistical tests. The significance level of the correlation coefficient was indicated with the upper indexes ** for the $p \leq 0{,}01$ or * for $0{,}01 < p \leq 0{,}05$.

The relations were analyzed and tested as follows. For independent variables measured at a nominal level (such as work position, gender, and education), and dependent variables measured on an ordinal scale (Likert scale), the analysis was conducted using subgroup means and/or cross-tabulations. The statistical tests employed were non-parametric tests, including the Mann-Whitney U test for pairwise comparisons and the Kruskal-Wallis test for comparisons involving more than two subgroups.

For independent variables measured as scale variables (such as age, organizational size, and the averaging variable of personal innovativeness in IT), and dependent variables measured on an ordinal scale (Likert scale), the analysis was conducted using Spearman's rank correlations coefficient, tested with Spearman's rank correlation test.

Additionally, an averaging variable was created from the four variables measuring the personal innovativeness in IT (see Section 3.2.2) by calculating the mean value of the responses for each informant. The internal consistency was high, with Cronbach's Alpha being .834. The reliability of the research was supported by the ability to duplicate the results should the research be repeated in comparable conditions.

3.4 Impact of AI on Self-Efficacy Among Knowledge Workers

The AI impact on self-efficacy is distributed across a spectrum ranging from negative to positive. Overall, these results indicate that while a small percentage of individuals felt a decrease in self-efficacy due to AI (4.4%), a notable proportion reported positive effects (46.2%), and the largest group perceived no change (49.4%). This suggests a generally neutral to positive reception of AI in terms of its impact on individual self-efficacy in the workplace.

Further analysis showed that the more one's work involved knowledge-based tasks, the more one perceived that AI use had a positive impact on one's self-efficacy ($r=0.204^{**}$). Also, the more positive the attitude towards the use of new technologies, the greater the perceived improvement in self-efficacy, which was enhanced by the use of AI ($r=0.302^{**}$).

Based on this dataset, there was no impact of age and gender on self-efficacy. In both cases the results were not statistically significant and without allowing for a generalized correlation across age groups (r=-0.044; p=0.342) and gender (p=0.905). Similarly, the length of career and the organizational size did not have an impact in this sample, with r=-0.047, p=0,340 and r=0.025, p=0,592 respectively.

Informant's work position had an impact, with notable differences in several categories. Managers and senior experts experienced more positive work effect from the use of AI compared to clerical support workers (p=0.009 and p=0.005 respectively). Managers found more positive effect in comparison to experts (p=0.013).

Compared to experts, their more senior and specialized colleagues – senior experts – perceived stronger positive effects (p=0.010). Similar pattern was identified in the analysis of the second question related to self-efficacy that asked to evaluate the impact of the use of AI on ability to cope with challenging tasks in one's work (p=0.050).

Moreover, while a small fraction saw a decline in their self-efficacy in coping with challenging tasks (1.1%), the overall impact of AI was largely neutral (56.1%) to positive (42.8%). A significant portion of respondents felt that AI had improved their capability to manage difficult tasks at work, reinforcing the notion that AI can be a beneficial tool in enhancing individual work capabilities, especially among those who are already inclined towards embracing new technologies.

Further analysis reinforced the notion that the more the person identified with knowledge work, the more positive impact AI had on one's ability to cope with challenging task (r=0.175**) and, therefore, somewhat increased self-efficacy. The analysis slightly reinforced the conclusion that informant's age (r=-0.122**) and career length (r=-0.102*) correlated inversely with the self-efficacy: with the increase of informant's age and career length, there was a decrease in self-efficacy. Respectively, younger informants' self-efficacy increased with the AI use. The organization size (r=0.025, p=0.583) and gender (p=0.831) did not impact self-efficacy. The results in terms of informant's age and career length offered statistically significant correlation, indicating that the result was generalizable, while the conclusion for organization size was relevant for the sample in question.

3.5 The Role of AI in Enabling and Restricting Job Crafting Within Organizations

A fraction of respondents perceived a negative impact of AI on job crafting (2.3%). This suggests that for a minority, AI may impose limitations on their ability to personalize work tasks. Most respondents, 61.4%, reported "No change" in their ability to tailor their work, indicating that for most, AI did not interfere with or enhance their job crafting capabilities. A significant proportion of respondents observed positive effects of AI on job crafting (36.3%).

The more one's work involved knowledge-based tasks, the more one perceived that the use of AI had a positive impact on opportunities for job crafting (r=0.174**). Attitude towards the use of new technologies correlated with the experience of AI increasing job crafting (r=0.268**). Similarly to the results observed in respect to self-efficacy, informant's age (r=-0.134**) and career length (r=-0.099*) impacted job crafting inversely, with statistically significant negative correlation. In this sample, organizational size (r=-0.005, p=0.911) and gender (p=0.196) did not impact job crafting opportunities. In comparison to clerical support workers and experts, senior experts experienced higher increase for the opportunities to tailor their own work due to the use of AI (p=0.005; p=0.033).

3.6 Influence of AI on Employee Proactivity in the Work Community

A minor portion of the respondents noted a detrimental effect of AI on their proactive behaviors (1.7%). This indicates that AI may limit initiative-taking in a small subset of the workforce. The predominant response, from 64.6% of the participants, was "No change" in their level of proactivity due to AI use. For most employees, AI has neither hindered nor facilitated their propensity to engage proactively at work. On a positive note, a significant number of participants reported improvements in their proactivity due to AI (33.7%). These responses underscored the potential of AI to enhance proactive behaviors in the workplace.

Similarly to self-efficacy and job crafting, employees with higher involvement in knowledge work (r=0.162**) and stronger positive personal attitudes towards new technologies (r=0.252**) experienced increased positive change in proactive and initiative-taking approach in work with the use of AI. In this research sample, informant's age (r=-0.013, p=0.777), length of career (r=-0.006, p=0.891) and organizational size (r=0.033, p=0.476) did not have a notable impact, and nor did gender (p=0.301). With AI use, proactivity increased more

in managers and senior experts in comparison to clerical support workers (p=0.015 and p=0.004 respectively), in managers in comparison to experts (p=0.034) and in senior experts in comparison to experts (p=0.008).

The results indicated the connection between proactive behavior and sufficiency of information and resources provided by the employer, enabling employees to be proactive and take initiative in using AI in their work (r=0.242**), with the slight increase in proactivity with the positive perception of the organizational support.

4. Discussion and Conclusion

This research explored the implications of AI on entrepreneurial spirit manifested through three key competencies – self-efficacy, job crafting, and proactivity – within knowledge work environments. The findings supported the proposed hypotheses and suggested a nuanced spectrum of effects, with a predominantly neutral to positive impact on self-efficacy and more considerable variance in the influence on job crafting and proactivity. Aligning with previous literature, the results showed that AI facilitates an enhancement of these competencies under specific conditions, particularly when employees are provided with adequate information and resources, as was the case with proactive behavior.

The research corroborated prior studies on the role of self-efficacy, job crafting and proactivity as competencies reflective of entrepreneurial spirit and their positive connection to AI use (e.g., Humala et al 2023; Humala & Lahtinen 2023; Ruohonen & Humala 2022; Kärnä, Nikina-Ruohonen & Humala 2021). However, it also uncovered the multifaceted effects of AI in the workplace, including instances where these competencies are diminished.

A significant relationship between AI usage and increased self-efficacy, job crafting, and proactivity was particularly evident among those engaged in high levels of knowledge-based tasks and who held positive attitudes towards new technologies. Nonetheless, the data also indicated a degree of polarization among employees, especially between those at varying levels of involvement in knowledge-based work and personal innovativeness with IT.

Significantly, the results revealed that younger knowledge workers and those with shorter career lengths reported more pronounced experiences related to self-efficacy and job crafting. This underscored the need for enhanced support for older workers and those with longer careers in positively engaging with and developing AI capabilities. The support could include organizational measures, such as targeted training and the provision of suitable tools.

Moreover, the research found that proactivity in the workplace was moderately influenced by AI, with many employees experiencing increased initiative due to AI integration. This aligned with the hypothesis that AI can augment proactive behaviors, especially when supported by positive technological attitudes and sufficient organizational backing.

Interestingly, gender did not significantly influence the impact of AI on these competencies, suggesting that the effects of AI integration transcend gender boundaries and the opportunities for self-efficacy, job crafting and proactivity in the context of AI use are gender-equal among knowledge workers.

Previous research arrived at an uncertain outcome as to the relation between organizational size and the adoption of AI (e.g., Pumplun, Tauchert & Heidt 2020). This research found no significant correlation, suggesting organizational size was not a factor in how knowledge workers experienced the implications of AI use on their self-efficacy, job crafting and proactivity.

As a limitation, the research's reliance on self-reported data could introduce bias, and the diversity of organizational contexts suggests that AI's impacts are not uniformly experienced across different knowledge work roles.

Future research should aim to further delineate the conditions under which AI most effectively contributes to enhancing these competencies and to explore the longitudinal effects of AI integration across different sectors, organizational contexts, and knowledge work roles. There is also a need to monitor potential increases in employee polarization concerning AI impacts on entrepreneurial spirit.

The research results may be employed in organizational contexts to consider implementing supportive AI strategies that are inclusive and account for diverse employee experiences with technology, ensuring all workers are equipped to leverage AI benefits.

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Innovating Sustainability: Digital Marketplaces as Catalysts for Circular Economy on the Reuse of Electronic Devices

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Abstract: This study delves into the synergy between innovation management, the circular economy, and the development of digital marketplaces, with a particular focus on the reuse of electronic devices. It highlights how digitalisation within the circular economy can spur innovation in managing the reuse of electronic gadgets through digital platforms. Drawing on a robust quantitative analysis of data from over 400 Finnish and Baltic companies, this research is pioneering in its holistic integration of these sectors, addressing the critical need for insights into the operational and managerial dynamics of circular economy digital marketplaces. Employing a comprehensive quantitative approach, our investigation uncovered significant insights regarding the perceived opportunities, challenges, and value-added features of these marketplaces for electronic device reuse. Environmental protection, cost savings, and enhanced recycling opportunities were identified as major advantages by participants. However, the study also pointed out significant barriers to effective marketplace operation, including IT system integration, organisational culture challenges, and resource limitations. A noteworthy contribution of this research is its elucidation of the influence of company size on engagement in the circular economy, pinpointing large and micro-enterprises as potential pioneers in this domain. It also sheds light on the business-to-business (B2B) dynamics within digital marketplaces, exploring the interactions among sellers, buyers, and service providers. Our findings underscore digital marketplaces as pivotal enablers for sustainable practices in electronic device reuse, whereas digital platforms may expedite the transition towards a circular economy. This aligns with principles of innovation management by promoting collaboration, minimising waste, and fostering new business models. The conclusion emphasises the digital marketplace not just as a platform for transactions but as a vital ecosystem enabler, providing a wide array of value-added services. It underscores the importance for businesses, especially in the electronics sector, to integrate circular economy principles strategically, leveraging digital marketplaces to achieve sustainability goals while gaining competitive advantages. The research has directly influenced the launch of a pilot digital marketplace for electronic product reuse, showcasing the practical application of its findings. This emphasises the study's role in advancing innovation management practices by demonstrating the transformative potential of digital marketplaces in promoting circular economy practices.

Keywords: Circular economy, Electronic devices, Digital marketplace, Innovation, Sustainability

1. Introduction

The transition towards a sustainable and circular economy represents one of the most pressing challenges and opportunities of our time. In the quest for sustainability, the role of digital innovation, particularly in the context of the circular economy, has gained unprecedented momentum. The focus on electronic device reuse within this context is both a necessity and an opportunity, given the rapid pace of technological advancement and the resulting environmental footprint. Our study ventures into this critical intersection of innovation management, circular economy principles, and digital marketplace development.

The proliferation of electronic devices, coupled with their short lifecycle, poses significant environmental risks, ranging from resource depletion to hazardous waste. The circular economy offers a promising pathway to mitigate these issues by promoting the reuse, refurbishment, and recycling of electronic devices, thus extending their lifecycle and reducing waste. Digital marketplaces, as platforms that facilitate the buying, selling, and exchanging of goods and services, emerge as powerful enablers in this regard. By harnessing digital technologies, these marketplaces can significantly lower the barriers to electronic device reuse, fostering a culture of sustainability and innovation.

Our research looks into how digitalisation can catalyse innovation in the circular economy, specifically through the lens of electronic device reuse. By conducting a comprehensive quantitative analysis of over 400 Finnish and Baltic companies, this study pioneers in uncovering the operational and managerial dynamics that underpin the success of circular economy digital marketplaces. We aim to highlight the perceived opportunities, challenges, and value-added features these platforms offer, and how they can be leveraged to foster environmental protection, cost savings, and enhanced recycling opportunities.

2. Related Work

The European Union has outlined that development of the circular economy is required to combat climate change (European Commission, 2020). The effective implementation of circular economy practices can offer meaningful positive contributions to addressing the current environmental challenges and economic opportunities to shape business sustainability (Geissdoerfer et al, 2018). The current advancements in EU legislation and the Circular Economy Strategy highlight the increasing role of producers in meeting the obligations related to managing the end-of-life of products. Extended producer responsibility (EPR) commonly involves waste reverse logistics, guiding the collection, inspection, and processing of end-of-life products to support circular economy efforts by closing material loops (Bening & Petri, 2024). Research indicates that firm-specific characteristics, such as the sector and type of circular business model adopted, significantly influence the formation of barriers to the adoption of circular economy practices, revealing distinct challenges across sectors and models that can impact the success of these initiatives (Brändström, Jazairy & Lindgreen, 2024).

In circular economy connecting with wider ecosystem is very important (Lacy, Long & Spindler, 2020). In circular economy value creation reuse of products, components and materials is an important part that needs to be encouraged widely across various operations (Cole, Gnanapragasam & Cooper, 2017). The data concerning the quality of a used product, component or material is usually the most important attribute when determining value (Rogers, Lembke & Benardino, 2013). Efficient value creation from used goods therefore requires sharing accurate data between the ecosystem stakeholders. The transition to the ecosystem circular economy requires different stakeholders to share and trade data and goods in circular value networks (Orko & Åkerman, 2019). Digital solutions can be harnessed to enhance material recycling, lengthen the lifespan, and increase the utilisation of equipment (Sinervo et al, 2022). This points towards an increased demand for contemporary solutions and tools that enable a circular economy, such as digital marketplaces.

Growing digitalisation of business processes, along with rapidly advancing technologies, provides ample grounds for digital marketplace solutions and their ability to operate on timely information, current supply-demand matching, and overall transparency (Berg & Wilts, 2019). Digital marketplaces are places of commerce in which sellers and buyers can trade almost anything (Rogers, Rogers & Lembke, 2010). Digital marketplaces have been identified to be promising technologies in value-creating networks between the manufacturing sector, the waste and recycling industry, and digital services (Blackburn, Ritala & Keränen, 2024; Berg & Wilts, 2019). Sharing data and selling goods via digital marketplace in real time enables stakeholders to evaluate the capturable value available before acquiring the assets available. Digital marketplaces also offer the means to reduce the transactional costs related to finding suppliers and buyers and creating the needed documentation regarding transactions (Berg & Wilts, 2019). Digital marketplaces, such as eBay, are very popular within the secondhand consumer market for selling used products such as cars, electronics, clothing, etc. In B2B setting the increased complexity in interactions, the lack of trust and high cost are barriers for establishing standardised online marketplaces (Mourtzis, Angelopoulos & Panopoulos, 2021). Successful implementation of a digital B2B marketplace requires implementing critical success factors that guarantee neutrality in managing the transactions, while maintaining trust between the actors (Bolocco, Perego & Perotti, 2010). In general, a circular economy marketplace operator should focus on finding the right type of buyers, in order to increase the likelihood of customers buying a used instead of new product (Mak & Heijungs, 2022). For their capacity to tackle these and related opportunities, digital marketplaces have been recognised as essential elements in the creation and sustenance of a circular economy (Lacy & Rutqvist, 2015).

Electronic devices represent a special interest in this context, as they constitute the increasing e-waste combined with the lack of established environmentally sustainable reuse and recycling practices (Santato & Alarco, 2022). Electronics and electronic devices refer to computers, mobile phones, remotes, and cameras – devices that use electric current to encode, analyse, or transmit information. The use of electronic devices is characterised by shorter life cycles, as they are replaced and disposed of at a growing pace (Tang et al, 2022). From the environmental perspective, the reuse of electronic equipment should be a priority, though economically the possibilities for value creation are diminishing over time (Hischier & Böni, 2021). As the value of used electronics equipment decreases strongly over time, the speed to complete the transactions becomes one key parameter to measure in the ecosystem.

Following quantitative methodology, the present research investigated the requirements and opportunities associated with the creation of the circular economy digital marketplace for the reuse of electronic devices. The research resulted in meaningful and applicable managerial and business contributions that translated into the launch of the marketplace pilot (2022).

The present research leapt into the future of digitalisation, and brought together three domains: the circular economy, digital marketplace development, and its application for promoting the reuse of electronic devices. The combination of the three has great practical and managerial potential, but to date remains under-researched. For the success of the green transition, there is an urgent need for further understanding of the requirements and opportunities related to circular economy digital marketplace creation and operation.

As opposed to the linear model of production, the circular economy aims to preserve the value of utilised resources and materials as long as possible, use them as frequently as possible, and produce as little waste as possible (Ellen Macarthur Foudation 2020). The concept covers all aspects of economic activity from resource extraction to production, storage, and consumption, ending with disposal or recycling. (Wilts, 2016). To reach this goal, circular economy digital marketplace may serve as an instrument for bringing together the needed scope of businesses, actors, and organisations, and involving them in the reuse of electronic devices. This is aligned with the digital platforms' operational models that represent networked marketplaces and exchange constructs (Berg & Wilts, 2019; MacAffee & Brynjolfsson, 2017).

The research adds value to the existing body of knowledge and management practice by providing insight into requirements and opportunities associated with the creation and successful operation of the circular economy digital marketplace for the reuse of electronic devices.

The research had pursued the hypothesis that the integration of digital marketplaces into the electronic device sector significantly enhances the efficiency and effectiveness of circular economy practices, primarily through improved matchmaking between supply and demand, reduced transaction costs, and the provision of a platform for the exchange of critical product information.

3. Methodology

This study's findings derive from a comprehensive quantitative dataset gathered at the outset of the project. Within the scope of this paper, we narrow our focus to a specific segment of the dataset, examining participants' perceptions of the opportunities and value-added features provided by the digital marketplace, challenges to its adoption, and their preferred role within the marketplace ecosystem. The research received financial support from the Helsinki-Uusimaa Regional Council, Finland. The data collection phase spanned from June to August 2021. We compiled the contact details of the participating firms from Selector's company database, employing specific selection criteria to guide our process:

- Finnish companies with less than 50 employees, incl. CEOs of the following industries: electronics and equipment manufacturers, wholesalers, retailers, and recycling companies;
- Finnish companies with 50+ employees, incl. CEOs and Marketing, IT, Sales, Purchasing, Production, Product Development and Communications Managers from all industries;
- Companies from Baltic countries with more than 5 employees, turnover more than 50 MEUR, industries included manufacture of electronic equipment and components, waste management and recycling, storage, other logistics, film, sound, video, radio and TV program production, communications and satellite communications, computer network services, and repair services.

On June 15, 2021, a survey was distributed to 14,422 organisations in Finland, and subsequently, on July 5, 2021, an additional 1,090 organisations from the Baltic region were included. Follow-up reminders were dispatched on June 22 and August 4, 2021. Out of the total, 404 organisations responded, yielding a response rate of 2.6%.

The survey was conducted using Webropol, an online survey platform. It featured a variety of question types, including single-choice, multiple-choice, and open-ended questions. To gauge the perceived opportunities and barriers within the digital marketplace for second-hand electronic devices, responses were collected on a five-point Likert scale ranging from "fully disagree" to "fully agree" (assigned values from 1 to 5), with an additional "don't know" option that was excluded from the analysis as a missing value.

The data from the questionnaire was analysed to identify trends among the participants and between different groups. Statistical analysis was performed using the SPSS software, employing both descriptive statistics and nonparametric tests (Kruskal-Wallis and Mann-Whitney U tests) to identify significant differences in responses based on the Likert scale across various groups. Spearman's rank correlation was utilised to examine the strength and direction of associations between ordinal variables, an approach necessitated by the non-normal distribution of the attitudinal data, as noted by Metsämuuronen (2017).

3.1 Profile of Respondents

Regarding the demographics of the participants, a vast majority of the surveyed organisations (97%) had operations in Finland, whilst one-third (33%) had operations in other European Union countries and one-fifth (20%) operated outside the EU. Notably, 66% of the organisations operated only in Finland and 18% operated in all listed areas. Of the responding entities, large organisations employing over 249 individuals accounted for one-third (34%), whilst nearly half (47%) were classified as medium-sized, having a workforce of 50 to 249 employees. The survey predominantly captured the perspectives of senior executives, who made up 57% of respondents, followed by middle management, representing 25%.

The composition of the respondents was diverse, with three-quarters (76%) coming from the private sector and 22% representing public sector organisations. The sectors in which these companies operated varied, including manufacturing (29%), services (21%), and trade, both retail and wholesale (15%), in addition to sectors focused on education, consultancy, or R&D (12%).

Technology usage was universal among the organisations, with all reporting the use of IT, computing, and mobile devices. Other prevalent technologies included entertainment electronics like televisions (77%), security systems (73%), and household appliances, such as washing machines and dishwashers (69%), along with measurement and testing equipment (64%) and other specialised professional electronics (62%). A small fraction (2%) were involved in the manufacturing or sales of electronic devices.

The study's validity and reliability were carefully considered. The coherence between the study's outcomes and its initial objectives underscores the accuracy of the measurements. Validity is further enhanced by the integration of literature review and comparisons with prior studies, establishing a connection with established trends.

Despite a modest response rate of 2.6%, the substantial number of respondents (404) deemed the sample convincing and representative, given the broad range of electronics used across the participating organisations. The study's reliability is underpinned by the potential to replicate the findings if the research were to be conducted anew under similar circumstances. Analytical methods were applied to ensure result consistency throughout the survey, and the internal consistency of the Likert scale responses reported was high, with Cronbach's Alphas ranging between .83 and .87.

4. Results and Analysis

The research results show that the circular economy is perceived as important, and businesses are prepared to pay attention to it. Companies tend to have a positive view of their own circular economy practices and believe that the circular economy is incorporated in the company's daily life and routine (81%). In practice, for customer and warranty returns, electronic equipment is mainly recycled back into raw material (56%), serviced and re-sold (49%) and destroyed (36%). As expected, IT and mobile devices circulate faster. More than 70% of respondents felt they would be willing to pay more for electronic devices if their repairs were easier.

The match of the digital marketplace with the internal systems was one of the prerequisites for getting involved in a systematic way with the platform. Security issues were highlighted to be of the outmost importance. Safety and security aspects were noted, including the evaluation of the functionality and integrity of the product for the buyer, enabling secure and environmentally friendly certified process. The platform was seen as the primary responsibility of IT managers and IT departments (51%), but almost all companies noted the current lack of a dedicated resource for this purpose.

4.1 Opportunities Presented by a Digital Marketplace for the Reuse of Electronic Devices

There were several key opportunities that companies perceived as the result of a digital marketplace for the reuse of electronic devices. The list was topped with the protection of the environment and reduction of the carbon footprint. These opportunities were closely followed by the perceived opportunities of utilising the marketplace to find new recycling opportunities and appropriate recyclers and users. (See Figure 1)

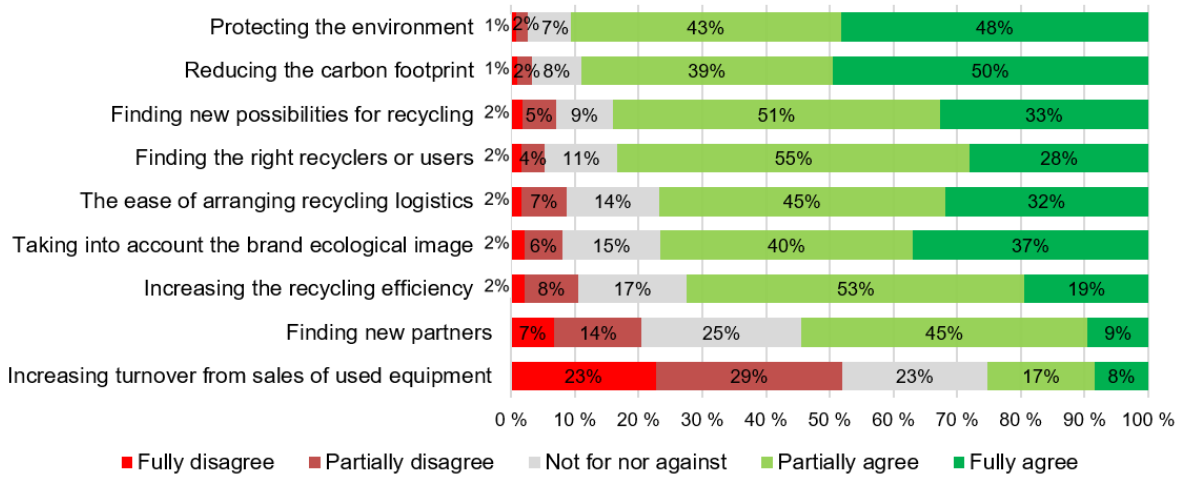


Figure 1: Opportunities for using digital marketplace for the reuse of electronic devices [Fig.: Taking the brand's ecological image into account; Increasing recycling efficiency]

Organisations in public administration saw greater opportunities than companies in two areas, including cost efficiency (p = .049) and finding new recycling opportunities (p = .036). The marketplace was perceived as an opportunity to find new partners mostly in public administration and service companies – and, in contrast, least in training, consulting, research and development companies (p = .039). Increasing turnover is perceived mostly as an opportunity in retail or wholesale companies and least as an opportunity in manufacturing companies (p = .009).

4.2 Value-Adding Features of a Digital Marketplace

The key added value for businesses in the marketplace was the ease of the process of reuse of electronics (72%), finding buyers and sellers (67%) and minimising costs (52%), but not necessarily the best possible price (only 19%). These value attributes translated into key motivations for using the digital platform and parameters sought by companies in a digital marketplace. When asked what services a digital marketplace should offer, it was most hoped that it would bring together buyers and sellers (85%), and well over half (67%) of the respondents wished for a sales service. The next most desired was to get up-to-date information on legislation (45%) and useful links (43%). A third (33%) wanted consulting services. (See Figure 2.)

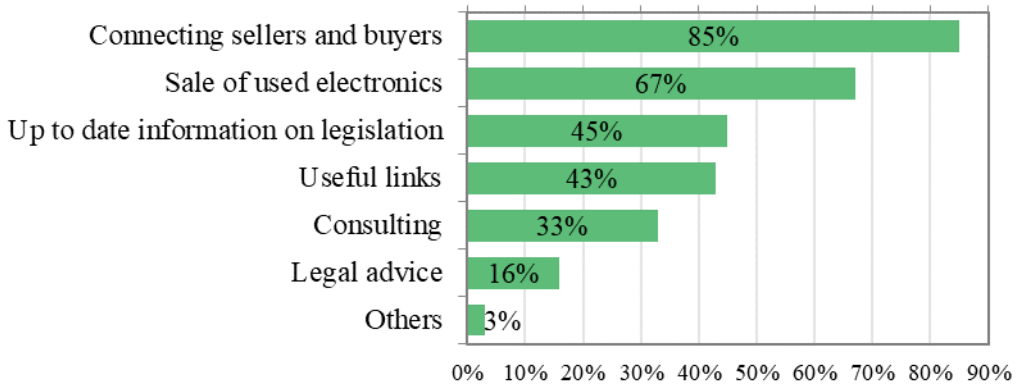


Figure 2: Digital marketplace for the reuse of electronic devices: Services desired by companies (n = 393, 1150 responses)

The respondents further elaborated on the specified digital marketplace features in their open-ended responses. The highlighted services included, for example, a donation service, erasing data on devices, responsibility information, and support in the case of disputes i.e., if the device does not work as required.

Respondents were asked what kind of product data they would like from electronic devices in order to purchase used electronic devices from the marketplace (see Figure 3).


Warranty
Service history
Condition
Price
Model
Age
Sale
Cycle
Manufacturer
Operator
Maintenance history
Purchase
Technical data
Security issues
Software
Parts
New
Same
Time
Make
Number
Case
Basic
Electronic
Previous owner/use
Estimated
Market
Recycle
Spare
Waste
Repairability
Proof
Available
Replaced
Year
Pay
Sold
Compatible
Date
Level
Origin
Serial
Weee
Computers
Account
Relevant
Current
Economy
General
Sell
Well
Provider
Center
Featuresname
Usage
Reliable
Quite
Emptied
More
Users
Point
Taken
Safety
Old
Net
Side
Quality
Next
Effort
Wouldn't
Spoke
Recycles
Defect
Importer
Partner
Options
Actual
Seller
Upgrades
Accurate
Way
Course
Energy
Type
Factory
Forth
Co
Fi
Os
Now
Certificate
Country
Manuals
System
Weekend
Make
Instead
Main
Offer
Latest
Itself
Focus
Detailed
Without
Depends
Directly
Circular
Enough
Emissions
Easy
Back
See
Business
Reasons
Activity
Responsibility
Length
Heavy
Legal
Procure
Treatment
Eco
Test
Financier
Price
Want
Version
Consumption
Seller
Achieve
Being
Kind
Fixed
Ability
Bit
Sw
Eg
One
Up
Turn
Sheet
Owner
Lathes
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Supplier
View
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Place
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Config
Time
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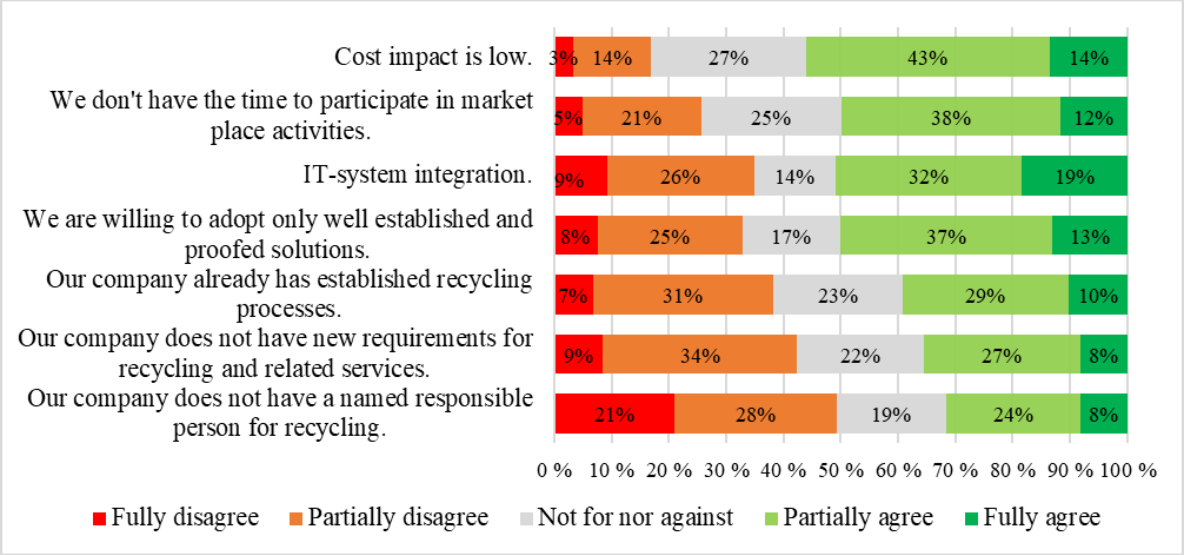


Figure 4: Main barriers in companies for using the digital marketplace for the reuse of electronic devices. [Fig.: well-established; Our company does not have a person designated for recycling responsibilities]

Other obstacles to the employment of the digital marketplace included, e.g. the following: lack of customer acceptance for the recycling of specific equipment, organisational culture (such as large organisation and respective slow decision-making), the lack of a recycling culture, resistance to change within the organisation.

4.5 Company Size Characterises Circular Economy Engagement

Interestingly, large and micro-enterprises (in contrast with SMEs) demonstrated greater motivation towards active engagement in the circular economy and respective marketplace – showing potential for this target group to serve as innovators and early adopters for the digital marketplace. Furthermore, larger companies renew IT and related professional electronics at a quicker pace than smaller companies. This indicates the digital marketplace matching opportunity, where larger companies sell used equipment to the smaller ones.

The interest of the respondents in co-operation with higher education institutions (willingness to actively engage in circular economy research and development activities), positively correlated with the readiness to participate in the digital marketplace. This correlation was noted among large enterprises (public ones included) and micro-enterprises – supporting the above argumentation for this target group as early adopters of the digital marketplace.

The perceived opportunities presented by a digital marketplace were impacted by company size too. Micro-enterprises saw more opportunity in increasing turnover from sales of second-hand goods ($p = .000$) and finding new partners ($p = .021$). Large companies identified more strongly with the opportunities in improving the cost of recycling ($p = .042$), and considering the image of brand ecology ($p = .000$) as associated with the reuse of electronic devices.

4.6 B2B Roles Within the Digital Marketplace Environment

The results of the present research show that in addition to company size, the roles that companies are willing to take on shape their involvement in a digital marketplace for the reuse of electronic devices. Most companies (87%) saw an opportunity in adopting the role of a seller in the digital marketplace. Half of the companies desired to engage in the marketplace in the role of buyers. Only about one-tenth identified with the role of repairer or service provider. Other possible roles that were indicated by the respondents included transportation provider, equipment calibrator, certification provider, information broker and others. (See Figure 5.)

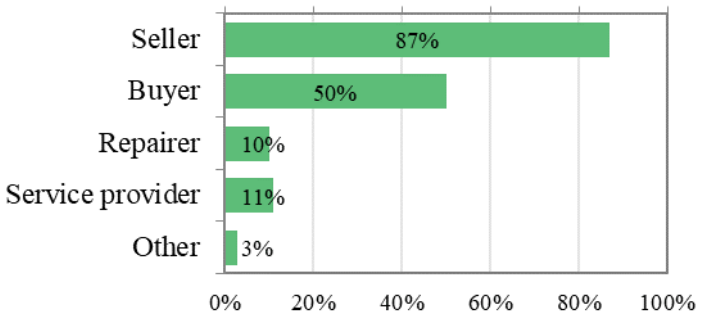


Figure 5: Preferred company role in the digital marketplace for the reuse of electronic devices (n = 374, 607 responses)

The companies willing to adopt the role of sellers mostly represented retail and wholesale businesses (98%). On the other hand, they were least ready to take on the role of a buyer (45%). Service sector companies hoped more for a seller's role (87%) than a buyer's role (46%). All other company types were quite evenly willing to adopt the role of a seller (79% - 86%) or a buyer (51% - 53%). (See Figure 6.)

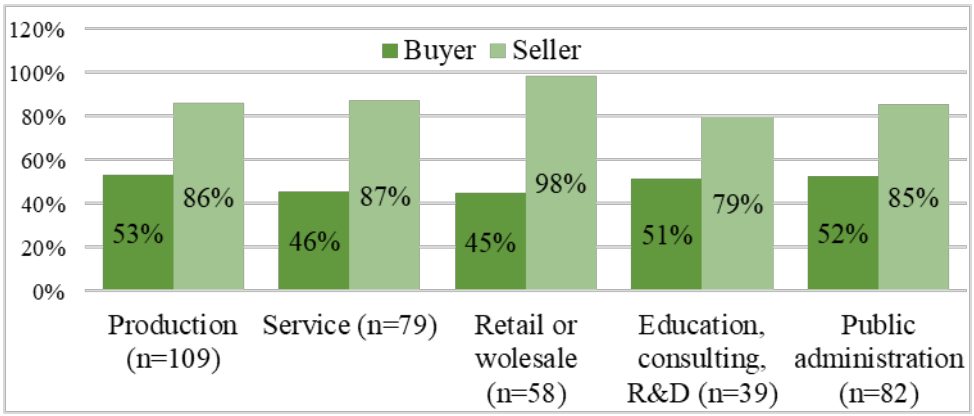


Figure 6: Desired role in the digital marketplace for the reuse of electronic devices by company type (n = 367)

When comparing companies using various types of electronic devices, it was found that all (100%) companies using agricultural electronic devices were interested in the role of a seller. Similarly, 92% of media production device users, 91% of hospital and laboratory device users, and 89% of security equipment users desired the role of the seller. The role of a buyer was most desired by users of agricultural devices (88%), measurement and testing devices (54%), media production devices (53%), and other industrial production or professional equipment (53%).

5. Discussion and Conclusion

Our research substantiates the proposed hypothesis, confirming that digital marketplaces significantly enhance circular economy practices in the electronic device sector. The analysis of over 400 companies indicated that these platforms simplify the buyer/seller matching process and are instrumental in facilitating device reuse. Companies valued the reduction in transaction costs and the exchange of crucial product information through these platforms, aligning with our hypothesis on their efficacy in improving circular economy efficiency.

The study explores the integration of circular economy principles and digital marketplace dynamics in electronic device reuse. Through a comprehensive survey, it identified strong business support for these practices, particularly the use of digital platforms for device recycling and reuse. Notably, businesses are actively incorporating circular economy actions into their daily operations. The marketplace is not only a transactional hub but also supports an ecosystem offering services such as legislative updates and consulting, proving vital for various company sizes.

This work has practical implications, demonstrated by Haaga-Helia University of Applied Sciences in Finland, which has leveraged these findings to pilot a digital marketplace for electronic product reuse, launched in 2022 with partner companies.

5.1 Managerial Implications

For managers and practitioners, this study emphasises the importance of integrating circular economy principles into business strategies, especially in the electronics sector. Adopting digital marketplaces for electronic device reuse aligns with sustainability goals and provides competitive advantages such as cost savings, improved brand image, and access to new markets. Managers should ensure these platforms are secure and user-friendly in order to facilitate broad adoption.

Digital marketplaces may be adopted by companies to support new business models and collaborative opportunities. Companies could adopt various roles within marketplaces such as, for example, service providers, certifiers, and information brokers. Collaborating with higher education and research institutions can advance sustainable reuse practices. The study stresses the need for ecosystem thinking in the electronics sector, promoting information sharing, and collaboration across individual stakeholders.

5.2 Future Research Potential

The research results suggest future investigation into digital marketplace design, including identifying key product categories for transactions, pinpointing business challenges they address, and understanding necessary services. It also explores the motivations behind companies' participation, paving the way for developing user roles and personas in order to engage a broader range of organisations effectively.

The intersection of circular economy principles with digital marketplace development offers fertile ground for further exploration. Future research could explore technological nuances, employing advanced data analytics, blockchain, and AI to boost transparency and efficiency, and examine consumer behavior regarding reused electronic devices. Cross-sectoral studies could assess the scalability of digital marketplaces across industries.

The study, originally focused on Finland and the Baltic countries, suggests expanding research to other European nations, integrating qualitative methods and service design with ongoing quantitative research.

In conclusion, digital marketplaces are transformative for the circular economy, serving as catalysts for systemic change by promoting device reuse. The study underscores the importance of innovation managers in fostering an ecosystem conducive to circular practices. This research not only highlights the operational and strategic requirements of circular economy digital marketplaces but also the collaborative efforts needed from all stakeholders to advance towards a more sustainable and resilient economy.

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Innovating Civil Engineering: Strategies for Fostering Stakeholder Engagement in the Circular Economy

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Abstract: Sustainability and circular economy principles are increasingly important in civil engineering, as highlighted by the United Nations Environmental Programme in 2023 the construction activities represented 36% of global energy use in 2020. However, the sector's focus on reducing operational carbon overshadows the need for addressing embodied carbon from materials like cement, steel, and aluminium. To address this, a shift towards incentivizing all supply chain stakeholders and cultivating collaborative models is necessary. This research provides an initial scoping for the development of the Lithuanian Construction Materials Reuse Optimization (LSEPO) platform, a pioneering regional initiative fostering a marketplace for reused building materials. Such platforms are recognized for their potential to overcome sustainability barriers by utilizing digital technologies for efficient data management and stakeholder collaboration. Our research identifies a significant gap in the existing literature concerning effective stakeholder engagement strategies critical for the success of such platforms. To bridge this gap, we employed a three-tiered methodological approach: firstly, a semi-structured literature analysis delved into existing stakeholder engagement strategies within the circular economy. This review highlighted a fragmented understanding of incentives and collaboration dynamics across different sectors. Secondly, a content analysis of global material exchange and circular construction platforms provided insights into best practices, showcasing successful communication methods, innovative incentive models, and robust collaboration frameworks. Lastly, integrating these findings, our study proposes a conceptual stakeholder engagement framework tailored for social innovation in civil engineering, more specifically Lithuanian Construction Materials Reuse Optimization (LSEPO).Practical implications of our findings underscore the necessity for platforms like LSEPO to incorporate adaptive engagement strategies that are context-sensitive and inclusive, facilitating a broad spectrum of stakeholder inputs. The study demonstrates that effective stakeholder engagement goes beyond traditional communication methods; it requires a systemic integration of technological innovation and incentive alignment to promote sustained participation and collaboration. By providing a comprehensive foundation for the development of the LSEPO platform, this research not only aims to advance it as a beacon of social innovation and environmental stewardship within the civil engineering sector but also sets a benchmark for future initiatives aiming to embed circular economy principles effectively.

Keywords: Circular economy, Civil engineering, Co-creation, Stakeholder engagement

1. Introduction

In the quest for sustainable civil engineering, the circular economy (CE) emerges as a central framework, underpinned by alarming environmental statistics and a pressing need for systemic transformation. The United Nations Environmental programme (2023) report underscores the construction sector's substantial share of global energy consumption, sitting at 36% in 2020, and a similar proportion of CO2 emissions. Beyond these figures lies a more granular challenge: the reuse of building materials. Despite over 90% of a building's content being potentially reusable, the World Economic Forum (2014) revealed that only a meagre 20–30% of these resources find a second life post-demolition. The pathway to resilience, therefore, hinges on reshaping production and consumption patterns towards a circular model—a transition that not only mitigates environmental impacts but also boosts socio-economic indices such as GDP and job creation (Hieminga, 2015).

As the CE gains momentum, digital platforms emerge as powerful tools in the push for sustainable civil engineering. Digital technologies hold the promise of revolutionizing waste management and recycling processes by enabling predictive analytics and optimization that are crucial for the CE. Kovacic et al. (2020) argue that these technologies not only facilitate the reduction of waste but also streamline its reintegration into the production cycle. The capabilities of digital platforms to ensure traceability and foster confidentiality, transparency, and reliability are invaluable in enhancing the efficacy of circular projects and minimizing their environmental footprint (Charef, 2022). However, there remains a substantial gap in fully engaging the diverse array of stakeholders involved in the construction industry's lifecycle. The development and success of online

platforms are inextricably linked to effective stakeholder engagement, a component that is still not sufficiently leveraged in the sector. Addressing this, our research pivots to a question that is both pertinent and pressing: *How can the construction industry better harness digital platforms to enhance stakeholder engagement, thereby facilitating the adoption of CE principles?*

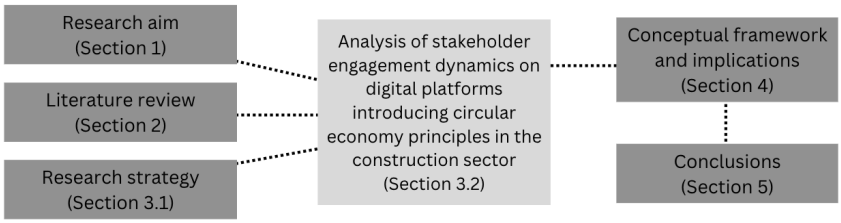


Figure 1: Logic of the inquiry

This inquiry delves into the current landscape of research, seeking to identify and bridge the gaps in stakeholder collaboration for a truly circular and sustainable built environment (see Figure 1). Through this exploration, we aim to articulate strategies that foster a more cohesive, informed, and proactive stakeholder community, which is vital for realizing the full potential of CE within civil engineering. The culmination of this research is to pave the way for the Lithuanian Construction Materials Reuse Optimization (LSEPO) platform, which aspires to become an example of social innovation and environmental responsibility, leading the civil engineering sector in Lithuania and the region towards a more sustainable and circular future.

2. Literature Review

The CE opposes the traditional linear economic model—a systemic shift advocated for by thought leaders in response to the unsustainable nature of current global consumption and production patterns. Historically, the global economy has been characterized by a linear "take-make-dispose" model, resulting in significant resource extraction, commodity volatility, and the generation of waste (Hieminga, 2015). The EC, conversely, proposes a paradigm where economic growth is decoupled from finite resource use, promoting the continual use of resources and minimizing waste. In the construction sector, however, the concept of CE remains nascent and fragmented. Various interpretations of CE exist (Kirchherr et al., 2017), and a coherent, universally accepted definition within the construction industry has yet to emerge (Adams et al., 2017). This has led to divergent initiatives, ranging from design for deconstruction, the hierarchy of construction and demolition waste management, to the development of secondary materials markets and urban mining. The transition to CE in construction is further complicated by a dichotomy in approaches: the top-down strategies led by policy and governance, contrasted with bottom-up initiatives steered by social innovation and grassroots movements (Munaro & Tavares, 2023). This dichotomy raises questions about the roles and responsibilities of various stakeholders in driving the sector towards circularity. Hence, understanding the heterogeneous landscape of stakeholder interests is paramount.

The investigations on the role of stakeholders in the CE within the construction sector is gaining prominence. Adams et al. (2017) identified a significant knowledge gap amongst key players such as customers, designers, and subcontractors concerning CE, highlighting barriers such as inadequate incentives for end-of-life design and unclear economic benefits. As Chinyio and Olomolaiye (2010) categorized, stakeholders can be internal, like project professionals and suppliers, or external like the public and government bodies, each wielding varying degrees of influence over organizational objectives and projects. The complexity of stakeholder relationships in construction projects is further magnified in CE due to the addition of roles such as demolition contractors and recycling plants, which contribute to a more complex supply chain network (Chen et al., 2022). Finally, Volk et al. (2019) developed a CE framework to encapsulate the intricate web of stakeholder interactions and material flows within construction, a domain often overlooked, impacting decision-making and policy formulation. This approach revealed that establishing clear communication channels and building trust between diverse stakeholders can foster stronger and more cohesive partnerships (Hart et al., 2019), which is essential for navigating the CE transition in construction.

The integration of information and communication technologies is recognized as a crucial enabler for CE within the construction sector (European Commission, 2020). They enhance information flow and communication among value chain stakeholders, a necessity for CE transformation identified by the Wuppertal Institute (Wilts & Berg, 2018). However, the role of specific functions of digital technologies in promoting circularity is still not fully understood (Wynn & Jones, 2022). The research gaps articulated by Wilts & Berg (2018) emphasize the

need for detailed information on the quality and quantity of secondary materials, the reduction of transaction costs, the consideration of externalities in pricing, and the integration of recyclability in product design. Addressing these gaps requires enhanced coordination among stakeholders and is critical for the successful implementation of CE in construction. Digital platforms (such as secondary material exchange platforms) are acknowledged as a important instrument for catalyzing stakeholder collaboration and accelerating the adoption of CE principles in the construction sector (Charef, 2022; Rodrigo, 2024). Yet, despite their potential, the dynamics of stakeholder engagement on these platforms remain underexplored in scholarly work.

Given the gaps in literature on stakeholder dynamics, several focal points for further analysis emerge: (1) *motivation for knowledge sharing and collaboration*: understanding the incentives for knowledge exchange is key to fostering collaboration (Adams et al., 2017). Platforms must provide robust systems for information sharing that align with stakeholders' interests and needs; (2) *collaborative decision-making functions*: identifying effective digital decision-making functions that can incorporate the diverse perspectives of the industry's stakeholders (Chen et al., 2022); and (3) *stakeholder engagement dynamics*: analyzing engagement strategies on digital platforms to determine their effectiveness in promoting CE practices within the sector (Hart et al., 2019). By addressing these three elements, the paper will explore the intricacies of stakeholder dynamics and their implications for advancing CE in the construction sector, aiming to inform the development of robust digital platforms that catalyze this shift.

3. Analysis of Stakeholder Engagement and Collaboration Strategies in Online Platforms

3.1 Methodological Approach to Platform Content Analysis

To ensure a nuanced understanding of stakeholder engagement best practices in the context of global material exchange and circular construction platforms, our study adopts a qualitative content analysis methodology. This approach is particularly suited for exploring complex phenomena within specific contexts, allowing for a rich, contextual comprehension of the core phenomena without striving for universal applicability. The qualitative content analysis method, as detailed by Kim and Kuljis (2010), enables the condensation of extensive raw data into meaningful categories and themes, fostering valid inferences and interpretations tailored to our research objectives. Our choice of this methodology aligns with its frequent application in studies that require an in-depth exploration of communication contents and stakeholder interactions, similar to ours. As Mayring (2004) suggests, this approach is inherently communications-centric, making it ideal for examining the dynamics of material exchange platforms. It provides a structured yet flexible framework to deeply explore the specific cases we have selected, which are crucial for gaining insights into the actors involved, the types of collaborative activities, and the pursued goals. Moreover, it allows us to discern and articulate the interconnections and synergies among various stakeholders effectively. By employing qualitative content analysis, our objectives are twofold: firstly, to extract and categorize critical aspects of stakeholder engagement, and secondly, to identify emergent patterns and synergies that may influence the effectiveness and sustainability of material exchange initiatives

Sample. In determining the selection criteria for material exchange and circular construction platforms, our study employs purposive sampling. This approach is necessitated by the inherent challenges in defining a complete universe of online platforms due to the absence of an obligatory registry for such operations. Consequently, constructing a strictly statistical frame for random sampling is unfeasible, aligning our methodology with the conditions described in studies like those by Pałka et al., 2024, and Bajaj et al., 2021, where similar methodological constraints are addressed. The platforms included in the study were selected based on the definition of material exchange platforms which encompasses platforms that enable stakeholders to connect and collaborate for material reuse and recycling (Wu et al., 2022; Caldera et al., 2020). The selection criteria for material exchange and circular construction platforms are as follows: (1) *interactivity* (platforms should foster open, inclusive, and collaborative engagement); (2) *contributors* (the platforms should be capable of involving a substantial number of participants); (3) *collective action* (platforms should facilitate collaborative actions among diverse stakeholders); (4) *data availability* (information about goals, metrics, and initiators should be publicly accessible on the platform's website) and (5) *sustainability impact* (platforms should demonstrate a measurable positive impact on sustainability, such as reducing carbon footprint, promoting energy efficiency, or contributing to the conservation of natural resources).

The selection was conducted through analysis of European Circular Economy Stakeholder Platform. The European Circular Economy Stakeholder Platform, launched in March 2017 by the European Commission and the European Economic and Social Committee, serves as a dynamic hub for stakeholders to accelerate the

transition to a CE in Europe through idea exchange, information sharing, and collaborative events including an annual flagship conference. The resulting sample of platforms together is presented in Table 1 below.

Table 1: Material exchange and circular construction platforms in the sample

Platform	Focus	Platform	Focus
SalvoWEB	Reclamation and re-use	Ecocycle	Construction demolition materials
BuildReuse	Construction and demolition waste	Restado	Reclaimed construction materials
Green Building Information Gateway	Green buildings	Circular Building Knowledge Platform	Circular buildings
Concular	Circular material flow	Rheaply	Resource utilization
Material reuse portal	Reuse of construction materials	Circular homes	Facilitation of circular renovations
Loopfront	Reuse of building materials		

Data collection procedure. Data collection began with the creation of a standardized data collection template (see Table 2 below). This template was segmented into (1) *motivation for knowledge sharing and collaboration*, (2) *collaborative decision-making functions* and (3) *stakeholder engagement dynamics* based on the insights of literature review on stakeholder engagement in CE. The team of researchers analyzed the content of the platforms, related websites and social media activity. Only publicly available data were collected for analysis. No information on the users of the platform were collected during the procedure. Data collection activities were conducted in the period from October, 2023 to January, 2024.

Table 2: Template for data collection

Element	Category	Subcategories & descriptions
Motivation for knowledge sharing and collaboration	Platform goals	The drive and incentives behind the sharing of knowledge and cooperative efforts, crucial for nurturing CE principles and sustainable practices in the construction sector.
	Key user/audience groups	User groups that are targeted for knowledge sharing and collaborative outreach (e.g., architects, general public, contractors, public officials).
Collaborative decision-making functions	Initiators and developers	Identify individuals and/or organizations that initiate decision-making systems i.e., who is in charge of the processes and what is the hierarchy of leadership.
	Strategic functions facilitating collective action	The environment or platform features that foster collaboration, like forums or project management tools. Subcategories like analytical tools, databases for material reuse, and BIM systems that aid in decision-making.
Stakeholder engagement dynamics	Engagement and collaboration strategies	Methods, processes and approaches that encourage trust-building and collaboration (e.g., transparency initiatives, stakeholder meetings, or community engagement strategies).
	Partnerships formed	Collaborative partnerships formed (e.g., joint ventures, industry-academia collaborations, or community projects).

Data analysis. Subsequent stages involved systematic coding of platform content and assessing the dynamics and design of the platforms based on the dimensions outlined in the Table 2. The coding was conducted using qualitative content analysis software Nvivo. A comparative analysis across the platforms then provided insights into best practices in stakeholder engagement and collaboration.

Limitations. While the methodology has been robustly designed, it is important to note its limitations. The heterogeneity of data available online presents challenges due to variability in content, semantics, and user interfaces. Additionally, the sample size, while curated, is not exhaustive and hence may not be fully representative of the broader landscape of such platforms.

3.2 Results of Platform Content Analysis

3.2.1 Motivation for knowledge sharing and collaboration

Understanding the incentives for knowledge exchange is key to fostering stakeholder collaboration. In this regard, the sample of material exchange and circular construction platforms is characterized by a diverse array of goals and objectives, ranging from the promotion of reuse and recycling to fostering collaboration and

community engagement. The objectives of the platforms, as outlined in Table 3, illustrate a commitment to collaborative value creation that extends beyond the traditional confines of economic gain. These platforms, by facilitating the exchange of reclaimed materials, providing analytics for green building, optimizing material flow through technological innovation, centralizing knowledge for circular construction, and offering digital tools for sustainable living, contribute to a broader value proposition. This proposition is multi-faceted, encompassing environmental stewardship, education, and community engagement, thus resonating with the missions of the respective organizations.

Table 3: Categories of platforms based on their core goals

Categories	Platforms in the sample	Description
Marketplaces for reclaimed materials	SalvoWEB Restado	Platforms in this category function as digital marketplaces that connect sellers and buyers of reclaimed building materials. They are pivotal in creating a supply chain for repurposed materials, thereby minimizing waste and encouraging the reuse of resources within the construction industry.
Green building analytics and reporting	Green Building Information Gateway (GBIG)	This theme encompasses platforms that aggregate and analyze data related to green building practices. They offer analytical tools for assessing sustainability metrics and facilitate the sharing of green building achievements, contributing to a data-informed approach in the construction sector.
Circular economy and innovation in material flow	Concular Ecocycle	Platforms under this umbrella utilize cutting-edge technology to optimize the lifecycle of building materials. Through innovative approaches such as artificial intelligence and proprietary recycling techniques, they support the CE by enhancing material traceability and reuse.
Centralized knowledge hubs for circular construction	Circular Building Knowledge Platform Material Reuse Portal	Included here are platforms that compile and disseminate information on circular construction. They act as centralized knowledge repositories, providing access to research, best practices, and policy information that underpins the shift towards sustainable construction methodologies.
Digital tools for sustainable living and construction	Circular Homes Loopfront	This category represents platforms that offer digital tools and resources for implementing sustainable and circular practices in living spaces and construction projects. They aim to empower stakeholders with the means to undertake environmentally conscious renovations and developments.

Additionally, based on the content analysis of the platforms in the sample, the audience and user base can be categorized into four pivotal groups, each contributing uniquely to the advancement of CE principles within the construction sector: (1) *construction industry professionals* form the backbone of these platforms, encompassing architects, builders, demolition contractors, and engineers who actively seek and list sustainable materials; (2) *regulatory actors and policy influencers*, including urban planners, local government authorities, and environmental NGOs, are integral to shaping the ecosystem; (3) *educational and research entities* such as universities and research institutions; and (4) the *end-users*, ranging from individual property owners and DIY enthusiasts to large corporate entities managing real estate portfolios. These groups represent within which circularity in construction is not merely an aspirational goal but an operational reality. The platforms in the sample showcase a synergistic network with heterogenous actors and resources is needed to push the industry toward a CE.

3.2.2 Collaborative decision-making functions

The architecture of decision-making and support systems within digital platforms for circular construction and material exchange reflects the leadership and vision that drives them. Understanding the entities behind these platforms is essential because their philosophy, strategic goals, and operational focus directly influence the way decisions are made and how the platforms are structured to support those decisions. The analysis of the platforms in the sample allowed to identify following groups of initiators/developers: (1) *visionary founders* are often individuals or small teams ignited by a passion for sustainability and circularity; (2) *dedicated non-profit organizations* emerge as a collective of like-minded individuals who, driven by a shared mission rather than profit, pool their resources and expertise to advocate for and implement circular practices; (3) *institutional developers* such as university labs, government-funded research projects, or initiatives backed by professional councils like the U.S. Green Building Council, harness academic rigor, policy knowledge, and a broad network of professionals to construct platforms that are rich in content and authoritative in their domain; and (4) *Corporate drivers* are companies like Holcim, which spearhead platforms with the aim of scaling circular technology solutions across global markets. The examination of digital platforms in the sample reveals a rich

diversity in the approaches to initiation and development, encompassing both grassroots, bottom-up movements as well as structured, top-down strategies. This diversity not only enriches the industry's capacity for innovation but also highlights the importance of tailored approaches that resonate with the unique contexts and stakeholders within the sector.

To fully grasp the transformative potential of digital platforms in fostering sustainability within the construction sector, it is also important to look beyond just the initiators and delve into the operational mechanisms these platforms employ. The ways in which they implement collective actions and drive the adoption of CE principles are as crucial as the vision that sparked their creation. Circular construction and material exchange platforms that have been studied demonstrate a variety of methods to galvanize collective action with Table 4 presenting a comparative view.

Table 4: Strategic functions facilitating the collective action

Platform	Matchmaking & marketplace	Educational & advocacy	Technological innovation	Community building
SalvoWEB	✓	✓		
BuildReuse		✓		✓
Green Building Information Gateway	✓	✓		
Concular	✓	✓	✓	✓
Material reuse portal	✓	✓	✓	
Loopfront	✓	✓	✓	✓
Ecocycle		✓	✓	
Restado	✓	✓		
Circular Building Knowledge Platform	✓	✓		✓
Rheaply	✓	✓	✓	✓
Circular homes	✓	✓		✓

Each function reflects a specific approach to catalysing collaboration and advancing the sector's objectives. More specifically, *matchmaking and marketplace* features create efficient channels between suppliers and consumers of reclaimed materials, fostering a transactional backbone that sustains the circulation of materials. In case of *educational and advocacy* functions, the efforts are made by the to not only share information but also to shape industry norms and influence policy, promoting broader adoption of circular principles and enhancing collective understanding and best practice dissemination. *Technological innovation* is another function identified which leverages cutting-edge technologies to bring transparency and efficiency to the lifecycle management of construction materials. Finally, *community building* activities are essential to forge and fortify the networks of practice and support, evident in platforms that offer collaborative forums and campaigns, strengthening the sector's social fabric and driving concerted action towards sustainability goals. Our findings highlight the diverse methods through which current platforms catalyse collaboration. Looking forward, there is a valuable opportunity to explore how these functions operate in practice, to refine them, and to innovate further. By doing so, future digital platforms can enhance their effectiveness in promoting the adoption of CE principles and in supporting the industry's transition to sustainable operations.

3.2.3 Stakeholder engagement dynamics

The content analysis suggests that the strategies for stakeholder engagement are not monolithic across these platforms; rather, they are as varied as the stakeholders themselves. After the analysis of platform content, our research group consolidated engagement and collaboration strategies of circular construction platforms into (1) *community and trust*: strategies that cultivate a cohesive user community through trust-building measures, such as codes of conduct and active engagement on social media. These methods aim to foster a sense of shared purpose and commitment to circular principles among all participants; (2) *education and resources*: this include efforts to develop and disseminate educational content, such as wikis, forums, and training programs. The focus is on empowering stakeholders with the knowledge and tools necessary to implement and advocate for circular construction practices effectively; (3) *policy and advocacy*: strategies

under this category aim to influence policy and promote industry collaboration. They involve engagement with policymakers, industry leaders, and other key stakeholders to align regulatory frameworks with the goals of the CE and (4) *technological empowerment and accessibility*: platforms leverage digital tools to facilitate stakeholder participation in the CE. This includes intuitive online marketplaces, digital documentation of materials, and platforms that provide clear insights into the environmental and economic impact of users' activities. These categories represent a strategic approach to engaging various stakeholders in a way that promotes collective action and supports the overarching mission of transitioning to a circular construction economy. Each platform's decision-making and support systems reflect an understanding that stakeholder engagement is not a one-size-fits-all solution. The diversity in approaches demonstrates a tailored approach to involving stakeholders in meaningful ways.

Finally, in the realm of circular construction and material exchange platforms, strategic partnerships play a vital role in expanding capabilities and enhancing the impact of these initiatives. Platforms have formed alliances across a broad spectrum of stakeholders, including salvage yards, consulting firms, sustainability experts, and academic institutions, each contributing their specialized knowledge and resources. These collaborations span from grassroots community organizations to high-level industry consortia, reflecting a commitment to shared CE goals. They include partnerships with technology providers to refine platform infrastructures, joint ventures with construction and demolition firms to optimize material reuse, and connections with policy entities to shape sustainable practices. Collectively, these alliances embody a concerted effort to integrate circular principles into mainstream construction processes.

4. Conceptual Framework and Discussion

The content analysis in the realm of circular construction and material exchange platforms highlights the necessity of customizing engagement strategies to the context and needs of diverse set of stakeholders. These findings resonate with prior research on stakeholder engagement in sustainable CE (e.g., Kujala et al., 2023; Re & Magnani, 2023). Based on insights outlined in the previous sections, the research team developed a conceptual framework focused on stakeholder engagement in the circular construction and material exchange sector (see Figure 2). The framework is based on series of stages that reflect the evolution and deepening of relationships between platforms and their stakeholders. These stages reflect the platforms lifecycle—from inception and community formation to growth and systemic impact—mapped against the types and levels of stakeholder engagement revealed by the data.

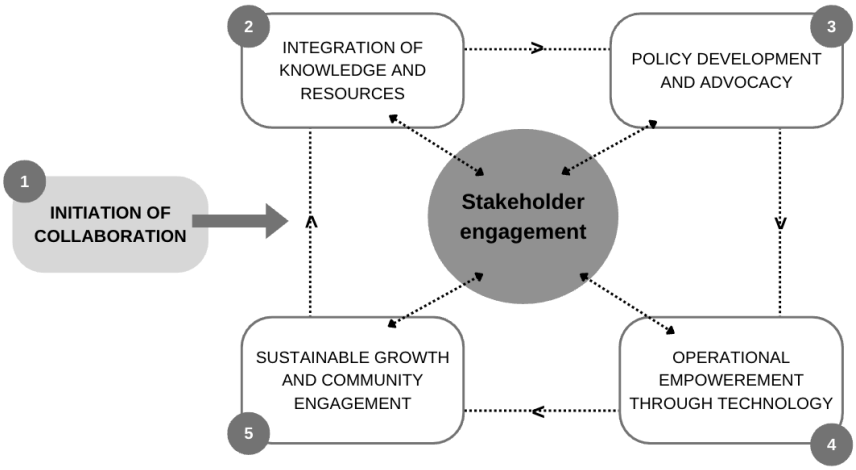


Figure 2: Conceptual framework for platform development

The stages of this framework mirror the lifecycle of platforms from their inception through to their systemic impacts, aligning with the lifecycle patterns and stakeholder engagement levels identified through our data analysis. This framework is deeply informed by the broader CE principles discussed in the literature review, including the shift from a linear to a circular model as advocated by thinkers like Hieminga (2015) and the varied interpretations and applications within the construction sector as examined by Kirchherr et al., 2017, and Adams et al., 2017.

- Initiation of collaboration: at this foundational stage, platforms establish trust with key stakeholders such as salvage yards and sustainability firms, which is critical as highlighted by Hart et al. (2019), who

note the importance of trust in fostering strong and cohesive partnerships. This stage involves setting up codes of conduct and community forums, essential for supporting future sustainable practices as seen in models discussed by Adams et al. (2017).

- Integration of knowledge and resources: this stage leverages educational content and training to enhance stakeholder capacity, akin to the approaches of platforms like BuildReuse. It reflects the necessity for continual resource use and minimal waste generation in CE, a concept outlined by the European Commission (2020).
- Policy development and advocacy: engaging with policymakers and influencers to shape the regulatory landscape marks a mature phase of engagement, aiming to effect systemic change—a strategy aligned with the top-down approaches discussed by Munaro & Tavares (2023).
- Operational empowerment through technology: utilizing technology to make participation in circular practices more efficient and scalable connects directly to the role of ICT as an enabler for CE as identified by Wilts & Berg (2018). Platforms enhance functionality through partnerships with technology providers, a crucial element for integrating recyclability in product design and reducing transaction costs.
- Sustainable growth and community engagement: this final stage involves expanding reach through strategic partnerships and fostering a community ethos, driving collective action toward sustainability goals. This stage embodies the bottom-up initiatives and the community-driven approach to CE transition discussed by Charef (2022) and Rodrigo (2024).

The theoretical implications of this framework highlight the essential nature of stakeholder engagement in driving the CE transition, particularly in the construction sector, where complexity and fragmentation often slow progress. Practically, this framework serves as a guide for digital platforms aiming to facilitate CE, providing a structured approach to stakeholder engagement that is vital for overcoming the barriers identified in the literature review. By addressing these, the framework contributes to closing the significant knowledge and practice gaps in the sector. More specifically, the proposed conceptual framework paves the way for the Lithuanian Construction Materials Reuse Optimization (LSEPO) platform, which aspires to become an example of social innovation and environmental responsibility, leading the civil engineering sector in Lithuania and the region towards a more sustainable and circular future. The emphasis is on cultivating an inclusive community from the start, as this underpins stakeholder buy-in and ensures the platform resonates with its user base.

5. Conclusions

This paper has offered a first look into the intricate dynamics of stakeholder engagement on circular construction and material exchange platforms. The findings highlight the diversity of engagement approaches, stressing the importance of customizing strategies to stakeholders' varying needs and contexts. This customization is paramount, as it ensures that platforms do not just exist as mere transactional hubs but evolve into ecosystems where knowledge, resources, and collaborative endeavors flourish. The research underscores the roles that different stakeholders play in this ecosystem, from material suppliers to policymakers, and from grassroots participants to corporate entities, all contributing to a shared vision of circularity and sustainability.

The paper proposes an actionable framework that delineates the evolving stages of stakeholder involvement, from the initial building of trust to the establishment of robust communities aimed at driving sustainable growth. This framework, distilled from a thorough content analysis, serves as a guiding instrument for the strategic development of platforms like LSEPO, paving the way for their adoption and impact within the circular construction landscape. By leveraging this framework, future platforms can harness the full potential of digital technologies to foster the principles of the CE in the construction sector. It invites future exploration into the functions and operations of such platforms, calling for a deeper understanding of how digital engagement can catalyze industry-wide change. Ultimately, this research serves as a stepping stone towards more comprehensive investigations that aim to bridge the current gaps in the literature and provide practical solutions for advancing sustainable practices within the construction industry.

This paper calls for future research to delve deeper into the operationalization of these functions and to explore the dynamic interplay between various stakeholders. Strategic partnerships, as showcased by the platforms, are pivotal for expanding capabilities and advancing CE principles. The research underscores the significance of these partnerships in fostering innovation, sustainability, and community engagement, ultimately contributing to a more resilient and circular construction industry.

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The Process of Ecosystem Emergence for an Enabling Technology: The 5G Case

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Abstract: This study aims to investigate how the process of ecosystem emergence occurs with the advent of 5G technology, focusing on the challenges and opportunities for Mobile Network Operators (MNOs) in the enterprise market. For this purpose, an exploratory and qualitative multiple-case study was conducted, involving key players in the Italian 5G industry. The research analyses the roles and interactions necessary for creating a 5G ecosystem, emphasising the importance of cooperation among numerous stakeholders due to the complexity and specificity of 5G applications. The results indicate that 5G can be defined as an Enabling Technology (ET), However, it is still lacking the pervasiveness in terms of wide applicability associated with General-Purpose Technologies (GPTs). The successful development of a 5G ecosystem requires dual co-orchestrators: MNOs and intermediaries. MNOs alone are unable to properly manage the ecosystem due to the diverse and specific nature of 5G applications. Intermediaries by their side, provide essential technical and business expertise, supporting MNOs in creating value across various sectors. The study provides insights into the evolution of business models for companies leveraging 5G technology. It emphasises the need for strategic collaboration among stakeholders to maximise the potential of 5G, offering guidance for businesses on how to adapt and thrive in this emerging ecosystem. The originality of this study lies in its integration of two literature streams, the ecosystem one and the enabling technologies one. This research contributes to both literature streams by highlighting the co-orchestration model necessary for 5G. It underscores the challenges and characteristics of orchestrating an ecosystem driven by enabling technology, offering valuable perspectives for both academia and industry practitioners.

Keywords: 5G technology, Enabling technology, Ecosystem emergence, Orchestrator

1. Introduction

The fifth generation of mobile networks (5G) not only offers incremental performances to its predecessor 4G, but also opens possibilities for applications in the B2B market, unlocking multiple opportunities for both the offer and the demand sides. 5G, which can be considered an enabling technology (ET) (Teece, 2018; Gambardella et al., 2021), is struggling with its adoption, especially in the enterprise market, where it promises numerous opportunities but use cases with clear benefits have not been found yet. MNOs, the long-standing focal players in the telecommunications industry (Gooderham et al., 2022), are struggling to propose 5G business solutions, even if they are the actors supposed to drive this technology's adoption, especially in some countries, like Italy, where they own the main source of value for the system (e.g., 5G network frequencies' licences in mid-band 3.6-3.8 GHz). Yet, the 5G environment is complex, characterised by multiple players engaging in overlapping activities.

This complexity suggests that 5G business solutions could be developed through an ecosystem. Given its status as an ET, 5G can be applied across various verticals, yet MNOs often lack the specific competencies required to meet the demands of these diverse applications. The existing ET literature is sparse, particularly regarding how inventors and vendors of such technologies can create and capture value (Gambardella et al., 2021). While these technologies have traditionally been studied from a macroeconomic perspective, there is a growing interest in their strategic implications (Conti et al., 2019).

In recent years, ecosystem literature has increasingly focused on how companies adopt new technologies and the importance of co-creating value (Jacobides et al., 2018). Despite this, empirical investigations into the orchestration mechanisms in ecosystem emergence remain limited (Jacobides et al., 2018; Lingens et al., 2021; Thomas et al., 2022). This gap in the literature underscores the need to explore how the process of ecosystem emergence occurs in 5G technology.

Therefore, this study aims to analyse the emergence of the 5G ecosystem and to investigate the mechanisms of value creation and capture within this context. By integrating insights from the literature on ET and ecosystems,

this research seeks to provide a comprehensive understanding of the 5G ecosystem's structure, the roles of different actors, and the dynamics of their interactions.

To address this, the study poses the following research questions: How does the process of ecosystem emergence occur in the context of 5G technology? What roles do various actors play in the 5G ecosystem, and how do these roles evolve?

This study is original in its approach, combining two distinct literature streams, the one on ET and the one on ecosystems, to explore the strategic adoption of 5G. Unlike previous research that often focuses on discrete technologies targeting specific uses (Kapoor & Lee, 2013; Hannah & Eisenhardt, 2018), this paper examines 5G as a multifaceted ET with broad applications across various industries.

The main contributions of this study are manifold. First, it provides a framework to explain the mechanism of ecosystem emergence in the 5G context. Second, it offers a detailed representation of the 5G ecosystem, giving also practical insights for MNOs and other stakeholders on how to effectively navigate and leverage it. Finally, this study enhances the theoretical discussion on enabling technologies and ecosystems, contributing to academic knowledge of the two literature streams.

2. Literature Review

2.1 5G as an Enabling Technology

The concept of General-Purpose Technologies (GPTs) was introduced by Bresnahan & Trajtenberg in 1995, defining them by three key characteristics: pervasiveness, ongoing technical improvement, and enabling complementary innovations in various application sectors. Essentially, GPTs have a profound impact on the entire economy, continuously improve, and inspire innovations across diverse fields (Teece, 2018). The difference between enabling technologies (ET) and GPTs is the fact that the former are upgradable, adaptable technologies with widespread applicability but no measurable economy-wide impacts (Teece, 2018).

5G technology is widely recognised by scholars as an ET (Teece, 2018; Rathje & Katila, 2021; Adner & Lieberman, 2021). To become a GPT, 5G must become pervasive in use in multiple markets since the emergence of 5G is not solely confined to the telecommunications industry; rather, various vertical industries are poised to leverage wireless communication (Dolgui & Ivanov, 2022). In this context, it becomes imperative to pay closer attention to opportunities that extend beyond MNOs, even if they are the historical focal actor supposed to drive this technology's adoption (Ghezzi 2012; Ghezzi et al., 2015), especially in some countries where they own the main source of value for the system (5G network frequencies' licences in mid-band). According to Knieps & Bauer, 2022, the telecommunication ecosystem has become less MNOs-centric, and it encompasses a wide range of stakeholders with diverse goals and interests.

2.2 Interconnected Business Model and Business Ecosystem

The essence of the business model is to define how the company creates value, captures it and profits from its products or services (Teece, 2010). Scholars emphasise that the shift to interconnected business models offers a multi-level perspective, enabling analysis ranging from individual firms to broader network interactions, thus highlighting the intricate value architectures within commercial relationships (Jocevski et al., 2020). Furthermore, the interconnected business model perspective acquires particular significance when considered in relationship with digital technologies (Nylund et al., 2022). The "interconnected Business model" concept is closely related to previous discussions on business ecosystems and value networks (Jocevski et al., 2020).

Value networks can be seen as a system of interconnected and interplaying BMs of different firms operating in the industry (Ghezzi, 2013). Indeed, with the value network concept, value is co-created by a combination of players (individuals, groups, or organisations) in the network (Ghezzi et al., 2009; 2013). The ecosystem could be defined as a network of organisations that jointly create an innovative value proposition for the client that a single firm could not offer by itself (Lingens & Huber, 2021).

In the recent literature, value networks and ecosystems are treated by some scholars almost as synonyms (Clarysse et al., 2014), while others try to evidence differences between the two structures. Indeed, while an ecosystem can be visualised as a network, it stands apart due to its potential to span across various sectors and the presence of a set of distinctive, asymmetrical connections that are established at the group level by specific complementarity (Jacobides et al., 2018). Finally, some other researchers see the ecosystem concept as an evolution of a value network (Cavallo et al., 2021). Regarding value creation and capture processes, while constructs as value networks place emphasis merely on value creation, the ecosystem one focuses also on the

"demand side" and value appropriation (Cavallo et al., 2018). Indeed, within an ecosystem, value is collaboratively created, captured, and distributed to optimise the total value gained and allocated, benefiting not just the focal firm but also all participants within the ecosystem (Yrjölä et al., 2022). A point of contact between the two literature streams is the orchestrator figure, which is mentioned and considered crucial for the development of both value networks (Dellyana et al., 2018) and ecosystems (Adner, 2017), especially in the case of ecosystem emergence, where misalignment between the actors involved may generate high transaction costs (Cavallo et al., 2018; Thomas et al., 2022)

Therefore, a comprehensive analysis of this actor becomes essential when deep-diving into discussions about value networks and especially ecosystems. This involves exploring the specific role the orchestrator plays within the ecosystem and identifying potential actors capable of taking this role. Lingens & Huber (2021) highlighted that the orchestrator is the actor in charge of defining partner activities, with the most extensive overall view of the ecosystem, and the player capable of favouring alignment within an ecosystem as well as ensuring fair value sharing and proper value creation.

3. Methodology

The research is based on a multiple-case study (Eisenhardt, 1989) for investigating the process of 5G ecosystem emergence. One of the opportunities enabled by 5G is the establishment of 5G Mobile Private Networks (5G MPN). These networks comprise dedicated wireless infrastructure utilising 5G technology to furnish tailored and secure communication services for specific organisations or entities in different verticals (es. Manufacturing, Logistics, Healthcare). However, even though it represents a first concrete opportunity that does not require public coverage (which might require public funding intervention for implementation, considering the geographical extension and the type of investment), the market in Italy is currently stagnant. There are only a few proactive pioneering companies from different verticals that are investing to implement use cases. Moreover, 5G technology adoption signifies an important shift in the traditional value chain structure, requiring a high degree of collaboration among various entities. The exploratory multiple-case study approach included direct interviews with eight employees who worked on 5G at a strategic level within their company, representing three of the many types of actors present in the 5G B2B context: IT integrators, technology vendors and end users. It has been taken the choice not to include MNOs in the interviews since secondary sources and informal speeches regarding their role were exhaustive and consistent in outcomes. The companies were selected because they had already been involved in 5G B2B projects. Interviews were carried out during the solar year 2023 and the scripts were validated with industry experts before conducting the interviews. After having collected a significant number of quotes and data from 11 semi-structured interviews and more than 20 secondary sources (collecting 140 pages of transcripts and 527 minutes of interviews), a systematic analysis was conducted. A within-case analysis was carried out to gain familiarity with the data, and then a cross-case analysis was useful for comparing all the information gathered (Eisenhardt, 1989). Subsequently, quotes were grouped in first, second and overarching dimensions (Figure 1). Taking together the analysis based on informants' codes (1_{st} order) and the one rooted in academics-based themes (2_{nd} order), permitted a qualitatively rigorous illustration of the connections between data and the research topic (Gioia et al., 2013). Regarding the case selection, according to the Eisenhardt method, there is no rule about the number of cases selected (Eisenhardt, 2021), rather the selection must be driven by the possibility of observing the phenomenon under research. Here below the coding tree obtained from the interviews is reported (Figure 1).

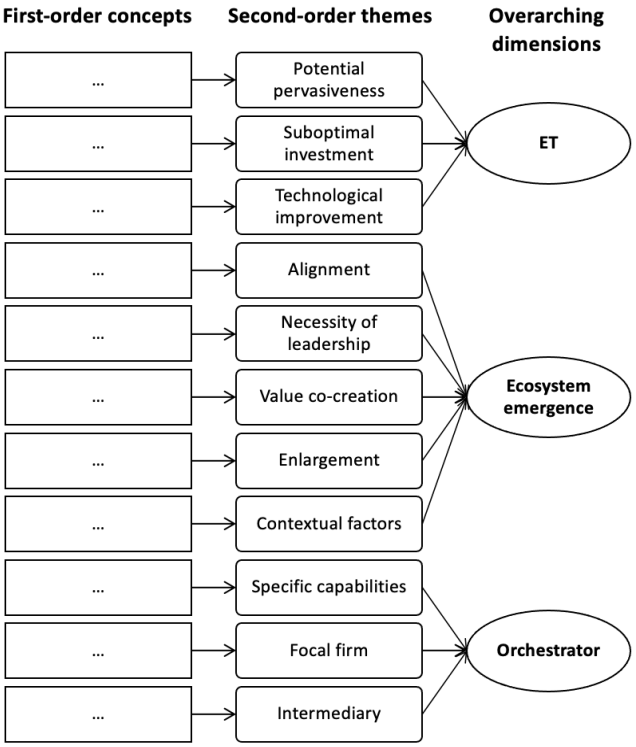


Figure 1: Coding tree structure

4. Findings

4.1 Enabling Technology

Practitioners unanimously recognise 5G as an ET, which facilitates novel solutions previously unattainable with other technologies, particularly in the enterprise sector. 5G enables the realisation of different deployments which are specific industry by industry. Based on what emerged from the interviews, it was possible to group the main activities needed for 5G deployment into three different layers: network infrastructure layer, network function layer, and service development layer. The first two include activities related to the physical deployment of the network, network hardware and software components, and network provisioning, which in the Italian case is only accessible by MNOs. The service development layer concerns all activities for providing connectivity and value-added services. As shown in Figure 2, although MNOs are the traditional focal actor of the industry, due to the numerous applications that 5G promises related to its ET nature, they don't possess all the complementary assets (both tangible and intangible) needed in the Service Development layer to manage the value proposition of the ecosystem. As mentioned by practitioners: "*It is the MNO who holds all the technology and infrastructure part, and so it is the one who can certainly be a bit of a leader, but it does not have the skills perhaps of others to provide solutions that are perfectly all-round*" (Network Architect 5G Network Solutions, IT Integrator 1). This is also evident from what end users have said, as they are proactively developing the first 5G MPN (Multi-Party Network) projects. The red arrows indicate that the flow of innovation originates from them, demonstrating that the value proposition is not as clear-cut.

4.2 Ecosystem Emergence

Considering that there is not a clear 5G value proposition and the actor's role is not defined, the 5G ecosystem is still in an emerging phase. This is recognised also by interviewees, especially concerning the fact that end users are proactively experimenting with 5G to understand how to leverage it. Due to the actual inability of the traditional focal firm to work alone due to the necessity of several complementary assets which differ among the different verticals, which is a new situation compared to the previous 3G and 4G technology, multiple actors need to collaborate to create value together. However, it is evident that, at the moment, the different players are not fully aligned. Therefore, the ecosystem lacks a single company acting as a leader which can align the different players towards a common value proposition and show end users solutions with an actual return on 5G investments. As stated by practitioners: "Probably the real problem is that there is no leader." (Senior Director, Technology Vendor 1).

4.3 Orchestrator

The proactive companies experimenting with 5G solutions would prefer a single contact point rather than many. However, none of the stakeholders involved have both the required business and technology competencies and all the other complementary assets needed. Who has the key resource (mid-band licences) struggles to be the sole orchestrator because 5G represents such an innovative technology that it is even difficult to design the correct value proposition oriented to value-added services rather than "just" connectivity. As mentioned by practitioners: "*The ability to translate business needs into technology requirements needed for the infrastructure is perhaps the biggest challenge MNOs have, because they are used to sell SIM connectivity*" (VP, Division Director - Communications, Media & Services, IT Integrator 2). Thus, there is an overlap between those who own the technology and the actual orchestrator, which, instead, appears as a dyad of actors. From the end user standpoint, among the actors with whom there have been the most interactions, two players have been recognised as possible orchestrators for the 5G ecosystem: the MNO, and the IT integrator. While the MNO is essential for every 5G project because it owns the network licences and has deep technology competencies, it is argued that it does not hold the necessary business capabilities to offer specific vertical solutions targeting end users' requirements. Even though recently telcos have been trying to acquire these competencies, they are struggling to do so because they have been focused on providing "just" connectivity. However, the real value coming from 5G adoption concerns the possibility of enabling several "value-added services" that end users still struggle to understand on their own, as just mentioned. Nevertheless, some interviewees recognise IT integrators as natural orchestrators since they possess technology competencies and complete business knowledge to cover the requirements of the different industries. However, also in this case their resources and competencies are not enough, due to the ET nature of 5G.

5. Discussion

Results revealed the chaotic actual situation in the 5G B2B context (Figure 2). There is overlap in value creation activities since different actors are trying to propose solutions, offering multiple services, also out of their core competencies. This perhaps is a symptom of the fact that there is confusion about the various possible 5G applications, and that supply and demand are struggling to find alignment, being the value proposition not clearly defined.

As stated in the literature, the missing element crucial for the emergence of ecosystems is alignment, which should be provided by the orchestrator, an actor also in charge of ensuring proper value creation (Lingens & Huber, 2021; Thomas et al., 2022). At the same time, findings suggest that the 5G B2B context is missing an actor with both deep technological and business competencies that can connect demand and offer and provide a solution which shows a real return to end users. This player, given the wide applicability of ET, should also have a specific understanding of multiple industries. According to interviewees, this firm would be the ideal orchestrator, however, no one seems to hold all the necessary characteristics.

Within ecosystems, the actor expected to be the orchestrator is the focal firm (Mann et al., 2022). In the empirical setting, this player is the MNO, since it stands in a central position, is linked to almost all the actors, and holds the main source of value (Cavallo et al., 2021). However, MNOs, even if they have all the necessary technology requirements, are missing vertical domain competencies to understand the context of the client and propose customised solutions to end users, especially because 5G is targeting multiple sectors. As evidenced by Stonig et al. (2022), in certain cases focal firms need to engage in organisational change to promote ecosystem creation. Results showed that MNOs have been trying to acquire business competencies, however, they struggled a lot and have not succeeded yet. The collected data suggests that the orchestrator role in the 5G ecosystem could potentially be assumed by intermediaries (es. IT integrator) because of their expertise in defining a list of use cases in the vertical target. However, these players do not own the key resources and do not possess specialised technology capabilities. As evidence, interviewees noted that the orchestrators from a technological standpoint are the MNOs, while from the business capabilities are the IT integrators. The MNOs can be referred to the focal firm, the intermediaries, as the co-orchestrators, as they establish and mediate relationships while bridging diverse knowledge, competency, and capability gaps (De Silva et al., 2018).

A tidier setting (Figure 3) emerges with respect to the actual situation, driven by the centralization of orchestration activities in the hands of two players, MNO, the focal firm, and an intermediary company.

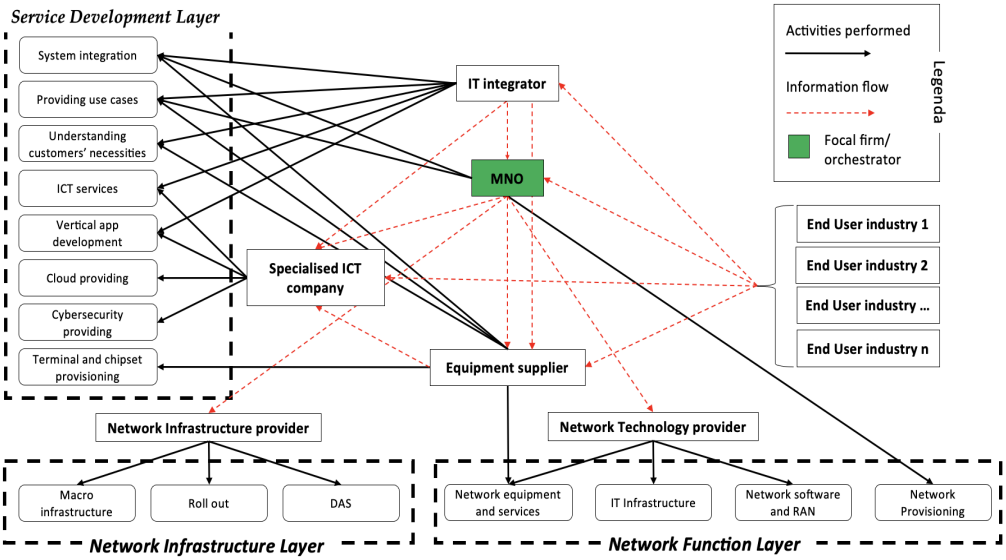


Figure 2: Actual 5G environment framework

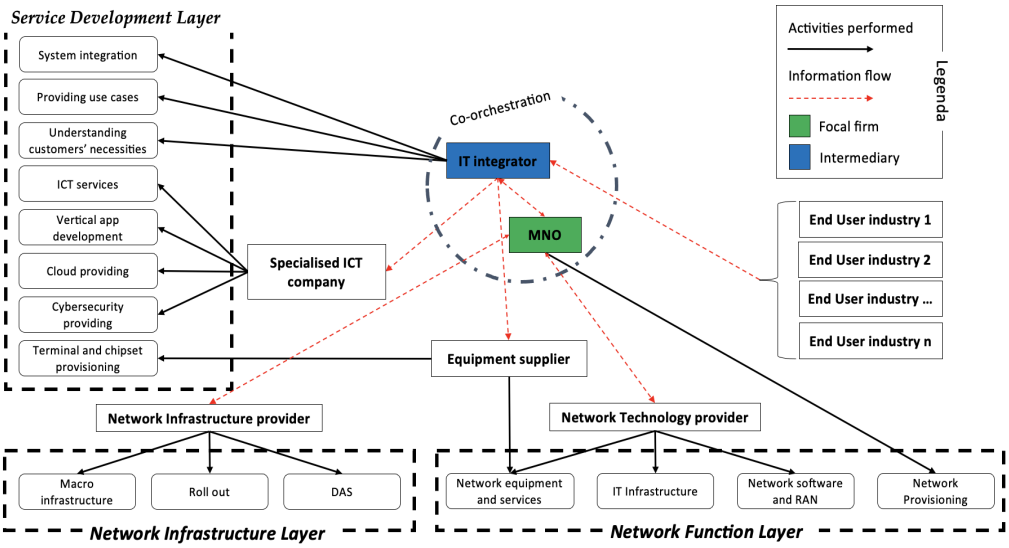


Figure 3: 5G ecosystem framework

5.1 Theoretical Contributions

The theoretical contributions of this research are manifold. First, this investigative empirical study contributes to the 5G managerial literature by providing modelling of the 5G ecosystem, corroborating existing studies (e.g. Teece, 2021; Bauer & Bohlin, 2022). Moreover, it provides the 5G managerial literature with a work that doesn't deal exclusively with the 5G technicalities, but the strategic adoption of such ET. Second, the research contributes also to the ecosystem and ET literature by showing that in an ecosystem based on an ET, due to the wide range of applicability, there is a lack of overlap between those who own the technology and the actual orchestrator since a single firm is not capable of taking on the role of orchestrator alone, but it needs to be supported by an intermediary. The focal firm, indeed, does not have all the capabilities to take the lead and, to promote ecosystem creation, needs either to engage in organisational change (Stonig et al., 2022) or to be supported by an intermediary. This actor, which has responsibility for connecting parties for collaboration (De Silva et al., 2018) and is characterised by cross competencies, can collect information from the customer, understand its needs and create tailored exhaustive solutions. In particular, a dyad of co-orchestrators is needed since overall, they hold the critical asset for the system and the alignment capabilities needed for the ecosystem to emerge. Indeed, for ETs it is important to provide the technology while knowing the multiple industries where it can be applied to foster cross-contamination among them.

Finally, this is also one of the few studies that examine the strategic adoption of an ET from an ecosystem perspective, considering that most publications regarding the structural alignment of a multilateral set of collaborating partners have often focused on discrete technologies (e.g., Kapoor and Lee, 2013; Bohnsack et al., 2024)

5.2 Practical Contributions

Managers and policymakers can benefit from this study in many ways too. To use ET effectively, firms must evolve their business models, focus on their core competencies, and accept their roles in the ecosystem by cooperating with other actors. MNOs should know it is more convenient for them, and preferred by the end user, to cooperate with IT integrators instead of offering end-to-end solutions. Furthermore, IT integrators should understand that it is impossible for them to autonomously orchestrate the ecosystem when they miss the critical resource. From the end user perspective, it emerges that, except for peculiar cases, it is convenient to refer directly to IT integrators, given the potential applications of an enabling technology are uncountable. Moreover, it is highlighted that what is slowing down the optimal commercialisation of 5G is not just technological improvement, but the lack of alignment of the various players from a business strategy perspective.

5.3 Limitations and Future Research Avenues

Given the limited existing literature on the subject, it was chosen to use an exploratory approach employing multiple case studies. Such qualitative research is potentially biased by the interviewer's or interviewee's interpretations, which might distort the final outcomes (Yin, 1984). Future research could analyse quantitatively with longitudinal data how ecosystem emergence occurs with ET. Furthermore, because of the limited data collection, while it has emerged that both actors are necessary to foster the development and adoption of ET, it has not been investigated how the two co-orchestrators can share the created value, introducing new challenges regarding the capture of value from these actors.

Moreover, the research is largely confined to a specific case, and the results may be closely tied to the unique characteristics of the selected context. Accordingly, conducting other research on actual ET could be an interesting avenue for confirming the takeaways of this investigation. Analysing these different technological landscapes might serve as an integrative approach to verify and expand the insights that emerged from this study, thereby enhancing the strength and generalizability of the conclusions.

6. Conclusions

This study examined the development of an ecosystem based on an ET. Driven by a lack of academic research on ecosystem emergence, this study offers a novel analysis of an ET from an ecosystem perspective through an exploratory case study. Qualitative research was conducted using multiple case studies on eight companies within the 5G context. The interactions among these companies were investigated to understand the dynamics of the emerging ecosystem. The key finding is that, in the case of an ecosystem based on an ET, the focal firm does not succeed in becoming the orchestrator alone, because it lacks familiarity with the end user’s business models, processes and specific context comprehension. Therefore, given the large breadth of applicability of an ET, there should be intermediary firms as co-orchestrators.

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The Strategic Adoption of 5G Technology From a Business Model Perspective

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Abstract: Even if 5G is considered an enabling technology, its transformative potential and widespread adoption remain limited. This paper explores how Mobile Network Operators (MNOs) innovate their business models by leveraging 5G. Through an exploratory multiple-case study of Italian MNOs, key determinants concerning innovation in value proposition, creation, and delivery are obtained inductively from interviews and grouped into different 5G business model archetypes. These latter are "Advanced connectivity provider", "Vertical Service Provider", and "Orchestrator". The first focuses on offering 5G as an enabling technology on which end users can build their own applications. The second selects target industries and allows access to a specific service. The third doesn't own specific knowledge but it acts as the intermediary between a customer and a capable partner's network, ensuring that the project is carried out and targeting multiple verticals. The research provides both theoretical and practical contributions: from a theoretical standpoint, it contributes to the business model innovation literature by offering empirical work that investigates the strategic adoption of a new technological paradigm focusing on the architecture of the business model rather than a measurement of performance afterwards. Moreover, it contributes to the 5G literature with an empirical study that focuses on the strategic implications of the phenomenon rather than just the technical aspects, and to the enabling technology literature by offering a study that examines an enabling technology from a firm-specific perspective. From the standpoint of practitioners, it can offer managerial guidance on developing suitable 5G business models to promote technology adoption and maintain competitiveness by harnessing the potential applications envisioned with 5G.

Keywords: 5G technology, Business model innovation, Mobile Network operator, Enabling technology

1. Introduction

Advanced connectivity, especially 5G, is the pillar of digital transformation. The fifth generation of mobile networks (5G) not only offers incremental performances compared to its predecessor 4G, but also opens up possibilities for applications in the B2B market, unlocking multiple opportunities for both the offer and the demand sides. 5G has been recognized by scholars as an enabling technology (ET) (Teece, 2018; Rathje and Katila, 2021) and estimations suggest that focusing on its development in key sectors such as mobility, healthcare, manufacturing, and retail could lead to a substantial boost on the global GDP, with a potential increase up to $2 trillion by 2030 (McKinsey & Company, 2022). Therefore, the deployment of 5G may necessitate a shift in the attitudes of telecommunications stakeholders, particularly Mobile Network Operators (MNOs) (Cave, 2018; Lehr et al, 2021; Gooderham et al, 2022), who have traditionally held pivotal roles in the telecommunications sector (Ghezzi et al, 2010; Ghezzi et al, 2015). With the advent of 5G, MNOs can change the trajectory of their business model development, especially considering the ongoing price competition in the traditional consumer market, thus unlocking a multitude of possibilities. This becomes especially pertinent considering the potential deployment of private, standalone 5G networks across various industry verticals (Lehr et al, 2021).

However, both from a theoretical and practical standpoint, the prevailing approach to understanding the multifaceted nature of 5G has primarily been technology-centric. Furthermore, only a limited number of scholars have examined Emerging Technologies (ET) from a firm-specific perspective (e.g., Gambardella et al, 2021; Teece, 2018). Therefore, through an exploratory multiple-case study approach with the key informants of Italian MNOs, this paper aims to bridge this gap, offering contributions to both theory and practice. The research provides three business model archetypes related to MNO's 5G business model innovation configurations which contribute both to the managerial literature of 5G technology, as well as the literature about ET and Business model innovation (BMI). Practically, it improves managers' awareness and understanding about 5G strategic implications on a company.

The structure of the paper is as follows: In the second section, a literature review concerning 5G technology the literature about 5G MNOs' business model innovation is presented. In the third paragraph, the methodology used to answer the research question is reported. The findings are outlined in Chapter 4, followed by the discussion driving contributions both to theory and practice and conclusions (Chapter 5, 6).

2. Literature Review

2.1 5G Technology

According to the European Commission, 5G is "*the critical new generation network technology that will enable innovation and support the digital transformation*" (European Commission, 2023). In other terms, 5G represents a new and advanced technology with high potential and a broad portfolio of applications which it could enable (5G-PPP; 2016; Cave, 2018; Ahokangas et al, 2021). Furthermore, from an academic perspective, 5G technology is widely recognized by scholars as an enabling technology (ET) (Teece, 2018; Rathje & Katila, 2021; Gambardella et al, 2021) which is missing to become a General-Purpose technology (Bresnahan and Trajtenberg, 1995) due to the lack of pervasiveness on the overall economy.

Lee and Yu (2022) outlined three key distinctions that set 5G apart from its predecessors: (i) the capacity to connect networked products and services; (ii) the promise of providing extensive, high-capacity, highly reliable, and low-latency connectivity to support diverse scenarios; and (iii) the implementation of "scenario-based" slicing. Massaro and Kim (2022) concurred, emphasizing differences such as higher data rates, traffic density, reliability, user speed, lower latency, and connectivity for numerous devices, as well as lower power consumption enabling Internet of Things (IoT) applications. According to Bauer and Bohlin (2022) and to the main 5G-enabled applications described so far, 5G primarily targets the business and industrial markets rather than the mass consumer market traditionally served by MNOs.

Knieps and Bauer (2022) described local industrial networks as "natural experiments" toward innovative solutions. Consequently, 5G-enabled networks, such as smart manufacturing, agriculture, augmented maintenance, and safety monitoring, are garnering attention from entrepreneurs and companies due to their ability to address diverse needs under specific conditions. Therefore, the deployment of local and private 5G networks presents a tangible opportunity for both MNOs and new stakeholders across various sectors (Ahokangas et al, 2021). However, despite the several opportunities they can enable, there is still uncertainty regarding the 5G business case (Blind and Niebel, 2022), and the value creation mechanism from its adoption across different applications remains unclear (Dolgui and Ivanov, 2022). Massaro and Kim (2022) noted the absence of a "killer service" or application in both B2C and B2B contexts, with many solutions still in the research and development phase (Knieps and Bauer, 2022). Only once the value generation from 5G adoption becomes apparent can the technology be scaled up across diverse sectors (Dolgui and Ivanov, 2022).

Therefore, the emergence of this technological paradigm is not solely confined to the telecommunications industry; rather, various vertical industries are poised to leverage wireless communication (Vuojala et al, 2020). In this context, it becomes imperative to pay closer attention to opportunities that extend beyond MNOs, however, they are the historical focal actor supposed to drive this technology's adoption, especially in some countries where they own the main source of value for the system (5G network frequencies' licenses in mid-band 3.6-3.8 GHz) that they paid dearly.

2.2 5G MNOs' Business Model Innovation

As shown by Gooderham and colleagues (2022), MNOs have faced at least three phases during their existence. The first phase took place between 1990 and 2010 with 2G and 3G, where mobile operators based their business models on voice, messaging, and elementary connectivity (Lehr et al, 2021). The second phase regards the following decade, from 2010 to 2020, with 4G as the dominant technology, where internet connectivity became the major revenue stream for MNOs, instead of the previous voice and messaging. The third phase, which is the period between the previous time windows described and nowadays, is characterized by the advent of 5G and, according to the scholars, the following question arises: "Will this phase be the rebirth phase for MNOs?" The main solution drawn by several scholars regards all the 5G-enabled services MNOs could offer to enterprises and public players; therefore, it seems that the future of 5G lies in the enterprise, not in the consumer market (Lehr et al, 2021; Gooderham et al, 2022; Matinmikko et al, 2018; Cave, 2018). MNOs must be able to develop new capabilities which allow them to co-create digital solutions with business partners to have multiple revenue models (Gooderham et al, 2022; Matinmikko et al, 2018). Otherwise, the risk is that they will end up offering an undifferentiated and price-sensitive commodity. Therefore, already with earlier technologies, MNOs have adjusted their business models (Ghezzi et al., 2009; 2013); however, with the fifth generation, it seems that the development trajectory has changed strongly (Lehr et al, 2021), and the discussion about the best 5G business model for MNOs is still ongoing.

Furthermore, through a non-systematic search regarding the literature about Business Model Innovation (BMI) and technology, the need for greater structuring to intercept a relevant phenomenon emerges. First, as

mentioned by Foss and Saebi (2017), several studies retrospectively describe BMI when considering the adoption of specific technologies; however, it is not common to find predictive and theoretical perspectives. Such a gap addressed by the authors is also outlined by Tongur and Engwall (2014, p.534) when they explicitly affirm that "*further research is needed addressing the interrelationship between technology and business model innovation before, during, and after a technology shift occurs*". Accordingly, Baden-Fuller and Heaflinger (2013) introduce a similar concept from a more technological perspective, addressing the fact that often the impact of technology adoption is restricted to performance measurements; however, such a link with technology requires further investigation at a BM architecture level by understanding the mechanism to innovate BM through its components to create value.

Considering the gap emerged in the managerial literature where the need to investigate MNOs' business model innovation mechanisms becomes evident (Ghezzi et al., 2012; 2015; Knieps and Bauer, 2022; Teece, 2018; Rathje and Katila, 2021), and considering the fact that being still a junior GPT (Teece, 2018), 5G constitutes a promising case for exploring business model innovation during a technology shift, the research aims to shed light on the different strategies MNOs can adopt to successfully commercialize 5G by answering the following research question: How can MNOs innovate their business model by leveraging 5G technology?

3. Methodology

The research adopts an exploratory multiple-case study approach due to a clear literature lack. The research process starts with a state-of-the-art literature review and a research question design. Consequently, data collection was performed (Table 1).

Table 1: Data collection

Level	Data source	Origins	Data usage
Primary	4 first-round semi-structured interviews	MNOs' key Informants	Gaining an initial understanding
	4 second-round semi-structured interviews		Deepen topics
	4 "Telco per l'Italia" interviews	Youtube	Gaining initial understanding
Secondary	9 online articles	Online newspapers	Triangulation
	69 company's website pages	Company's website	

The sample was formed according to a 5G adoption/investment, market share, and segments 'broadness. We investigated the Italian context, where frequencies for 5G service provision are exclusively held by Mobile Network Operators (MNOs) who made investments in 2018. These entities are feeling an urgent need to commercialize the technology because they were the only ones able to invest in these frequencies due to Italian regulations. It is important to note that the successful deployment of 5G depends not only on strategic decisions by such private actors but also on 'exogenous' factors such as incentives for achieving public 5G standalone coverage, which, due to the vastness of the territory, cannot be addressed by a single player. However, one of the opportunities enabled by 5G is the establishment of 5G Mobile Private Networks (5G MPNs). These networks are dedicated wireless infrastructures utilizing 5G technology to provide tailored and secure communication services for specific organizations or entities in various sectors (e.g., Manufacturing, Logistics, Healthcare). They offer rapid data transmission, minimal latency, and reliable connectivity, which cannot be achieved with other technologies. These solutions can benefit from the fact that public coverage is not strictly necessary to leverage these cutting-edge solutions. However, the commercialization of 5G MPNs is still in progress or nearly stagnant, with only proactive pioneering companies from different sectors investing and attempting to implement use cases.

Therefore, to investigate our research question, the three biggest MNOs (Telco A, B, C) and a virtual MNO (Telco D) were chosen. The study aims at reaching theoretical saturation to contribute to theory development (Eisenhardt and Graebner, 2007). The research acquired knowledge through two rounds of interviews, whose questions were adapted according to possible research opportunities, interview videos (used to gain understanding and deepen the topics), online articles, and website pages (used for triangulation). Data collection was performed in parallel with data analysis to extrapolate the highest information quality. It follows (Gioia et al, 2013) and Grounded Theory's methods. Thus, initially, the concept was maintained adherent with the interviews and concept labelled. Then, the study groups them into second-order themes to elaborate on

similarities and differences. Lastly, the overarching dimension collects them into the highest conceptualization Figure 1). Initially, each case has been considered singularly. Then, a cross-case analysis was performed.

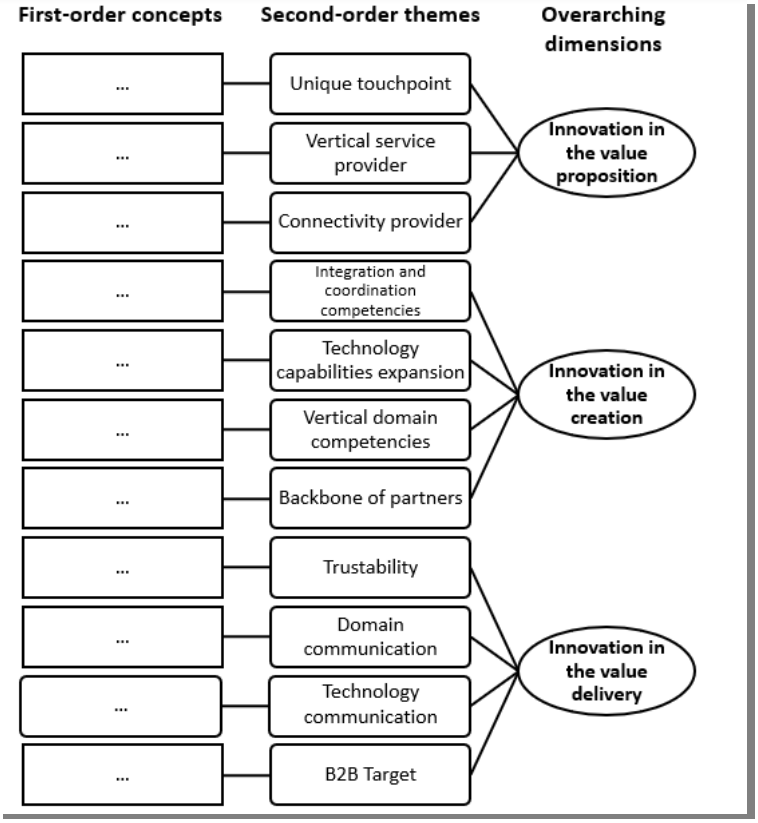


Figure 1: Coding tree

4. Findings

From the interviewees' words was possible to inductively obtain three overarching dimensions, namely the Value Proposition, Value Creation, and Value Delivery. Regarding the Value Proposition, three possibilities were obtained. The first regards a connectivity offer. "*We are telco operators, so we must bring enabling infrastructure*" (Telco A, Marketing Operative). Telco must fulfil performance requirements to make others able to develop services and products. 5G is a perfect fit due to its high performance and slicing nature. It may include a technology enlargement.

The second considers industry-specific service. "*5G enables solutions, use cases, both for consumer and business customers*" (Telco B, Head of Innovation & Vertical Solutions Business). The operator may address industry-specific needs without dismissing the connectivity business, escalating the value chain. The services may be sold "*on top of the connectivity*" (Telco D, CFO).

The last one embraces the referring point. "*We are the only one that can offer everything*" (Telco A, Marketing Manager in 5G & IoT Vertical Solutions). Telcos may position themselves as an intermediary in the service or product construction. "*It may be useful and interesting for a customer to have a unique partner*" that "*permits the customer to realize it most competitively*" (Telco B, Head of Innovation & Vertical Solutions Business).

Value Creation follows the Value Proposition needs. Given 5G applicability broadness, the MNO must establish a partnership network. Selecting a partner "*is a necessity, the innovation degree is very high, and the specialization is on the verticals*" (Telco B, Head of Innovation & Vertical Solutions Business). In particular, they may contribute to platform or application creation. Regarding the competencies, the research finds vertical domain competencies, transverse process competencies, and technology capabilities expansion. Targeting a specific industry requires "*a domain competence that is moved by the only technology components*" (Telco B, Head of Innovation & Vertical Solutions Business). Telcos can't be effective "*if you don't internally create that market knowledge*" (Telco C, Head of Innovative Concept Development & Scaling). The transverse process competencies regard more integration and coordination capabilities. "*You must act a bit as a coordinator between the competencies that are in the company rather than the ones offered by the third party*" (Telco B,

Head of Innovation & Vertical Solutions Business). The company may act as an intermediary between the client and the partners. Lastly, 5G changes the network abilities, adding elasticity, flexibility, and virtualization. 5G allows setting up "*system so-called BSs (Business Support) that are sufficiently configurable to answer to more aggressive speed and customization needs*" (Telco C, Head of Innovative Concept Development & Scaling). New competencies create new professional figures in MNOs, such as the specialist for the industry-specific ones, solution architect, and consultant for the transverse ones. In addition, 5G permits targeting a broad B2B segment. Even though the telcos can't turn B2C down, being their main revenue segment, "*5G is born for the industrial application*" (Telco C, Head of Innovative Concept Development & Scaling). Moreover, the company may require trustability building depending on the target market.

5G may profoundly change the relationship with the customers. The research identified two main approaches: passive and proactive. The Passive's mantra is "*You wait for customers to ask*" (Telco D, CFO). Therefore, the discussion focuses on keeping a stable relationship without investigating in-depth the real customer needs. On the other hand, "*more and more companies start seeing the operator as a partner with whom they can dialogue*" (Telco C, Head of Innovative Concept Development & Scaling). Thus, the Proactive requires a more complete customer engagement and dialogue.

Once the elements and current challenges related to the innovation of MNO's business models with the advent of 5G were defined, the authors attempted to aggregate the second-order themes into three different business model archetypes to outline three different directions based on what emerged from the interviews. Specifically, the three business model archetypes that were defined are: "Advanced connectivity provider", "Vertical Service Provider", and "Orchestrator". Figures 2,3,4 represent the Findings.

5. Discussion

In the first scenario, the so-called Advanced connectivity provider, the Value Proposition focuses on a connectivity offering and it may be complemented by other ICT technologies. In the Value Creation dimension, technology capabilities expansion is required without any new professional figures. Customers may be waited, given just the technology offers. Trustability can be automatically inherited from the current reputation in both market segments due to the MNO's position as a dominant player. In the second BM archetype, the "Service vertical provider", the main proposition will regard access to a service customized for specific vertical application domains. "*The operator is identified as who allows access to a service*" (Telco B, Head of Innovation & Vertical Solutions Business). It shifts the focus from connectivity and technological services to a service environment in which the customer may address different needs. It should require vertical domain competencies. A new professional figure may help the specialization in specific sectors. "*There are commercial figures called specialists that should be specialized in the single vertical*" (Telco A, Marketing Manager in 5G \& IoT Vertical Solutions). It is envisioned as a proactive relationship due to initial reputation issues and B2B customization demand.

In the final BM archetype, the touchpoint unicity is the main value proposition. Exploiting the partnership network, the telco may act as an intermediary and coordinator between the customer needs and the partners supplying. Thus, it requires strong transverse process competencies and dedicated professional roles able to judge the 5G overall solutions and it may guide the customer. Through "*dialogue availability*" (Telco A, Marketing Operative) and "*a higher engagement with the brand*" (Telco B, Head of Innovation & Vertical Solutions Business), the telco may establish a proactive relationship.

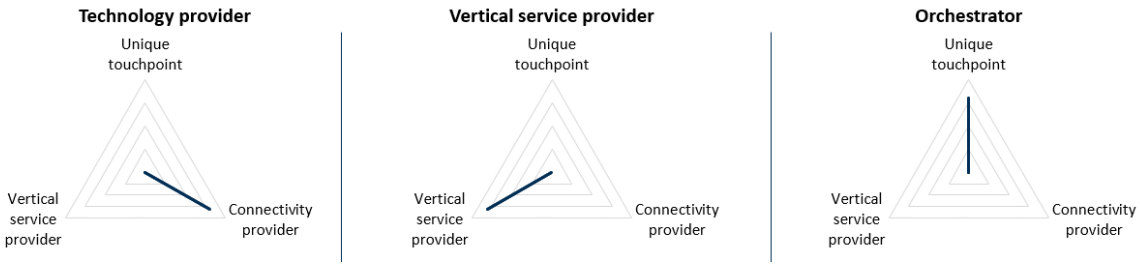


Figure 2: 5G MNOs' Business model archetypes: innovation in the value proposition

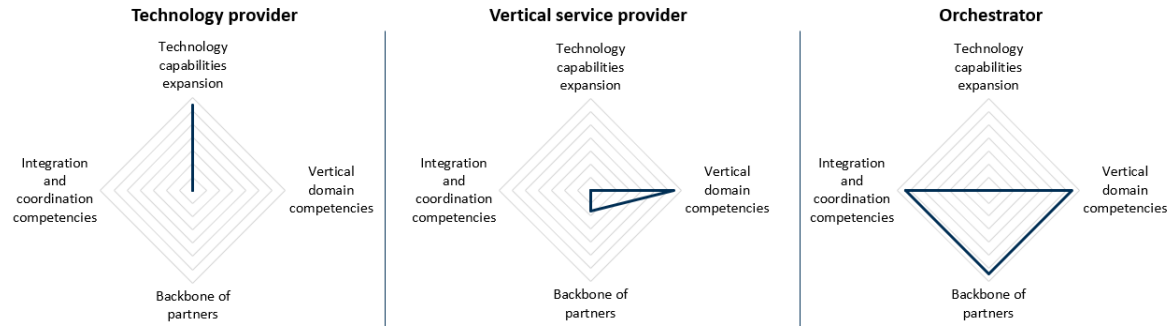


Figure 3: 5G MNOs' Business model archetypes: innovation in the value creation

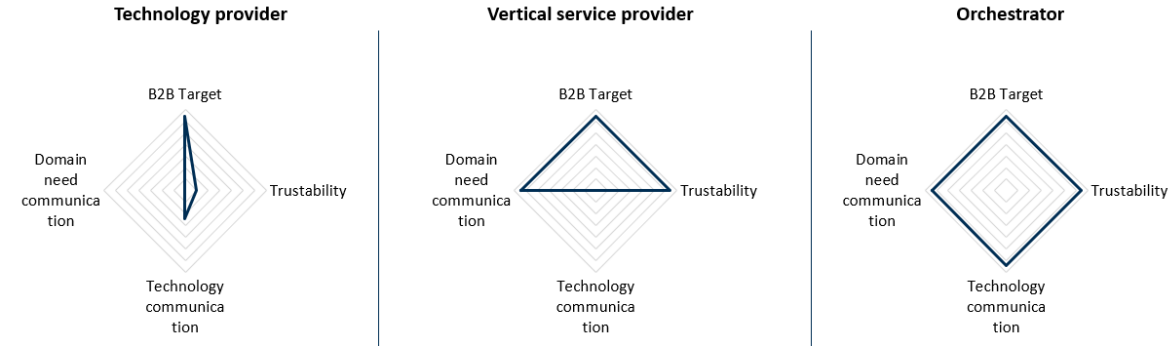


Figure 4: 5G MNOs' Business model archetypes: innovation in the value delivery

5.1 Theoretical Contributions

In opposition to the 5G technical literature in which the technologies and their impact or applications are well-defined, the 5G strategic adoption suffers from the building tools to evaluate and face decisions. If the technology research may be considered mature from different perspectives, the current 5G managerial literature appears fragmented and there is little evidence concerning the exploration of 5G strategic implications in terms of Business Model (Moqaddamerad and Tapinos, 2023) Therefore, the research contributes to the 5G literature by providing three different 5G BM archetypes based on key determinants concerning Value Proposition, Value Delivery, and Value Creation.

This research contributes to the servitization literature by presenting an empirical study on the challenges faced by technology providers in ET commercialization. In this context, the significance of the core technology diminishes due to difficulties associated with early adoption by pioneers in terms of optimal utilization. Therefore, transitioning towards Business Model (BM) servitization, as suggested by Tongur and Engwall (2014) and Sjodin and colleagues (2020), could represent a feasible option for commercializing ET already integrated into certain use cases offered to companies. In such cases, significant changes are required in the mechanisms of value creation, particularly concerning vertical domain competencies (Vertical Service Provider) or the ability to coordinate all other stakeholders (Orchestrator) in the conceptualization and development of use cases.

From a BM literature standpoint, the research contributes to the ongoing debate regarding the strategic impact of new technological paradigms from a BM perspective (Baden-Fuller and Haefliger, 2013; Foss and Saebi, 2017), particularly concerning value creation mechanisms (Teece, 2018; Sjodin et al, 2020) related to new digital technology-driven BMI archetypes (Ancillai et al, 2023). As a matter of fact, It provides an empirical study that attempts to address the interrelationship between technology BMI during a technological shift, rather than retrospectively (Foss and Saebi, 2017; Tongur and Engwall, 2014). Furthermore, due to the collected data, the impact of technology is not evaluated based on performance metrics, as is common in most studies, but rather on BM architecture (Baden-Fuller and Haefliger, 2013).

5.2 Practical Contributions

"*Facing a potential technology shift, [...] they must make a difficult choice that could profoundly affect their business model*" (Tongur & Engwall, 2014)". Given the choice spectrum and high investment, it is hard to coherently decide which path to follow, especially if they are just explorative attempts. The research may

guide managers' choices, depending on the selected strategy. Each archetype has distinct characteristics and addresses different visions and purposes. Model characteristics may provide a framework to assess future business models, unknown till now, and help the MNOs reposition themselves in new market positions. In the third scenario, the results highlight that continuing as a connectivity provider and even as a carrier represents the easiest path in terms of required resources and expertise. However, at the same time, MNOs may risk being "confined" to being a mere technological provider, struggling both to return on 5G investment (especially 5G licences) and to sell the technology itself. In the second scenario, there is a transition from "product," namely connectivity and SIM cards, to the “service”, namely the 5G use case. In this case, the most critical choice is how to define the vertical and internally acquire new resources to gain domain expertise. The third scenario is the one that would allow maintaining one's own expertise and being able to sell the application to the end customer. However, this could also be the most “ambitious” role for other players in the value chain, who could disrupt MNOs.

5.3 Future Avenues

Being a qualitative study, interviewers and interviewees processed questions and answers through a subjective interpretation. The research considered only two interview rounds due to limited resources and time availability. Additional cycles would have increased and granularized the findings. The study doesn't include the Value Capture mechanism due to the market and technology's immaturity. As reported in the “Findings” section, technology and knowledge sophistications drive the market.

Future avenues may amplify the research context and its generalizability. The Italian context presents strict regulations regarding transmission power and investments. It may be interesting to analyse distinct contexts to assess if the same perceptions and archetypes arise. Changing the player's perspective may improve generalizability. It is unlikely that OTTs, other service providers, and the demand will remain static in the market, especially after a performance power-up. Lastly, when the market reaches sufficient maturity, quantitative examinations may confirm or re-evaluate the current literature state-of-art.

6. Conclusion

5G serves as an enabling technology within the B2B sectors, presenting an opportunity for Mobile Network Operators (MNOs), key players in the telecommunications industry, to innovate their business models and uphold a central position in the sector. Through qualitative and exploratory research involving interviews with four Italian MNOs and three pioneering companies seeking to adopt 5G, three distinct business model (BM) archetypes have been delineated prescriptively. These archetypes are characterized by various configurations of determinants derived inductively from the interviews, pertaining to innovation in value proposition, creation, and delivery. Specifically, MNOs can opt to persist as "Technology providers," offering 5G as an enabling technology while leaving the task of understanding its use cases to end-users. Alternatively, they can commercialize 5G value-added services to companies integrating the technology into specific applications, positioning themselves as "Vertical Service Providers" by integrating into downstream verticals. Another avenue for MNOs is becoming the unique touchpoint or “Orchestrator” for 5G project development facilitating interactions among all involved actors as intermediaries. This research contributes to the limited body of literature analysing the adoption of enabling technologies from a firm-specific perspective and adds to the discourse on 5G by presenting evidence of its status as an Emerging Technology (ET) and offering an analysis of its business implications rather than solely focusing on technical aspects. Moreover, it contributes to the ongoing debate on the strategic impact of new technological paradigms from a business model perspective, particularly concerning mechanisms for value creation and capture associated with new, digital technology-driven BMI archetypes. From a practitioner's standpoint, this research offers managerial guidelines on developing appropriate business models to (i) promote technology adoption and (ii) maintain competitiveness while capitalizing on the myriad potential applications promised by 5G. Furthermore, this framework could assist MNO managers in evaluating potential directions for the commercialization of the technology itself.

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Business Agility in Technology Companies

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Abstract: Agile approaches have been used in the software business for many years. However, the agile approaches can bring a lot of velocity to many other business areas. Many authors have reported that using agile business approaches instead of conventional business approaches has addressed the needs of productivity in the current era. For successful implementation of the agile business concept in a company, the maturity for using this approach should be evaluated. This paper presents the results of a survey which was carried out regarding agile business issues in the light of maturity. Specifically, the ability of companies to adopt agile approaches was assessed based on the five-level maturity model of which level 5 shows the highest maturity. The results show that most companies are mainly at level three regarding open innovation and business agility. It is recommended that companies should also focus on the actions required at levels four and five. Because of the content of levels four and five, we suggest that company strategies should be aligned with agile strategies based on the agile business concept. We also argue that corporate change management skills are needed to realize levels four and/or five.

Keywords: Agile approach, Maturity, Technology companies

1. Introduction

Technological advances, new consumer demands, and the market globalization have brought out about new opportunities and challenges for companies which try to adopt different approaches to stay ahead of competition. Agile software development is a popular approach which several companies adopt to transform their processes (Denning, 2018; Van Waardenburg et al., 2013) as it can improve their productivity, resilience, and product quality even when applied at a large scale (Ismail et al., 2011; Rigby et al., 2018). Several of the agile principles and strategies focus on software development companies- however, agile approaches can be integrated into several business and domains and positively transform them (Lindvall et al., 2004; Steindl, 2005).

Nonetheless, the way agile methods affect each company is unique (Fraser et al., 2006) and their successful integration is also influenced by numerous factors (Shahane et al., 2014). The profile of a company (Bottani, 2010), its culture (Tolfo et al., 2011), and the practices used to adopt agile methods (Gerster et al., 2019) are some of the factors that impact the degree at which agile approaches can effectively be integrated and which transform the existing practices and processes of a company. Due to the variety in which agile approaches influences companies, it is important to measure to what degree they have been adopted and integrated within companies (Choraś et al., 2020; Kanakaris et al., 2019). By doing so, companies would be able to develop a notion of business agility (Setiawati et al., 2022).

The aims of this paper are to reveal the status of the business agility maturity in companies especially in Finland. In the following sections we clarify the differences between agile methods in software development, business agility, and the maturity model used to assess the agility in an organization. Thereafter, the methodology used and the data analysis are presented. Finally, the results of this study are further discussed and conclusive remarks are provided.

2. Agile Methods in Software Development

An agile way of work starts with understanding agile software development. Agile software development was created as a response to the heavy plan-driven software process improvement approach (Siakas et al., 2005; 2006) at the end of the 1990s. The Agile manifesto (Beck et al., 2001) explained agile software and system development as light way business-centric, communicative, and fast developing of new software and systems. In agile software development continuous adaption is used in an iterative process for fast delivery of working software embracing changes in the requirements (often caused by a turbulent external business environment),

end-user participation (customers on board for understanding customer needs), and creative software developers (empowerment of software engineers, collective ownership, and team rotation) (Georgiadou et al., 2019; Siakas et al., 2005; 2006).

Agile methods have increasingly been used in software development since the creation of the agile manifesto in 2001 and focus on an iterative and collaborative process (Siakas et al., 2005, Berki et al., 2007; Siakas and Siakas, 2007, Baskerville, 2011), while business agility refers to a broader capacity of an organization facing a volatile, uncertain, complex, and ambiguous business environment to swiftly respond by adapting to changing circumstances, emphasizing overall adaptability and responsiveness (Girod et al., 2023, Ronzon et al., 2019). For distributed software development, which today is a norm, there are different challenges related to differences in time, location, and culture (Siakas & Siakas, 2006; Struciński et al., 2014; Lampropoulos et al., 2018).

Agile methods, as adopted in ICT companies, include certain features, such as (Beck et al., 2001):

- highest customer satisfaction based on continuous delivery of software:
- changes to software features are possible at any time of the development process,
- frequent delivery of software in the timescale from a couple of weeks to some months,
- nonstop interaction between users and developers in projects,
- good working environment for project work is needed,
- emphasis on face-to-face communication when running a project,
- working software as major measure regarding level of project success,
- promotion of sustainable development through agile processes,
- nonstop quality control that enhances agility,
- avoidance of complexity - simple ways of working,
- self-organizing teams enabling best results in different ICT throughputs, and
- intervals in design which, in turn, enable good effectiveness and behavior.

3. Business Agility

The concept of business agility has its roots in agile software development, but has mainly been discussed in other areas than ICTs. Two main approaches build on agile principles, the agile method used in software development and the use of agile principles to create an organization-wide (digital) transformation by accelerating the principles and facilitating digital change (Beretta & Smith, 2023). Beretta and Smith (2023) argued that “agile has become an organization-wide movement where firms are striving for excellence in business agility as they seek to adapt to the fast-changing business environment”. However, to satisfactorily adopt, promote, and integrate business agility approaches, there are several challenges and issues that must be addressed (Goodhue et al., 2009) When implementing agile approaches within an entire organization, significant cultural changes occur and focus is put on aspects such as leadership behaviors suitable for business agility, digital mindset, customer-centric thinking, alignment between business and IT strategy, as well as dynamic and innovative capabilities (Mkoba & Marnewick, 2022; Sidhu, 2023). Hence, the adoption and implementation of agile approaches require significant cultural changes (Iivari & Iivari, 2011).

According to Uimonen (2024), business agility should be implemented by companies to acquire good level of strategic risk management and dynamic capabilities. Dynamic capabilities involve agility and resilience, which are related concepts. With these concepts, it is easier to approach increasing uncertainty in companies’ environment. Shams et al. (2021) claimed that business agility is particularly crucial in multinational enterprises (MNEs) operating in culturally different host countries. They identified factors dealing with continuous change and uncertainty that affect agile route-to-market (RTM) decisions at micro-market levels for enabling strategic renewal and sustainability in socio-economic contexts. They created a conceptual framework that aligns strategic business agility with the integration of different operational areas, such as supply change, ICTs and production. Lakshman and Gonzales (2023) argued that multiculturalism in top management teams influences cultural intelligence on team-level. In MNEs, this endorses business model innovation and enhances organizational dynamic capability and strategic business agility. The results of a study conducted by Troise et al. (2023) regarding the performance of young innovative companies showed a strong relationship between entrepreneurial alertness and digital platform capability, organizational agility, and business model innovation.

The current turbulent business era with new tools, such as generative artificial intelligence tools, have brought more velocity to the business life (Kanbach et al., 2024). Hence, it is important to understand business agility and other related concepts in management theory, such as dynamic capabilities, strategic flexibility, market orientation, and absorptive capacity (Overby et al., 2006). Wang et al. (2022) suggested that innovative use of

chatbots are drivers for creating business agility and business sustainability. To obtain the benefits of business agility, companies should create and adopt flexible business models and processes and encourage all the involved stakeholders to pursue an agile way of working.

Singh et al. (2013) emphasized that the notion of business agility "has received neither a consistent treatment in the literature nor a coherent typology or theory of its meaning (i.e., what it is) and significance (i.e., why it matters) to guide a systematic program of research". Business agility refers to the ability of a company to adapt to changes in the business environment. Girod et al., (20923) argued that different disciplines have articulated different versions of the term, such as agile software development, marketing agility, supply chain agility, strategic business agility, and international business agility, conveying slightly different meanings. Nevertheless, the common notion of business agility in the different versions refers to complex and ambiguous concepts developed in rapidly changing environments regarding a company's capability to operate in a flexible way and to take advantage of their resources, such as technology, for efficiently identifying and addressing opportunities and threats (Mathiassen & Pries-Heje, 2006). Shams et al. (2021) stated that (strategic) business agility refers to the ability of an organization to renew itself, to adjust its strategic directions, and to develop novel approaches to create value when facing new developments (Shams et al., 2021). Troise et al. (2022) defined business agility as "a firm's ability to respond to the challenges posed by the changing and uncertain environment and to renew its business. Overby et al., (2006) divided business agility into two capabilities, namely sensing (the capacity of identifying and foreseeing potential future opportunities) and responding (doing the necessary changes for exploiting new opportunities). Information and Communication Technologies (ICTs) are enablers for quickly sensing environmental changes and as a result, increase the likelihood of responding to change. A competitive advantage is created. By having compelling responding capability companies can provide incentives for identifying emerging opportunities which, in turn, improves the company overall sensing capability. The way ICT capabilities directly affect business agility is twofold, namely through the process integration capability (alignment of processes for capturing data/information pertaining customers, orders, and suppliers) and the knowledge management capability (processing of key information and sharing it with decision-makers). Therefore, decision making based on swift information identifying opportunities and threats in combination with forward-thinking is a strong enabler of business agility. Ilmudeen (2022) proposed that IT-enabled dynamic capabilities impact on the innovative capability of an organization and its business agility. Similarly, Škare and Soriano (2023) prove statistically that there is a strong relationship between the national / industry level of digitalization and agility. Ilmudeen (2022) concluded that operational agility is achieved due to ICT enabled sensing, and subsequent responding by taking advantage of opportunities for innovation and competitive action. The results of a study by Ashrafi et al. (2019) indicated that business analytics strongly impact on business agility because information quality increases (sensing) and as a result, innovative capability also raises (responding). According to Perkin and Abraham (2017), Jeff Bezos, the founder of Amazon, has clarified the business agility in the following way: "In today's era of volatility, there is no other way but to re-invent. The only sustainable advantage you can have over others is agility, that's it. Because nothing else is sustainable, everything else you create, somebody else will replicate."

According to Perkin and Abraham (2017), business agility is needed in general because of four reasons. These are digital transformation (integration of digital technology into all areas of a business), increasing velocity (speed of meeting certain milestones), need for focusing more, and need for flexibility. The digital transformation means responding to the needs of humans through technology. Velocity refers to the faster development of products and services. Focusing means concentrating on the strategy of a company and customers' needs. Flexibility refers to the skills required to work in different ways based on business needs. Perkin and Abraham (2017) described the steps to agile business including phases, such as "personal", "principles", "process", "practice", and "pace".

4. Maturity Model for Business Agility

Maturity assessment is used to investigate the current maturity level of a certain aspect of a company. The aim of such an assessment is to facilitate stakeholders in identifying strengths and weaknesses, and in prioritizing actions for reaching higher maturity levels. A business agility maturity framework has been developed to illustrate the agility expertise and capabilities of an organization, by combining metrics in a number of areas of agility, thus, revealing areas of excellence and also areas for possible enhancement so as to attain the next level of maturity (Cox, 2021). The business agility concept is a strategic option for a company. A road map is essential in order for a company to become more successful. According to our literature review in previous sections, the literature provides what is needed in the adoption of business agility. However, these sources do not provide

road maps for the guidance for improving business agility in companies. Therefore, a maturity model analysis helps companies to improve business agility in their businesses.

Maturity models can offer crucial guidance to companies which in turn can lead to their business becoming more mature to successfully meet challenges and overcome competition. The maturity model examines capabilities in any company (Enkel et al., (2011). The maturity model for the business agility includes the following five levels (Cox, 2021):

Level 1: Siloed operations, command and control management, no business architecture, no or few documented processes, success based on individual performance, no measurements, initiatives poorly managed, mistakes are penalized, and using a keeping people busy policy.

Level 2: Work can be quantified, value is used for more productive work, the transparency and shared understanding of work, and evaluation some metrics are in use.

Level 3: Agile principles are adopted at the business level, strategic goals have incremental checkpoints to ensure that all work aligns with organizational goals, management is moving to servant leadership.

Level 4: All business results have relative targets and regular measures (including non-financial measures). Specifically, work, projects, and/or products should be able to start, pivoted (changed) and stop easily.

Level 5: Adaptive funding models have been used to allocate funds against value streams. Governance is aligned with value delivery. System thinking approach to business has been accepted. Work, systems, and value streams have been visualized in a way that renders their management more feasible.

5. Methodology

Using the maturity model as a basis for examining the business agility levels, a survey was conducted over the time period of spring 2023. The aim of the survey was to reveal the status of the business agility maturity in the companies especially in Finland based on employees' perspectives. The participants who were master students received a set of questions in the business agility context which focuses on maturity levels two to five. Three to four business related questions were included for each maturity level. The questions included in the survey for each maturity level are presented below:

- "How well the work has been quantified/measured as the activity which creates more value at your workplace?" (Level 2)
- "How well do you believe that added value has been understood as the source of better work?" (Level 2)
- "How well do you believe that there is transparency in the work activities at your workplace?" (Level 2)
- "How much you believe that there are metrics available for measuring the work success?" (Level 2)
- "How much you believe that agile principles and values have been accepted at your workplace?" (Level 3)
- How much you believe that strategic goals are connected to the real work at your workplace?" (Level 3)
- "How much you believe that your managers have attitude to serve (especially your customers/clients) in your workplace?" (Level 3)
- "How much you believe that all business results have targets and regular measures including non-financial measures in your workplace?" (Level 4)
- "How much you believe that how easily the new work can be started in your workplace? " (Level 4)
- "How much you believe that how easily old work can be changed or can be stopped in your workplace?" (Level 4)
- "How much you believe that funding for the most valuable things in your workplace can be possible?" (Level 5)
- "How much you believe that your administration is connected to the creation of value through the business at your workplace?" (Level 5)
- "How much you believe that system thinking has been adopted in the business at your workplace?" (Level 5)
- "How much you believe that work, systems and value streams are visualized and managed?" (Level 5)

After being given the above-mentioned claims, the participants were able to provide their comments on promoting open innovation. Particularly, the focus was on which aspects and elements promote open innovation and which ones hinder it.

In total, 61 master students, 32 females and 29 males, whose mean age was 34 years (range 20-55 years), participated in this survey. Particularly, 39 of the students, who participated were from three different higher education institutes in Finland while the other 9 were from a higher education institute in Germany and the other 13 from a university in Morocco. The respondents were full-time engineering professionals who participated in the technology organizations' leadership courses in their universities. They had mean working experience of 12 years (range 1-30 years). 16 respondents worked in operational level positions, 30 in mid-level positions (as an expert with responsibility), and 12 in executive positions (management). 28 respondents worked in ICT companies and other respondents worked in other technology areas including construction, chemical engineering, steel and zinc production. The respondents worked mostly in technology expert positions.

The survey for this study was voluntary and anonymous. The data collection process involved the use of an online questionnaire which was uploaded on the Webropol platform as well as the use of a paper-based one. The participants rated each item (variable) of attributes on a Likert scale of 1 to 5 where 1 meant "Done extremely badly" (Extremely low) and 5 meant "Extremely high" (extremely well). Statistical analysis was carried out using the Statistical Package for the Social Sciences (SPSS). The analysis followed a quantitative approach and focused on the average of the participants' responses and on the outcomes of T-tests.

6. Data analysis

To examine the participants' responses, their answers to each question of each particular maturity level were analyzed. Specifically, the average score for each question as well as the mean score of their responses to the questions related to a specific maturity level were examined. Of the total 5 maturity levels, levels 2 to 5 were included in this analysis. Since maturity level 1 does not showcase any significant proof regarding company business agility, it was not included in this study. In particular, Table 1 presents the questions and the average scores of responses of maturity level 2 and Table 2 presents the related information about maturity level 3. Table 3 represents the questions and responses relevant to maturity level 4. Finally, Table 4 showcases the participants' average scores and the questions related to maturity level 5.

Tables 1-4 (see next page) depict participants' average score for each question based on the 5-points Likert scale as well as the statistical significance (p) of each claim.

Table 1: Maturity level 2 questions and average score of responses

Question	Average
"How well the work has been quantified/measured as the activity which creates more value at your workplace?"	3.59
"How well do you believe that added value has been understood as the source of better work?"	3.49
"How well do you believe that there is transparency in the work activities at your workplace?"	3.48
"How much you believe that there are metrics available for measuring the work success?"	3.41
Mean of responses at level 2	3.49

Table 2: Maturity level 3 questions and average score of responses

Question	Average
"How much you believe that agile principles and values have been accepted at your workplace?"	3.16
"How much you believe that strategic goals are connected to the real work at your workplace?"	3.58
"How much you believe that your managers have attitude to serve (especially your customers/clients) in your workplace?"	3.62
Mean of responses at level 3	3.45

Table 3: Maturity level 4 questions and average score of responses

Question	Average
"How much you believe that all business results have targets and regular measures including non-financial measures in your workplace?"	3.38
"How much you believe that how easily the new work can be started in your workplace?"	3.48
"How much you believe that how easily old work can be changed or can be stopped in your workplace?"	3.03
Mean of responses at level 4	3.30

Table 4: Maturity level 5 questions and average score of responses

Question	Average
"How much you believe that funding for the most valuable things in your workplace can be possible?"	3.49
"How much you believe that your administration is connected to the creation of value through the business at your workplace?"	3.36
"How much you believe that system thinking has been adopted in the business at your workplace?"	3.03
"How much you believe that work, systems and value streams are visualized and managed?"	3.49
Mean of responses at level 5	3.34

Furthermore, to get a better understanding of the participants' responses, we created a sum variable for each of the maturity levels and compared the sum means using the T-test. According to Kolmogorov test, the responses data agreed with the normal distribution. For that reason, conducting statistical data analysis through T-test was deemed as an appropriate method. The related results are showcased in Table 5.

Table 5: Comparing means

Comparing means using T-Test	
Level 2 responses versus Level 3 responses	p=.751
Level 3 responses versus Level 4 responses	p=.249
Level 4 responses versus Level 5 responses	p=.957

The results show that in most companies, agile business practices are currently at level 2 to 3. However, the differences when proceeding from low levels to upper levels are not significant. The notable thing is that the respondents evaluated some features of agile business less significant in their organizations. These features were "How much you believe that agile principles and values have been accepted at your workplace?", "How much you believe that how easily old work can be changed or can be stopped in your workplace?", and "How much you believe that system thinking has been adopted in the business at your workplace?".

7. Discussion

As technologies become more advanced and complex, their role in companies is becoming more important. Companies have to effectively adopt and integrate ICT tools in their processes to stay ahead of the ever-increasing competitive global market. Agile approaches offer several benefits throughout the product or service development cycle. Although many companies use agile approaches, there is a great variety regarding the degree in which companies are able to fully integrate them. Employees have first-hand experience in many of the processes of a company. Therefore, their perspectives are closely related to the true capabilities of a company to integrate agile approaches.

Therefore, this study focused on the viewpoints of master student who were also working in technology related companies. Emphasis was put on levels 2 to 5 of the company maturity level. Specifically, the participants quoted that system thinking has not been effectively adopted at their workplace, that changing and stopping existing processes and practices that use the old ways is difficult, and that agile values and principles have not yet been accepted at the workplace at the level that they should. Additionally, the participants most agreed that managers have an attitude to serve, that quantifying/measuring their work adds value at their workplace, and that strategic goals are closely connected to the real work environment. From the results, it was revealed that the majority of the companies examined are currently at maturity levels 2 or 3. Hence, companies should focus more on further adopting appropriate practices and methods to improve their ability to effectively integrate agile approaches.

Moreover, our results show that the agile business concept has been moderately accepted in companies. We found that in three issues of our survey, namely i) "adoption of principles and values" ii) "changing work" and iii) "system thinking", more understanding is needed and this understanding can be achieved through training and changing management activities. These are fundamentals which can help companies to meet the need of velocity which has been argued in section 3 (Uimonen, 2024; Shams et al, 2021).

In the adoption of principles and values, the methods of change management are vital because of the cultural change as argued in section 3 (Goodhue et al., 2004; Mkoba & Marnewick, 2022; Sidhu, 2023; Iivari & Iivari, 2011). This should be introduced by the methods for example suggested by Kotter (1996) – this includes actions such as motivating, introducing short-term benefits, introducing long-term benefits, and rewarding employees. The same can be applied to issue two "changing work". Individual change is slow. Employees' attitudes toward change are challenging (Ahmad & Cheng, 2018). The third issue "system thinking" is vital for understanding the whole of the company. This can be organized during a company strategic meeting. Our suggestion to meet these challenges is the adaptation of Joiner's model of business agility (Joiner, 2019).

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Student's Entrepreneurial Intention in Higher Education: The Entrepreneurship Intention Questionnaire Applied At Esce – Polytechnic Institute of Setubal

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Abstract: The choice to pursue an entrepreneurial path is the result of a complex cognitive journey. It's vital to comprehend this mental process as it unfolds during the educational phase, especially since entrepreneurship is now a potential career option for a growing number of students. This paper explores and evaluates entrepreneurial intentions (EI) and their antecedents among 132 students from College of Business Administration (ESCE), Polytechnic Institute of Setubal (IPS). To collect data, the research used part of the Entrepreneurial Intentions Questionnaire (EIQ) designed by Liñán and Chen (2009) with additional demographic questions. This paper also examines the role of age, gender, work experience and self-employment in affecting personal attitudes, subjective norms, perceived behavioral control and entrepreneurial intentions. The research is based on a study developed by Liñan and Chen (2009) that was applied in two different cultures: Spain and Taiwan. This research adds another comparison with students from Portugal and the results allowed the confirmation of the findings of previous studies concerning the relationship between the entrepreneurial intention and the personal attitude and perceived behavioral control.

Keywords: Entrepreneurship, Entrepreneurial intentions, Entrepreneuship education, Higher education

1. Introduction

It is recognized that an entrepreneurial career offers significant opportunities for individuals to achieve financial independence and benefit the economy by contributing to job creation, innovation, competitiveness and economic growth (Barba-Sánchez et al., 2022). Today's students are tomorrow's potential entrepreneurs, which may explain why a growing number of universities, spread across the world, offer entrepreneurship courses and programmes. Numerous studies have identified entrepreneurial intention (EI) as a highly influential predictor of entrepreneurial activities and behaviors (Krueger et al., 2000; Arasti et al., 2012). Consequently, contemporary research has increasingly emphasized EI over the broader field of entrepreneurship (Yu et al., 2021). Indeed, the utilization of EI as a foundational framework for research has increases since the early 90s, underscoring the pivotal role of EI in various contexts (Liñán & Fayolle, 2015).

Taking this into consideration, it becomes crucial to comprehend the factors that shape the EI of students, as this understanding is vital for nurturing their future entrepreneurial aspirations. Numerous scholars have conducted investigations to explore the variables influencing the EI of students in higher education. Cognitive and personality factors, including self-efficacy, individual attitudes, desire for achievement and behavioral control, wield substantial influence over students' intentions towards entrepreneurship (Nasip et al., 2017; Biswas & Verma, 2021). On the other hand, social and environmental researchers have identified elements such as previous experiences, family background, regional culture, and government support as pivotal factors that shape the EI of students (Ali et al., 2019; Tiwari et al., 2020).

The argument that entrepreneurship can be stimulated and developed by education has been gaining importance inside and outside the academic world. The number of studies dedicated to studying the influence of entrepreneurship education on EI is considerable and their conclusions are difficult to ignore. Given the very important position of entrepreneurship as a driver of socio-economic development, there is special attention among policy makers, educators, academics, and scholars as it is considered as a critical factor in fostering the socio-economic development of a country (Nowiński et al., 2019). Considering this, entrepreneurship education in higher education institutions (HEIs) plays an essential role in enhancing students' foundational entrepreneurial knowledge and various cognitive and non-cognitive skills. By doing so, it stimulates and encourages students to engage in entrepreneurial activities (Brüne & Lutz, 2020). This, in turn, serves as a

catalyst for motivating students toward entrepreneurship, contributes to improve entrepreneurship quality, and ultimately leads to entrepreneurial success (Galloway & Brown 2002).

Entrepreneurship education has become a prominent feature in the curricula of HEIs, not only in business schools but also in other areas (Kuratko, 2005). On the other hand, it should be noted that the teaching of entrepreneurship is not only carried out in HEIs, since in last years there has been a focus on teaching entrepreneurship both in high school, as well as in middle and elementary school. The rapid growth of entrepreneurship education in academia is proof that students who attend entrepreneurship courses have more intentions to create new businesses than students who do not participate in entrepreneurship education (Çera et al., 2021; Li et al., 2022). Formal entrepreneurial education has an impact on students' propensity to pursue a career as an entrepreneur (Shinnar et al., 2018).

2. Literature Review

2.1 Entrepreneurial Intention

The intention is a basic model for entrepreneurial behavior development and stands as the most reliable indicator of human behavior (Aamir et al., 2021). According to Ajzen (1991) and Sutton (1998), most socially relevant behaviors are under volitional control. Intention, therefore, can be considered an immediate antecedent of an actual behavior, an indicator of how hard individuals are willing to try, and an indicator of how much effort individuals are planning to exert in order to engage in a specified behavior (Kim & James, 2016).

EI has been extensively investigated in recent decades and continues to be of interest to researchers due to its importance for the development of many countries (Barba-Sánchez et al., 2022; Virasa et al., 2022). The literature on EI includes factors that influence it such as education (Thomas, 2023; Xu et al., 2023), personality traits (Kent et al., 2022), perceived ability (Sedeh et al., 2021) and teaching and training (Chaker & Dellagi, 2023).

Furthermore, entrepreneurship scholars have theorized that a series of external factors, such as the social, political and economic context influence EI (Doanh, 2021). Governments can intervene with financing schemes, tax policies and other support mechanisms that aim to mitigate market inefficiencies and promote entrepreneurship (Owen & Vedanthachari, 2023). Regarding the local context, several studies have focused on the capacity of certain resources, such as financial support (Sabri et al., 2023), entrepreneurship support services (Bazan, 2022) and human capital (Luo et al., 2022), can have in promoting EI.

Researchers Carr and Sequeira (2007) found that exposure to the family business serves as an important intergenerational influence on intentions to become an entrepreneur. Family characteristics have an implication in the emergence of new businesses, in the recognition of opportunity, in decisions to create a startup and in the mobilization of resources (Zaman et al., 2021). Likewise, previous exposure to entrepreneurship, both on the family and personal side, has an impact on EI. Exogenous influences (such as demographics, skills, societal traits, financial support and culture) affect attitudes and also indirectly affect intentions and behaviors to become entrepreneurs (Zaman et al., 2021). Family members in the business become a symbol for the entrepreneur and a source of financial and non-financial help. Likewise, family financial resources have a direct relationship with EI. It was observed that students with intentions of becoming entrepreneurs tend to be more qualified than individuals without entrepreneurial behavior. The experience of self-employment was directly related to students' EI (Gird & Bagraim, 2008).

A gender disparity has also been observed concerning entrepreneurial orientation (Villasana, Alcaraz-Rodríguez, & Alvarez 2016) as well as the motivation and intention to initiate one's own business (Hughes, 2003). The male students, as demonstrated by various empirical investigations (Dıaz-Garcıa & Jimenez-Moreno, 2010), tend to exhibit a stronger EI compared to female students.

Thus, recent studies have emphasized the need for an entrepreneurial attitude and intention as factors that determine entrepreneurial behavior (Cui & Bell, 2022). These factors can be greatly influenced by entrepreneurship education (Cui & Bell, 2022).

2.2 Entrepreneurial Intention and Theory of Planned Behavior

Based on the Theory of Reasoned Action (TRA) (Fishbein & Ajzen, 1975), the Theory of Planned Behavior (TPB) (Ajzen, 1988 and 1991) has become one of the most common psychological theories used to explain and predict human behavior (Carr & Sequeira, 2007; Kolvereid, 1996a; Maheshwari & Kha, 2021; Romero-Colmenares & Reyes-Rodríguez, 2022), including in the field of entrepreneurship (Liñán & Chen, 2009; Gieure, et al., 2020; Sampene, et al., 2022).

TPB has been validated as a robust and substantial theory throughout the various domains of human behavior (Cui & Bell, 2022). For example, TPB has been successfully applied to a wide variety of behaviors, such as organizational behavior (Wynn et al., 2021), health protection (Kim, et al., 2020), and purchasing behavior (Dorce et al., 2021).

The TPB establishes that intention is a consciously planned behavior (Bird, 1988; Krueger et al., 2000). Consequently, EI is considered an antecedent of the entrepreneurial behavior (Fayolle et al., 2006). Ajzen (1991, p. 181) defines intentions as "indicators of the difficulty that individuals are willing to try, of how much effort they are willing to exert, to execute the behavior". The stronger the intention to engage in a specific behavior, the more likely it will be to actually perform it (Ajzen, 1991). In other words, Ajzen (1991, 2002) maintains that intention is the immediate antecedent of behavior.

TPB becomes necessary due to the limitations of the original model in dealing with behaviors over which people have incomplete subjective control (Ajzen, 1991). In summary, the theory of planned behavior postulates that intentions have three conceptually independent determinants ("antecedents of intentions"), namely, personal attitude (PA), subjective norm (SN) and perceived behavioral control (PBC) (Ajzen, 1991). PA refers to the degree to which a person has a favorable or unfavorable evaluation or appreciation of the behavior in question. The term SN refers to the perceived social pressure to perform or not perform that behavior. As for PBC, this refers to the perceived ease or difficulty of carrying out the behavior. According to Ajzen and Fishbein (2004), the three theoretical antecedents should be sufficient to predict intentions, but only one or two may be necessary in any given application. In other words, the TPB states that the relative importance of the three factors can vary depending on the context. In a recent investigation conducted by Barba-Sánchez et al. (2022), they examined the components of the TPB within their research and their findings revealed that ATB and PBC exert a direct impact on the EI of students. However, it was observed that SN does not directly influence students' EI, but mediate the relationship between environmental awareness and ATB and between environmental awareness and EI.

Demographic characteristics and other characteristics related to the individual's background and environment are not directly addressed in the theory of planned behavior. This theory predicts that these factors do not have a direct impact on intentions, but an indirect impact through PA, SN and PBC (Kolvereid, 1996b; Krueger & Carsrud, 1993).

2.3 Entrepreneurial Intention Questionnaire

Liñan and Chen (2009) conducted research using a cognitive approach, employing an EI model. Their findings highlighted the need for further research to comprehensively understand the elements that influence individuals' perceptions of entrepreneurship. They also proposed the importance of conducting cross-cultural studies to gain deeper insight into how diverse cultures and values impact EI.

The model used by Liñan and Chen will be used in this research and is shown in Figure 1.

The hypotheses developed by Liñan and Chen are:

H1: Personal attitude positively influences entrepreneurial intention.

H2: Perceived behavioral control positively influences entrepreneurial intention.

H3: Subjective norm positively influences entrepreneurial intention.

H4: Subjective norm positively influences personal attitude.

H5: Subjective norm positively influences perceived behavioral control.

In the original model developed by Liñan and Chen, Hypotheses H6 and H7 are related to the influence of the country of origin: Spain or Taiwan.

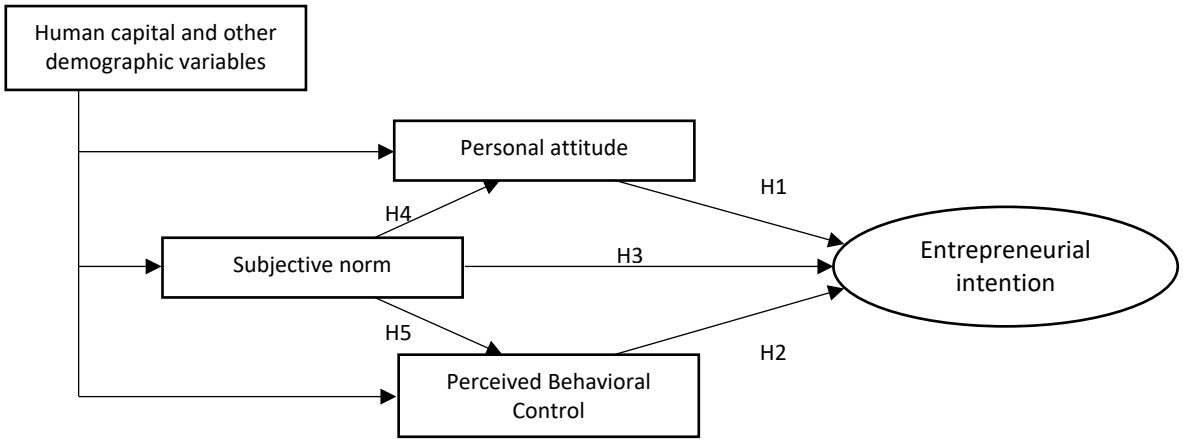


Figure 1: Entrepreneurial Intention Model by Liñan and Chen (2009)

Following the analysis of their data, Liñan and Chen (2009) reached at the conclusion that hypothesis H3 was not supported. Their core EI model, as proposed, received overall validation, except for the relationship between SN and EI (Hypotheses H3). Hypotheses H1 and H2 were confirmed, and it was established that SN indirectly influences EI through two pathways: one through PA (as confirmed by H4) and the other through perceived behavioral control (as confirmed by H5). Based on the findings of Liñan and Chen, this study intends to apply the entrepreneurship model to a sample of students from the Polytechnic Institute of Setubal (Portugal).

3. Methodology

Measures

This study used the Entrepreneurial Intention Questionnaire (EIQ) developed and validated by Liñán and Chen (2009). The questionnaire was specifically designed for applying the theory of planned behavior to entrepreneurship (Liñán & Chen, 2009; Liñán, 2008; Liñán et al., 2011). Initially tested with Spanish and Taiwanese samples, it has also been validated across various contexts, including both developed and developing countries (e.g. Hoda et al., 2021). The questionnaire comprised questions using a seven-point Likert scale (1=Strongly disagree to 7=Strongly agree) and nominal scales. The Likert scale questions assessed PA (5 items), SN (3 items), PBC (6 items) and EI (6 items). Nominal scales were used to measure gender (1=Male, 2=Female) and prior entrepreneurial exposure (whether respondents have work experience, or self-employment experience, with 1=Yes and 2=No).

Sample

The empirical analysis has been carried out on a sample of last-year students from College of Business Administration, Polytechnic Institute of Setubal, who attended the subject of entrepreneurship in the 2022/2023 school year. A total of 132 questionnaires were thus collected.

Student samples are very common in entrepreneurship research (Liñán & Chen, 2009) especially given evidence that university graduates between 25 and 34 years of age show the highest propensity toward starting up a firm (Reynolds, Bygrave & Autio, 2004).

To collect data, the research used part of the EI Questionnaire (EIQ) designed by Liñán and Chen (2009) with additional demographic questions (age, gender, course, labor experience and self-employment experience).

Entrepreneurial Intentions Questionnaire (EIQ)

The EIQ is an instrument developed by Liñan and Chen (2009) to measure EI and other variables such as PA, SN, and PBC.

Reliability and validity of the questionnaire were already verified by Liñán and Chen (2009) to ensure that each pool of questions is related to same subject and each subject corresponds to the required measure.

The questionnaire used in the research is divided into 2 sections. The first section identifies the profile of the respondents. In this section the main characteristics identified are: (1) the gender; (2) the age; (3) the course; (4) the work experience and (5) the self-employment experience. Section 2 comprehend the questions taken from the EIQ to measure, through a 7 Likert-type scale, the different constructs of the EI model (PA, SN, PBC and EI).

4. Results

As shown in Table 1, 51.5% of students are male and 48.5% are female and most are aged between 20 and 22 years.

The students participating in this study are from different courses, namely: Human Resource Management, information Systems Management, Marketing and Distribution and Logistics Management.

36.4% of the students surveyed indicated that they were pursuing a bachelor's degree in Distribution and Logistics Management, followed by Information Systems Management students (26.5%), Human Resource Management students (18.9%) and, finally, Marketing students (18.2%).

With regard to work experience, the majority (59.8%) reported having some work experience. However, only 19.7% of the total respondents claimed to have self-employment experience.

Table 1: Students' profile

	Frequency	Percentage
Gender		
Male	68	51.5
Female	64	48.5
Age		
20 – 22	95	72.0
23 – 25	24	18.2
26 – 28	5	3.8
≥ 29	8	6.1
Course		
Human Resource Management	25	18.9
Information Systems Management	35	26.5
Marketing	24	18.2
Distribution and Logistics Management	48	36.4
Work experience		
Yes	79	59.8
No	53	40.2
Self-employment experience		
Yes	26	19.7
No	106	80.3

Cronbach's alpha was employed to assess reliability, resulting in values ranging from 0.785 to 0.955 (Table 2). Convergent validity was measured using the Kayser-Meyer-Olkin (KMO) test, yielding a score of 0.856, and Barlett's sphericity test, which had a significance level of $p < 0.001$. Subsequently, based on the aforementioned test results, factor analysis was conducted. A Shapiro-Wilk test was performed to examine data normality. Consequently, the principal axis factorization extraction method was utilized. The analysis yielded a solution comprising four factors, for which the eigenvalues are requested to be greater than 1. The cumulative variance explained by these factors is 76.9 percent (Table 2).

As shown in table 2, item SN1 does not load strong enough for PA and item PBC1 also does not load strong enough for PBC. Consequently, these two items were excluded from the subsequent phases of the research. To gauge discriminant validity, correlation values among the various construct groups were analyzed. The results confirmed that each item has a strong correlation with its respective construct and not with others.

Table 2: Rotated Components Matrix

	Component			
Factor	**1**	**2**	**3**	**4**
PA1		0.578		
PA2		0.748		
PA3		0.840		
PA4		0.831		
PA5		0.639		
SN1				
SN2				0.873
SN3				0.914
PBC1				
PBC2			0.577	
PBC3			0.586	
PBC4			0.888	
PBC5			0.676	
PBC6			0.625	
EI1	0.718			
EI2	0.793			
EI3	0.702			
EI4	0.848			
EI5	0.847			
EI6	0.844			
Percentage variance explained	53.6%	10.5%	7.2%	5.6%
Cronbach's α	0.955	0.913	0.883	0.785
	EI	PBC	PA	SN

Extraction method: Principal components analysis

When we examine the correlations between variables (table 3), it becomes evident that hypotheses H1, H2, H4, and H5 find support based on the strength of their correlation coefficients and regression values. On the other hand, hypothesis H3 is rejected. This is because the SN exhibits a relatively weak correlation with EI, standing at 0.399, and the regression coefficient of SN in relation to EI holds a significance value of 0.814, which exceeds the threshold of 0.01.

This findings are consistent with the findings of previous studies referred in literature review (Kolvereid 1996a; Kolvereid, 1996b; Tkachev & Kolvereid, 1999; Krueger et al., 2000; Liñán, 2004; Veciana et al., 2005; Fayolle & DeGeorge, 2006; Engle et al., 2010; Kautonen et al., 2015).

Table 3: Correlation Matrix

	PA	**SN**	**PBC**	**EI**
PA1		0.324	0.202	0.460
PA2	0.729	0.031	0.208	0.432
PA3	Average	0.065	0.148	0.147
PA4		0.101	0.101	0.384
PA5		-0.138	0.295	0.544
SN1				
SN2	0.129	0.897	0.124	-0.124

	PA	SN	PBC	EI
SN3	-0.032	Average	-0.159	0.070
PBC1				
PBC2	0.265	0.036		0.590
PBC3	0.063	0.061	0.760	0.595
PBC4	0.102	-0.078	Average	0.183
PBC5	0.240	0.081		0.335
PBC6	0.345	-0.084		0.465
EI1	0.422	0.008	0.095	
EI2	0.298	-0.089	0.137	
EI3	0.412	-0.055	0.315	0.798
EI4	0.286	-0.004	0.312	Average
EI5	0.270	-0.002	0.348	
EI6	0.210	0.045	0.308	
	PA	SN	PBC	EI
Correlations (significant at 0.01 (bilateral))				
PA	1	0.411	0.693	0.837
SN		1	0.481	0.399
PBC			1	0.779
EI				1

A nonparametric test – Spearman's correlation was utilized to measure the strength of the relationships between demographic variables (age, gender, work experience and self-employment experience) and the constructs of the EI model (PA, SN and PBC).

Based on Table 4, there was a statistically significant low negative correlation between the PA and age (correlation coefficient = -0.363, p=0.000), and between the PBC and self-employment experience (correlation coefficient = -0.329, p=0.000). The relationships between the other variables showed negligible correlations with correlation coefficients ranging between -0.153 and 0.099.

Table 4: Correlation Test

			PA	SN	**PBC**
Spearman's rho	Age	Correlation Coefficient	-.363*	.033	.046
		Sig. (2-tailed)	.000	.000	.000
		N	60	60	60
	Gender	Correlation Coefficient	-.007	-.149	-.001
		Sig. (2-tailed)	.000	.000	.000
		N	60	60	60
	Work experience	Correlation Coefficient	-.153	-.090	-.080
		Sig. (2-tailed)	.000	.000	.000
		N	60	60	60
	Self-employment experience	Correlation Coefficient	.099	.031	-.329*
		Sig. (2-tailed)	.000	.000	.000
		N	60	60	60

*. Correlation is significant at the 0.05 level (2-tailed).

These results contrast with the results evidenced by Liñan and Chen (2009), who reported that gender, self-employment experience, and work experience had an impact on the constructs of the EI model.

5. Discussion

This study utilized the EIQ instrument, originally developed by Liñan and Chen (2009). In the original paper by Liñan and Chen (2009), a comparative analysis was conducted between Spain and Taiwan. The objective of this present research is to introduce a new comparison, this time with a sample of students from Portugal.

The EIQ questionnaire, which was validated by Liñan and Chen, proved to be comprehensive and provided ample data to assess the proposed model. The proposed model, rooted in the theory of planned behavior, assesses variables such as PA, SN, and PBC. In our study, demographic factors such as age, gender, and self-employment experience did not exhibit significant influence on the constructs of the EI model. In contrast, Liñan and Chen reported that gender, self-employment experience, and work experience had an impact on the model.

Considering both the prior utilization and outcomes of the EI model and the results of our current research, the model demonstrates robust support.

6. Conclusions and Future Direction

In this study, we present a model with the variables that influence EI among students from Polytechnic Institute of Setubal (Portugal). Our study builds upon the work previously conducted by Liñan and Chen (2009), which explored the same variables but in different cultural contexts, namely Spain and Taiwan. Our research extends this comparison to a third country, Portugal.

This study allowed the confirmation of the findings of previous studies that have demonstrated that EI is predicted by PA, SN, and PBC. The results achieved contribute to reinforce the application of the theory of planned behavior (Ajzen, 1991) and confirm the influence of cultural and social environment in human behavior. The results obtained in this study confirm the findings of previous studies that have demonstrated that EI is predicted by PA, SN and PBC.

The main limitations of this study are the non-representativeness of the sample, and therefore extrapolations should not be made. In future studies, it is suggested that the sample may have a greater number of higher education institutions, in order to cover students from different areas of education. On the other hand, it is also suggested to analyze other variables that may have an influence on students' EI, such as analyzing the influence of the family on the development of EI.

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The Impact of Covid-19 Pandemic on Small Wineries in Cyprus and Reflections on Wine Tourism: Entrepreneurs' Perspectives

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Abstract: Tourism-dependent countries like Cyprus, have been seriously affected by the shockwave that COVID-19 pandemic has generated to their sociocultural/economic fabric. One of the industries of Cyprus impacted is the wine industry. Indeed, the consequences of the pandemic have been reflected on various angles of the island's wineries; from the day-to-day operations to their overall strategy. Moreover, they influenced their relationship to tourism and the provision of wine tourist experiences. This is even more apparent in the case of small wineries. In this respect, the paper examines how tourism related wine enterprises, and more specifically, small wineries in Cyprus, handled the crisis and its impacts, through the analysis of the wine entrepreneurs' views. This study explores the dimensions of the pandemic imprinted on wineries' business and highlights the pertinent measures taken to deal with them. Additionally, it illustrates how wine tourist activities have been affected, enhanced, and reformed for the smooth wine tourist experience to be provided. To do so, exploratory research was utilized to collect data through secondary sources and face-to-face in-depth interviews with winemakers/managers/owners of small wineries in Cyprus. Findings reveal that the greatest challenge that small wineries faced, was the high degree of uncertainty, as Hotels, Restaurants, and Catering companies (HO.RE.CA.) were temporarily closed and consequently, the wine consumption related to tourist flows was reduced. Small wineries took a series of measures to handle the crisis, such as emphasizing communications through online media, improving the provided -tourist- experience in the wineries, or enhancement of direct marketing and distribution strategies. The paper concludes with recommendations for small winemakers to deal with the shocks of crises and for their sustainable competitive advantage.

Keywords: Wine tourism, Cyprus, Wine marketing, Covid-19, Wine industry, Innovation

1. Introduction

The pandemic of COVID-19 was among the most severe crises in the modern history that affected many sectors worldwide, including tourism and wine ones. Indeed, as Szolnoki et al. (2022) argue, the pandemic disrupted several dimensions of the wine-tourism industry including leisure, culinary, experiential, historical and cultural visits, making them rearranging their business model to adopt with the new circumstances, in order to, somehow, maintain their competitive position and remain viable. Considering that according to Gutiérrez-Escobar et al., (2021), wine is among the most widely consumed beverages worldwide, wine business has been severely impacted by COVID-19, with global revenues falling by more than 10% in 2020 (Lu, 2020). Many studies have been conducted in this area regarding the effects of COVID-19 on wine sales, consumption, and international commerce (Rebelo et al., 2021; Wittwer & Anderson, 2021). These studies highlight the challenging situation for the wine business and how it affected the wine market. Among the nations that the pandemic influenced their wine (tourism) industry was also Cyprus.

Tourism comprises one of the most important sectors of the economy for the island of Cyprus. Since its independence from the British Empire in 1960s, the government of Cyprus found on tourism the means for economic growth, sociopolitical stability and integrity, independence, and in expansion, improvement of the quality of life of the island's residents (Boukas, 2019). Indeed, Cyprus tourism has been steadily increasing, with minor fluctuations, in its recent history, while after 2010, tourist arrivals and revenues have been growing in an positive and steady pace (Boukas and Marneros, 2024); it is noteworthy that only in 2019 approximately four million international tourists visited the island generating €2.7 billion, (12.2%t of nominal GDP) (Cyprus Statistical Service, 2022). The wine tourism industry of the island follows also the same course.

Despite its small size, the island of Cyprus indicates a prominent wine tourism activity. Currently, there are 80 wineries, many of them capitalizing on the significant tourism activity of the island and providing wine tourism experiences, such as visiting wineries, tasting and learning the local wine culture or projecting the wine character of Cyprus through a series of festivals (Liasidou, 2018). In this respect, the wine villages of Cyprus are significant

attractions for wine tourism visitors that want to experience the unique varieties of the island, such as the Commandaria (a unique local ancient variety of sweet wine).

Nonetheless, as in any other industry, the wine tourism industry has been particularly negatively affected by the pandemic's consequences. Cyprus wineries experienced an unprecedentedly volatile climate following the COVID-19 outbreak. Businesses in the industry were extremely uneasy when the government of Cyprus declared a state of emergency in 2020, as hospitality facilities had to close down. Travel between wine areas and foreign visitor arrivals in those regions were prohibited under the state of emergency, which had the effect of significantly lowering wine consumption associated with tourist flows (Boukas and Marneros, 2024). In this vague landscape, the Cypriot wine tourism industry faced a unique crisis and it was necessary to adopt to the new circumstances, emphasising innovative products/processes.

This study explores the impacts of the pandemic on wineries' business strategy and operations and underlines their actions for handling the crisis, focusing on innovation not only on the wine tourism product development but also on other business activities. As such, the study illustrates how wine tourist activities have been affected, enhanced, and reformed themselves for the smooth wine tourist experience to be provided during and in the post-COVID-19 era. The paper concludes with a series of strategies that stress innovation in the business environment, that post-COVID19 wine-tourism industries in destinations with similar characteristics to Cyprus, can utilise in order for the more effective tourist experience to be formed and delivered.

2. Literature Review

2.1 Wine Tourism Industry Worldwide and Cyprus

Wine tourism is much more than a "food and beverage excursion" as it is associated with specific leisure activities and use of the tourist facilities of a given region (Nemethy, Lagerqvist & Walas, 2017). According to Hall et al. (2020) and Hall and Macionis (1998), wine tourism is characterised as a form of special interest tourism that includes visits to vineyards, wineries, wine festivals, and wine shows in wine producing regions. Marzo-Navvaro and Pedraja-Iglesias (2010), add other aspects, such as visiting local attractions or experiencing the indigenous lifestyle, for example, staying overnight in the vineyards.

In terms of the role of wine tourism to the wine destination's enhancement undeniably, it can be considered as a growing activity that contributes to the economic development of wine-growing regions (Hojman & Hunter-Jones, 2012; Molina, Gomez, Gonzalez-Diaz, & Esteban, 2015); the dynamic development of wine tourism has a positive impact on the creation of a strong brand image for wine destinations (Orth et al., 2012). Destination managers promote satisfying experiences to create an one-of-a-kind connection between the customer and the place where the wineries are located, so that improve their attractiveness. In this respect, the island of Cyprus has recognised the contribution of wine to its overall appeal and diversification of its tourism product (Boukas, 2019).

The Cypriot wine industry has gone through an evolution stage during the last decades, as there is a technological/equipment upgrade of Cypriot wineries, mainly because of more educated winemakers, subsidies from EU and Cyprus government aiming to improve competitiveness (Feilden, 2023). In terms of varieties, the wineries produce primarily red and white wines, but also offer rose and Commandaria. In addition, the wineries produce varietal wines from indigenous varieties and blended wines from indigenous and international varieties. The wines are produced from three indigenous varieties and eight protected designation of origin varieties. Wine production reaches 9 million litres, exports 1.5 million litres, and wine consumption rises to 16 million litres (An Overview of Cyprus 2023). In addition, the promotion of Commandaria and Zivania spirit which are ancient Cypriot wine produces, are among the prime products in wine tourism activities and enhance the wine tourism dynamics of the island (Cy statistics 2024). Nevertheless, the pandemic crisis of COVID-19 affected the competitiveness of the wine tourism product of the island but, at the same time, signified new innovative way/s that the wine tourism product is produced, promoted and delivered to its markets.

2.2 COVID-19: Impacts on the Wineries

The COVID-19 pandemic has largely changed wine tourism operations. Since the coronavirus emerged, the worldwide wine business has faced various challenges. For instance, Marco-Lajara et al. (2021), suggest that the Spanish wine sector has been hit, particularly on employment in wine-related economic activities, distribution routes, exports, and wine tourism. Similarly, Temperini et al. (2022) underlined the primary distribution channel management problems that small wineries faced, among them the lockdowns and the closure of the HO.RE.CA distribution channel, in order to comply with the policy regulations. As such, the pandemic actually created a

disruption in small wineries operations and brought to the surface challenges on various processes of wine (tourism) companies.

Indeed, the last years have brought a new reality for an industry that was traditionally based on promoting wine directly to the community and forging relationships with the end consumer and customer, mainly through the conventional way of selling. As Szolnoki et al. (2022) argue, COVID-19 significantly affected the financial condition of wineries, which they had to urgently find alternative ways of revenue generation for covering the overnight loss of many traditional sales channels such as cellar door, wine tourism events, culinary activities, travel retail, etc. The authors suggest that diversification of sales channels proved to be the foundation for resiliency. In this respect, today, businesses are almost forced to accept online platforms.

COVID-19 underlined the need for alternative and innovative ways and tools to perform traditional tasks and accelerated their implementation. For example, during the pandemic much more emphasis was placed upon technology. In fact, technology has changed the way consumers shop products, among them wine, much earlier from the crisis; with technology, wine buying became part of the online age (Halstead, 2013). Nonetheless, as Sigala (2023) argues, technologies and innovation were considered as necessity and have been instrumental for enabling the wine tourism industry to go through the crisis, re-start but also resetting its practices. This underlines why innovation may be among the few aspects that can improve a product's competitiveness.

2.3 The Role of Innovation for Wineries

Undeniably, innovation is a concept well-studied in the tourism literature. For instance, innovation has an important part on the diversification of many products, among them tourism (Benur and Bramwell, 2015). Nonetheless, it can also have an impact not only on the development of new products but also on the creation of innovative processes in tourism, such as the use of new technologies in the tourism production process or the co-creation of experiences (Boukas, 2021; Boukas and Ioannou, 2020). As Boukas (2021) argues, both innovative products as well as innovative processes can help products to grow and be fertile, providing equally spread benefits to various destination's stakeholders.

Regarding wine tourism, innovation can be met on various aspects such as at the production level through the cultivation/production of organic wines (Jones & Grandjean, 2017). Today a significant portion of the agricultural sector deals with organic products (Goodman, 2004). Consumers intend to pay more money for organic products as they consider them healthier, tastier and of higher quality, although many still confuse the concepts of organic, biodynamic and sulphur-free wines (Amato et al., 2017). In the same lines, alcohol-free or low-alcohol wine products, seem to hold an increasingly share of the wine market. This is mainly attributed to the scientific research published on the effect of alcoholic beverages on human health. As such, innovation could be beneficial for the creation of non-alcoholic produces for wine tourists.

Additionally, innovation is also seen on the packaging material and label on the bottle which may consist a differential advantage of the wine for the tourist. The packaging material and the label play an important role in marketing and act as a means of impression. Packaging that is innovative and convenient to manage is being launched in the wine market (IPSOS, 2018). In this aspect technology can be really helpful as it helps producing more innovative environmentally friendly materials, convenient to use.

Moreover, the evolution of technology and digitalisation had also affected the wine tourism product. Tourism, and wine tourism in particular, rely heavily on technology. Technologies have long been used to support, enhance, and revolutionise wine experiences and offers, as well as the operations of wine tourism stakeholders and wine tourists themselves. Blockchain, smartphone applications, social media and internet advancements, crowdfunding, and virtual and augmented reality were all projected to revolutionise and innovate the wine tourism business (Sigala & Robinson, 2019a).

Indeed, the use of social media and digital marketing has proven to be a valuable tool for the wine industry to increase brand awareness, engage with customers and increase sales (Obermayer et al., 2022). Digital marketing strategies such as social media advertising, email marketing and influencer marketing have become an essential part of the wine industry's overall marketing plan (Costa et al., 2021; Jeyamani, 2020). Wine tourism combined with social media can become an important tool for wine tourists/wineries. They can share their own experiences on social media, encouraging others to visit paving the way for a direct brand-customer interaction. Wine tourists may benefit from interacting with wineries of interest, further enriching their related searches (Cristófol, et al., 2020).

Overall, it is argued that innovation as expressed in various areas of wine tourism companies can play significant role for the winery and the wine destination's sustainable competitive advantage. This is even more evident in the case of crises, such as COVID-19 where many challenges and problems can arise into the surface. Therefore, there is a need to comprehend how wine tourism can be benefited from innovation during and post crisis for creating, improving or reorganising wine tourism practices.

3. Methodology

The paper is part of a preliminary study that aims to explore the role of Covid-19 on Cyprus wine tourism industry. In this regard, the study examines how Cyprus wine tourist companies have faced the impacts of COVID-19, focusing on their operations and strategy, and underlines pertinent actions for their recovery and post-crisis course, highlighting innovative practices. Finally, the paper suggests implications regarding management strategies that wine tourist companies could adopt, in order for them to gain and improve their competitiveness in a post-crisis environment.

In this respect, the key methodological approach utilised, was exploratory research through reviewing documentation about wine tourism in Cyprus, as well as face-to-face, in-depth interviews with seven managers/owners/representatives of Cypriot wineries from the areas of Paphos and Limassol, Southwest Cyprus (see Table 1).

Table 1: Profile of Interviewees

Respondent	Gender	Age	Area
1	Female	>40	Limassol
2	Female	> 40	Limassol
3	Male	> 35	Limassol
4	Male	> 40	Paphos
5	Male	> 55	Limassol
6	Male	> 55	Limassol
7	Male	> 55	Paphos

The interviews lasted on average between 1-1½ hours and were conducted in the premises of the interviewees. The wineries were selected based on an industry accessible list from the Ministry of Trade and Commerce and with the support of the Industry Group Oenognosia, Cyprus.

An interview guide was prepared for facilitating the process. The interviews were held in Greek language as all the respondents spoke Greek. All the interviews were recorded and transcribed verbatim in the Greek language. Afterwards, they were translated in English and analysed manually by each author independently. Data were analysed iteratively (Miles & Huberman, 1994) following a constant comparison method (Glaser & Strauss, 1967) for finding out emerging themes and distinguishing their relationships. Once theoretical saturation was reached, interpretations and coding themes by both authors were compared and a coding scheme that is suitable for the emerging data was prepared and followed.

4. Findings

4.1 Impacts of COVID-19 Crisis on the Operation and Performance of Wine Tourism Companies

Correspondingly to what happened to the rest world (Guedes et al., 2023; Niklas et al., 2022a, 2023b), in the case of Cyprus the pandemic hit both sales and visitation of Cypriot wineries. Based on the findings, the crisis has severely affected wineries' sales. As respondents indicate, the impact was noticed both on the visits as well as on the wine sales. Specifically, especially for smaller wineries that only provide wine to Hotel, Restaurant and Catering (HO.RE.CA.) establishments, the respondents underlined that since those companies had to remain out of operation because of the pandemic's governmental measures, they had to halt also their sales to them. As Respondent 3 indicated, a wine producer, producing only Commandaria, the winery faced a sharp reduction on sales both in house and in the retail (since they were no visits). As complemented, the reason for this is because sweet wine (i.e., Commandaria) is a particular variety mostly asked by Russian[1] tourists who, as stated, indicate

[1] Russian tourists possessed the second largest market of tourists on the island during that time.

a great preference for it. Since with the lockdowns there was not international travel to Cyprus there was also a fall on the Commandaria's sales, respectively.

In these lines, the majority of wineries stated that they faced significant decline in the overall number of visitors to Cyprus' Wine Routes/wineries, and also decrease in the number of wine tourists. This decline had a direct reflection on wine sales at the winery as well as wine consumption establishments. As Respondent 7 claimed: 'We did remain open but we struggled a lot as much of our operations depends on wine visits … the crisis was a serious test for our team's integrity and we were lucky that we remained strong". Similarly, Respondent 6 argued that neither their company nor the government were prepared for the consequences of such a crisis on their operations. This comes in alignment with the literature; as Kastenholz et al. (2022) argue, wineries had little advice about what should they do or amend in their practices regarding their operations and they had often difficulties in developing new marketing policies that could aid to overcome the fears of tourists.

Nonetheless, for the case of Cyprus, apart from the sales and visitation, the crisis did not appear to affect the actual production of wine. The surveyed wineries indicated that wine production was not impacted since demand for wine was increased from retailers (e.g., supermarkets). In contrast, the wineries did continue the production of the wines. Respondents indicated that there was no need to proceed with 'green harvest', and few of the wineries proceeded with distillation of fermented liquids (wines) to produce a local distillate called 'Zivania'.

Generally, the pandemic's consequences on Cypriot wine tourist companies followed the pace of all worldwide wineries. As the rest tourist activities on the island, wine tourism ones were significantly reduced due to the quarantine measures. Moreover, the high dependence of wineries on the hospitality industry challenged even more this situation. In an effort to deal with this enormous crisis, wineries on the island followed a series of measures, many of them innovative for them, to respond effectively to its impacts.

4.2 Responses to COVID-19: The Role of Innovation

Among the direct responses of the wine tourism companies was to perform several of their operations in an online format, transforming traditional activities (e.g., wine tasting, presentations, etc.) onto an online format. Actually, the majority of wineries tried to promote online sales, enhance virtual wine tasting, even searching new markets especially retail shops, but with scepticism, as for many of them, these practices were completely new. For instance, Respondent 2 mentioned that the online activities, such as online tasting, were something new for their winery and they had to train their personnel in this innovative way of doing business. Indeed, online operations were among the first measures adopted during COVID-19 period and many of these activities still continue today as a common practice from wineries. As Szolnoki et al. (2022) argue, in COVID-19 period there was an increasing tendency to perform online tasting for mitigating the loss from the policy measures. The authors argue that this was positively reflected both to the wine tourist experience, but also to the revenues of wineries. The authors conclude that online tasting will remain as an option for many wineries in the long term. In this regard, the online environment has created new opportunities to the wine tourism, something noticed also by the interviews.

In terms of distribution, the market moved from HO.RE.CA. industry to supermarkets but with no success as. As stated by Respondent 4, the problem with supermarkets was the low profit margin and long periods of payment. The respondent claimed that the cooperation of the small wineries with big supermarkets was not sustainable and viable for them, and hence they found that online distribution could be more vital. Moreover, wineries with strong distribution systems, especially after the pandemic, arranged to satisfy all their customers (HO.RE.CA.) in shorter periods of time. Instead, small wineries strangled and do strangle to distribute their wines in a short period of time due to their low(er) supply. Therefore, the dependence of HO.RE.CA. companies to big brands of wines has been increased. This left to the small wineries to concentrate more on direct sales, enhancing their options for visitation to their premises, especially after the pandemic period. As Respondent 7 indicates: 'One of the lessons gained from COVID-19 is that we had to find ways to be more independent'. As such, the interviews noticed a continuous turn of the smaller wineries towards wine tourism, and in this regard, this new tendency places wine tourism among the top alternative tourist activities on the island, where prior crisis its role was supplementary to the main tourist product, mass tourism. Interviewees argue that the opportunities provided by online activities such as sales or marketing ones, created a new environment with improved conditions to sell and market their products on newer, non-traditional for the island's tourism, markets, such as Germans.

In this respect, among the online operations used during the pandemic and afterwards was the enhancement of the wineries' activities in online platforms in which their actions and products are promoted. Respondents also indicated the growing utilisation of social media such as X (Tweeter), Instagram and/or Facebook (in alignment to the literature). As Respondent 7 claims: 'We had to remain alive… we use a lot the social media… many people know us from there and they recommend us to others'. Similarly, Respondent 1 suggested that the social media provided a good space for them to communicate with various publics such as visitors, official or even other companies. Indeed, as argued by Yu, Wang and Hanes, (2022, p. 75): 'In the era of digital economy, digitalisation has given the wine culture industry new vitality against the backdrop of COVID-19'. The authors complement that COVID-19 provided the opportunity for many wine tourism companies to utilise digitalisation not only to promote their produce but also open the gates to many people to know more about the unique culture of the brand.

To this end, another finding that has to do with innovation was the diversification of the Cypriot wine tourist product to new or unexplored prior the crisis, markets. All respondents indicated that they paid attention on the cultivation and promotion of the Cypriot indigenous varieties; furthermore, many wineries proceeded with small vinifications of local varieties; this gave a competitive advantage as they penetrated more seriously to the local market. One of the wineries stated (Respondent 2) that the promotion of 'Comandaria' and 'Zivania' is the flagship of Cypriot wineries with great benefits to 'ecotourism'. The pandemic gave the opportunity to wineries to search for new ways to focus on the local market. For instance, as mentioned, the home consumption has been increased, and the wineries performed many home deliveries during COVID-19. Additionally, some respondents claimed that they frequently organise events of various types (e.g., business, social, etc.) on their premises not only to increase their revenues but also to project the local wine culture to more potential visitors.

Finally, some wineries (i.e., Respondent 2 and 6) argued that after the crisis they try to value and further understand visitors. As suggested, since visitors are valued for their future continuous visitation, wineries try to understand what they want from the wine consumption and offer them enriching factors for creating a more enhanced tourist experience. For instance, as demonstrated, they ask the visitors about their preferences in tastes, offer them wine in appropriate glasses, and/or accompany them with the suitable food to enrich the taste. As Respondent 6 indicated: 'We try to listen to the visitor and make the experience together with him'. As such, in their effort to improve and differentiate their tourist experience, there is a tendency towards provided a more holistic experience to the visitor investing in co-creation (Boukas and Ioannou, 2020).

Overall, the interviewees argued that the most significant lesson gained from the pandemic, was that they realised their weaknesses and addressed more effectively their strengths; the interests of the company and the employees were aligned, as a result of empowering the team. Respondent 5 stated that every crisis makes the weak enterprises weaker and the strong enterprises stronger. The respondent concluded that even if the pandemic created a huge disruption on the landscape of wine tourism, it also indicated great opportunities that had to be seized. Indeed, as Boukas and Ziakas (2014) argue, one of the lessons of large crises is the realisation that the system of the crisis is chaotic and among the few responses that tourist destinations can do is to act quickly and think innovatively.

5. Conclusion and Recommendations

The study's findings are especially relevant to the Cyprus wine sector since they shed light on a volatile environment caused by the coronavirus pandemic. In reality, the study provides a significant contribution to the academic literature as it addresses the impact of the coronavirus on small island context and small wine enterprises, as well. From the survey it was found that the crisis highlighted the significance of the coherence among the employees of wine tourism enterprises, the importance to find out new ways to be independent such as more specific wine tourist products that emphasise locality to new markets (i.e., locals), and innovative elements that could be used for them to be more sustainably competitive, such as online practices in distribution and marketing and co-created wine tourist experiences. Finally, one of the major findings drawn from the research is a significant reorganisation of wine distribution channels, since domestic wine consumption and other channels expanded significantly.

To this end, the paper suggests that in order for smaller wineries to be more competitive in the long term, especially in traditional mass destinations, such as Cyprus, there is a need for them to concentrate on the destination's local identity, as a differential factor and/or expand in more alternative markets. Among the findings, it was found out that the majority of the small wineries invested in their local indigenous varieties, in order to be different in the global market, and this paid back; it is no surprise that the majority of sales regarding wine tourism come from 'Commandaria' or 'Zivania', that are both indigenous cultivations and varieties.

Towards this direction, the role of creative tourism is imperative not only to provide products (e.g., wine) and processes (e.g., specific production patterns) but also to provide complete experiences supported by co-created mutual involvement of the customer and supplier. Considering that wine making and consumption in Cyprus is part of its life and culture and has historic value, it can be concluded that the concept of creative tourism could be adopted in the production and delivery of the wine tourist experience. As Richards (2001) argues, creative tourism provides visitors the opportunity to develop their creative potential through active participation in learning experiences which are characteristic of the holiday destination where they are undertake (in this case wine tourist experiences). As such, the wine tourist experience in destinations similar to Cyprus, should incorporate all chronologic phases from the past, to the present and future of wine, should treat wine not only as a popular cultural product but a high cultural element with significant past and history (e.g., Commandaria), as well, and could emphasize the holistic experience through the incorporation of digitalization and virtual/online techniques, and the support of co-creation (Boukas and Ioannou, 2018, 2020). In this respect, the wine tourist experience can become richer and could help put wine tourism on the map of important activities in smaller destinations, among other traditional ones (e.g., 3Ss tourism).

Overall, this study concludes that small wineries and tourist companies in Cyprus proved to be quite strong during the crisis because of their direct response towards its consequences, as well as their investment in a large degree, on their strengths, capitalising opportunities provided to them such as new technologies, diversified distribution, and production orientations. The specific study is progressive and is based on a framework that incorporates various stakeholders such as entrepreneurs, policy makers, communities, etc. In this regard, a limitation of the study is that it focuses only on wine companies. Future research could shed light on the views of other stakeholders regarding their perceptions/reactions on the pandemic's impacts. Additionally, as this study is a preliminary examination, it concentrates only on the opinions of a small number of entrepreneurs. A greater sample size would provide a more representative image of the entrepreneurs' reflections. This is something that needs to be managed in future research. Finally, further research needs to analyse more the course of small wineries in small -island- destinations in the post-crisis era. In this respect, there is a need to expand on the examination of not only what the supply side (i.e., wineries and wine tourist companies) believes about the future of wine tourism, but also on the views of wine tourists themselves, in regards to how they perceive the 'newer' wine tourist experience, after the incorporation of innovative products, processes, and practices employed by wineries. This comparison, could allow identifying gaps for improvement of the future wine tourist experiences of smaller wineries in smaller destinations' context.

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A Review on Elizabeth Holmes and her Sinking Ship's Backstory

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Abstract: The scandalous fraud of the Theranos company and every step taken by its founder, Elizabeth Holmes, is well known in the media. In order to learn more about this topic and identify areas in which the company's management has fallen short, a variety of articles, newsletters, and papers were examined. The whole story of this enterprise was told by carefully putting in context what happened to Holmes in the workplace and in her personal life. In college, when she met Balwani, a romantic partner and important member of Theranos' management, the Stanford dropout began working on her company idea. Both were convicted of offenses connected to this type of business management. Five essential questions, as outlined by Lafley & Martin (2023), encapsulate the decision cascade that should be incorporated into any business plan. This essay attempts to explain Theranos' decision-making process in light of these considerations, complementing it with the strategic view defined by Porter's five forces. The facade of success that made it possible for investment to keep coming in while the technology did not make any progress was analysed too, divided into two parts: red flags and Elizabeth's crafted discourse about the company. Through this article, it is easy to conclude that Theranos' mismanagement was responsible for its collapse. With all that said, the following questions remain: Is there a bright future after a huge mistake? Perhaps a second attempt to help people with no ulterior motives? What will happen next? What can be expected?

Keywords: Elizabeth Holmes, Theranos, Fraud, Strategy

1. Introduction

Innumerable risks go with start-ups that aspire for quick growth via *blitzscalling*, such as Theranos' case, where it prioritises speed of growth over operational efficiency. When entering the high-tech products field, a company faces difficulties regarding technological uncertainty, potentially causing disconnection between customer needs and wants or even the product's value being dependent on complementary systems or network effects. The risk factor amplifies when unsustainable business models are adopted, unfinished product launches occur, and there is overspending and compromising ethics by fostering a culture of conformity and secrecy (Straker et al., 2021). Given this perspective, according to Carreyrou et al (2018), "Theranos' failure is a compelling saga about myopic personal ambition, bad faith inducement, an apparent dearth of strategic thought, the outdated use of design-as-decoration, fraudulent storytelling, and scientific impossibility". Such strong words always end up having a negative connotation and a strong impact on people's judgement of the company and the CEO herself. From the rise to the fall, various strategic factors and leadership decisions culminated in unravelling a case as mysterious as Theranos, where fascination meets doubt. Nevertheless, can it be seen just as a series of fraudulent mistakes, or is there a glimmer of hope that it was all just a misapplied strategy that, over time, has become an unstoppable snowball?

Thus, this work focuses on searching for the background that haunts this case. However, more than a fraud, more than a failure, this case can offer valuable lessons for companies to learn from mistakes and improve their performance to avoid meeting the same end. With that being said, this paper aims to provide an insight into the life story of Elizabeth Holmes (creator of Theranos), as well as an overview of the strategies adopted by this company during its years in business.

2. Methodology

In order to gain a deeper understanding of the Theranos case, this article aims to perform a detailed analysis based on various articles, as well as media publications and documentaries, including the well-known miniseries "The Dropout". This one-season miniseries covers a little of the entire process of the creation and downfall of the company, as well as Elizabeth's life so it was used as a complement to the writing regarding the path that this story took.

In general terms, the document can be divided into three essential parts, each of which requires the application of different information selection criteria. In the first phase, the search targeted heterographic articles and news

items, which are much more descriptive and factual. This would help to understand the emergence of the company, the story of Elizabeth Holmes, and the idea behind the creation of Theranos along the business, economic, and political context of the company so that the reader can be placed in the time and environment of the scandal. A more strategic view was considered in the second stage where articles related to business and technological practices were used to analyse Theranos' practices, strategic models, and ethics. Here, the reader can see through a strategist's eye and try to get more involved in the choices that led to failure, along with the seriousness of the consequences. Finally, in the last part, a more "subjective" look at the CEO's behaviour is considered, and a context is built for her success facade. Some interviews or even articles related to behavioural analysis are taken as examples. Please see the information on the various sources used as a basis for this work, as well as their main message (Figure 1). The most notable events concerning the company can be seen in the timeline in Figure 2.

Title	Reference	Type of reference	Main Message
Theranos phenomenon promises and fallacies	Eleftherios P. Diamandis	Article	Evaluates the promises, questions some of Theranos' promises, and mentions the dangers of putting a revolutionary technology on the market without proving its accuracy and efficacy with articles open to the public with the results
Purposeful life of sugar-coated lies: How Elizabeth Holmes legitimised her fraud	Janet Ho	Article	Analysis of Elizabeth Holmes's interviews in order to what speaking techniques she used to cover up the company's lies and to legitimise it
The Dropout	Elizabeth Meriwether	Biographical Drama Miniseries	A Hulu original series based on the Elizabeth Holmes's life story starting with the love affair with 'Sunny' Balwani and the company's build-up for the first half, and then shapes into the toxic relationship between both and the process of building a lie to keep the investments coming, finishing with the company's downfall
Holmes verdicts prompt questions over justice for patients	The Lancet	Journal	Small resume about Theranos, the fraud, the fall and the patients that testified as witnesses against the company owner
Elizabeth Holmes	Biography	Newsletter	Life of Elizabeth Holmes and Theranos' fall from the top to the bottom
Elizabeth Holmes' Net Worth Plummeted to $0 After Her Imprisonment For Fraud	StyleCaster	Newsletter	Elizabeth Holmes net worth went from $4.5 billion to $0 after stealing more than $700 million
They Still Live in the Shadow of Theranos's Elizabeth Holmes	The New York Times	Newspaper Article	Shared examples of women who suffered unfair comparisons with Elizabeth Holmes only because they are women as well
Elizabeth Holmes and Theranos: A play on more than just ethical failures	Medina Williams	Newspaper Article	A resume on each step of the Theranos case, unravelling the crucial technical points behind the scandalous scene, that more than an ethical failure reveals some plays behind the scenes

Figure 1: Various sources regarding the Theranos' case and their main message

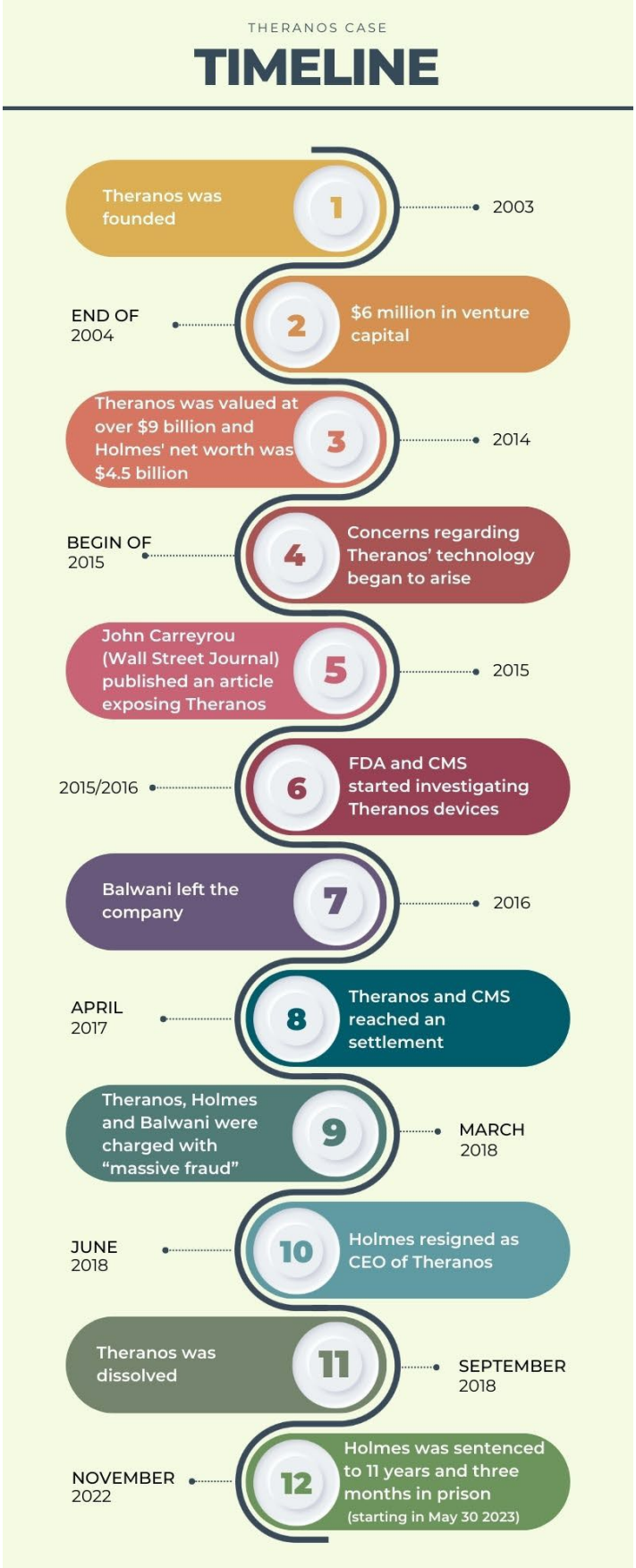


Figure 2: Theranos' most important events timeline

3. Background

3.1 How Theranos Became a Unicorn

Elizabeth Anne Holmes, born in 1984, started her entrepreneurial career with a firm providing coding translation software to Chinese institutions. After attending Stanford University, she collaborated with Channing Robertson, who later joined the board of Theranos (Donica & Biography.Com, 2023).

Her original concept was a tiny patch for drug delivery, but she later developed a novel blood test to change the healthcare system. During an interview, she claimed: "To me, there was nothing greater that I could build than something that would change the reality in our healthcare system today, which is that when someone you love gets sick, usually by the time you find that out, it is too late to be able to do something about it." (Jaffe, 2022). At the age of 19, Holmes started her startup company that ended up being rebranded as Theranos ("therapy" and "diagnosis" mashup) (Jaffe, 2022), (Mann, 2022). She stated that Theranos had developed technology that allowed tests for numerous diseases to be performed using a small amount of blood (Ranscombe, 2023) and could diagnose early-onset diseases that could be efficiently treated or prevented by offering quick and affordable lab testing to the public (Li & Diamandis, 2015). Theranos quickly developed exclusive techniques, including a nanometer tube for blood sample drawing called “nanotainer” and a lab apparatus for testing various diseases such as diabetes and cancer, using the same blood sample. Additionally, Theranos advocated for new laws to be passed in a few states so that the tests could be given out without a prescription. In biomedical engineering, patient independence, and ease of use of devices are increasingly valued, so the company’s proposals seemed very promising. Both technologies, globally estimated to be worth $52–57 billion in the early 2010s, would have completely changed the diagnostics sector (Donica & Biography.Com, 2023).

Channing Roberston introduced Holmes to prominent venture capitalists, who provide funding to companies with promising growth prospects in exchange for an ownership stake. By the end of 2004, she had raised about $6 million in venture capital and raised over $700 million for Theranos over the following ten years (Burgos & Hanson, 2023), which led to the company being valued at over $9 billion at its peak (2014). According to *Forbes,* Holmes' estimated net worth was $4.5 billion, making her the youngest self-made female billionaire in history at the age of thirty (Burgos & Hanson, 2023), (Donica & Biography.Com, 2023), (Jaffe, 2022), (Ranscombe, 2023). The company made her debut as a unicorn, i.e., a privately held business, customarily technology start-up recognised with a value of $ 1 billion or more, being rare and perpetually chased by investors looking for large returns (Straker et al., 2021).

3.2 The Beginning of the end

Theranos’ problems started due to its refusal to share information, and its lack of official press releases and websites, as its proprietary nature could expose the company to rivals. However, it struck several lucrative deals, such as one with Walgreens, so that Theranos could open labs for blood sample collection in almost 50 of the chain's locations and with expansion possibilities. Additionally, the company purported to collaborate with the US Department of Defense and major pharmaceutical companies such as Pfizer and GlaxoSmithKline, assertions that ended up being refuted (Burgos & Hanson, 2023), (Donica & Biography.Com, 2023).

Nick Bilton's Vanity Fair report revealed that Ian Gibbons, the chief scientist at Theranos, discovered several flaws in the company’s technology and warned Holmes that the tests were not yet ready for public use. Concerns about Theranos' technology reached a breaking point in 2015 when medical research professors questioned its viability (Burgos & Hanson, 2023). In the same year, the company was exposed by *Wall Street Journal* investigative reporter John Carreyrou, who began questioning the effectiveness of the Theranos machine (Mann, 2022). Carreyrou claimed the Edison blood-testing machines were unreliable in producing accurate test results due to the use of conventional equipment. The company's strict secrecy was also revealed by former employees, who claimed that although Holmes and President Ramesh "Sunny" Balwani knew about the drawbacks of the technologies being used, they forced employees to fabricate test results and false demonstrations by threatening them (Burgos & Hanson, 2023), (Donica & Biography.Com, 2023), (Ranscombe, 2023).

The Food and Drug Administration (FDA) and the Centers for Medicare & Medicaid Services (CMS) started looking into the case after the *Wall Street Journal* article was published. Theranos' "nanotainer" vial was declared by the FDA to be an "uncleared medical device" in October 2015, allegedly violating numerous FDA Title 21 Regulation infractions. In January 2016, the CMS began investigating a Theranos lab in Newark, California. After discovering anomalies in the lab's testing, it was shut down due to an "immediate jeopardy to patient health and safety". Months later, CMS prohibited Holmes from owning/running a clinical blood testing laboratory for two years. The company faced many other legal challenges and penalties from various organisations and

individuals (Burgos & Hanson, 2023), (Donica & Biography.Com, 2023). In April 2017, Theranos was fined $30,000 by CMS and banned from the blood-testing sector for two years, for focusing on technology development instead of processing clinical samples. That same month, a state fraud lawsuit was resolved by giving $4.6 million back to test-takers (Donica & Biography.Com, 2023). Holmes, Balwani (president and chief operating officer) and Theranos were charged by the US Securities and Exchange Commission in March 2018 for raising over $700 million "through an elaborate, years-long fraud". Holmes, despite not admitting guilt in her SEC settlement, agreed to pay a $500,000 penalty and relinquish majority control over Theranos. After many years of lawsuits and significant leadership changes after Balwani left the company and Holmes resigned as CEO in June 2018, David Taylor, also CEO of the company, declared on September 5, 2018, that Theranos would collapse. Holmes' net worth dropped from $4.5 billion to zero (Burgos & Hanson, 2023), (Donica & Biography.Com, 2023), (Jaffe, 2022).

3.3 Trials and Final Sentences

Holmes and Balwani were indicted on nine wire fraud and conspiracy counts in June 2018. In January 2022, the jury found Holmes guilty on three charges, totalling almost $145 million in transfers, and one conspiracy charge. In November, she was given an 11-year and three-month prison sentence starting on May 30, 2023. Balwani was obligated to reimburse $452 million (Donica & Biography.Com, 2023).

3.4 Some Relationships Work out, Some do not

Elizabeth Holmes, who ended her 12-year secret relationship with Balwani in 2016, decided to break the silence. She stated he was emotionally and sexually abusive and that he manipulated her into mismanaging the company. Although the two were indicted together, they were tried separately considering these accusations. Serving a 13-year term, Balwani was found guilty of all 12 crimes (Burgos & Hanson, 2023), (Donica & Biography.Com, 2023). However, Holmes met Billy Evans in 2017 and ended up marrying him. They had two children, in July 2021 and February 2023 (Donica & Biography.Com, 2023).

4. From a Strategist's Point of View

Theranos found itself in an unstable environment. Technological development is constantly evolving at an ever-increasing pace, competition is increasing daily, and the consumers' attention is easily lost to new products launched daily. Given these environmental factors, what set Theranos apart during its rise to the limelight (Lafley & Martin, 2013)? Visualising the company as an organisation where active decision-making is required, these choices can be seen as a decision cascade, where each step is interconnected and dependent on the other. Five important questions define the success of your strategy, so where did Theranos fail (Lafley & Martin, 2013)? During these checkpoints, Theranos' analytical framework for assessing competitive intensity on its key product will also be discussed following the five forces defined by Michael Porter (Porter, 1980) to reinforce the points that failed during the process.

4.1 Goals for a Winning Aspiration

When the question "What is your winning aspiration?" is asked, all the company's limits are already being tested, as well as the entire panorama of decisions made. Aspirations are statements that translate the ideal future, helping to turn concepts of winning into more defined concepts (Lafley & Martin, 2013).

When evaluating the internal rivalry (Porter's first force) that Theranos faced, it is important to recognize that diagnostics is a highly competitive field. This industry continuously seeks innovations and improvements in testing accuracy and efficiency, necessitating extensive networks and adherence to regulatory requirements, which intensifies the rivalry (Evans, 2023). In this context, Theranos aimed to revolutionize diagnostics by offering a multi-analytical test, challenging the traditional targeted and centralized diagnostic test paradigm (Diamandis, 2015). By introducing this groundbreaking idea, Theranos sought to disrupt the paradigm of laboratory medicine through a differentiation strategy as an innovative disruptor, allowing individuals to order blood tests from pharmacies. Holmes claimed to be "democratising" medicine and empowering patients by improving access to tests and enabling earlier detection of health problems (Fiala & Diamandis, 2018).

4.2 Where to Start the Fight?

In such a large sea of opportunities, the competitive field chosen will dictate the markets, customers and consumers, the channels chosen or even the product categories (Lafley & Martin, 2013).

Theranos focused on a specific area of the healthcare system: diagnostic and multi-analytical tests using blood samples. Given that the machine could diagnose several diseases and medical conditions, Theranos has

considered many possible consumers and customers. Theranos' battlefield consisted of fighting the usual procedures and allowing the patients to obtain a single container for all the exams in some selling point (e.g., pharmacies). This strategy would then play out in commercial outlets with wellness points and pharmacies (Fiala & Diamandis, 2018), (Westman, 2021).

Evaluating the second of Porter's five forces, the threat of new entrants, Theranos operated in a sector with high barriers to entry (Evans, 2023). The medical diagnostics industry requires adherence to strict regulatory standards, significant investment in research and development, clinical validation, and substantial venture capital. Additionally, differentiation is essential to become a market disruptor. Although Theranos initially managed to overcome these barriers, its fraudulent practices and failure to meet regulatory standards exposed its vulnerabilities, demonstrating that genuine barriers cannot be bypassed merely with capital and marketing.

Considering this, we must also examine Porter's third force, the threat of substitutes. Initially, Theranos mitigated the high threat of substitution through its differentiation. However, following the exposure of its fraud, only established companies with more reliable results could maintain a high threat of substitution, despite not offering the same advantages that Theranos claimed.

4.3 Choose the Fights and how to win Them

To determine how to win, the organisation needs to create a competitive advantage, which enables the establishment of a unique value and sustainable delivery that values the customers in a way distinct from the firm's competitors. Consequently, this leads to superior returns for the company (Lafley & Martin, 2013).

4.3.1 The miracle product

The first step was to create a distinctive biomedical device that no one in the market could match. In this way, a miniaturised clinical laboratory system was created that would do away with the need for several machines for different tests (Edison Machine) capable of carrying out tests over a wide range (Hutter & Lawrence, 2021), (Fiala & Diamandis, 2018). Inspired by her fear of needles, Holmes developed a finger prick blood acquisition system to incentivize collection, reduce needle discomfort, and decrease blood volume. The patient could speed up this process when collecting blood (buying the container at selling points) and receiving the results (in any room with an Edison machine) (Fiala & Diamandis, 2018). To round off this ingenious idea according to claims by Theranos, the cost of the tests would be 10% cheaper than centralised laboratory tests, with a faster allocation of results (Diamandis, 2015).

4.3.2 Incredible by sight, but does it work?

Theranos' offering fell in the lab-developed tests (LDT) category, which the FDA has little control over. This means that if a test is designed and used in a single lab, that lab can market the tests without the United States authority's approval. When the US Congress authorised the FDA to regulate medical devices, including in vitro diagnostic tests, in 1976, this "enforcement discretion" was established. Back then, LDTs were far more straightforward and intended for tiny patient populations, including those with uncommon disorders for which other diagnostics would not be accessible. To reinforce this type of play, Theranos also built some partnerships with the potential to spread the points of possible application of Theranos' point of blood collection. For example, through the deal with Walgreens, Holmes successfully lobbied state legislators to change laws allowing anyone to order laboratory tests without professional medical approval (Williams, 2022), (Parkins, 2019). The scenario seems to be ideal, but the lack of results that could prove the genuine technological innovation and the associated operational inefficiency put Theranos in disadvantage when it comes to the industry's rivalry, it could not sustain its competitive position against the well-established rivals.

4.3.3 From marketing to reality

When Theranos began executing its ill-advised plan, it focused on the human fear of late, inaccurate, and high-cost diagnoses, using it to promote and boost its business model. By advertising the possibility of the patient's control of their health, the Theranos' panel of routine laboratory tests would be the best choice "before it was too late". The message promoted by the company has opposed the evidence-based guidelines in the diagnostic methodology, which aim to minimise unnecessary and redundant testing for improved post-predictive and negative predictive value. While patient autonomy in medical care and direct-to-consumer diagnostics can be a good pathway in the healthcare system, shared decision-making with a trusted clinician is always necessary to support the system's core (Das & Drolet, 2022). The equipment provided by Theranos showed inaccurate results for an estimated one out of ten patients (i.e., patients testified that the tests wrongly diagnosed AIDS) (Jaffe,

2022). Consequently, many treatment decisions made for inaccurate diagnostics were applied, which is extremely dangerous (Das & Drolet, 2022).

Regarding Porter's fourth and fifth forces, customer power and supplier power, Theranos appeared to be in control of both variables (Evans, 2023). Theranos claimed that its technology reduced dependency on traditional lab equipment and reagents, and that the Edison machine provided accurate results, alleviating customers' concerns and offering privileges that traditional lab techniques could not. However, these claims were compromised, leading to a loss of credibility with buyers and reinforcing the importance of traditional lab work (the initial suppliers).

4.4 Strong Core Capabilities for a Strong Organisation – due Diligence

The capabilities of an organisation can be seen as the map of activities and competencies that support the where-to-play and how-to-win choices (Lafley & Martin, 2013).

Whether investing with personal cash or capital funds, a due diligence is essential to wise decision-making. Experts conduct profound assessments across multiple disciplines, encompassing topics such as the validity of the science or even the working hypotheses, for example, but the level of management and the management systems are two of the most crucial evaluations in a due diligence. Leadership and team functionality are essential factors after such important parts of the evaluation. Such a procedure significantly increases the likelihood of discovering dangers and strategies for mitigating them (Witek, Jr & Klein, 2023). A strong due diligence benefits both the firm and the investors allowing risks to be reduced without compromising genuine innovation. Theranos investors were scrutinised for their inadequate due diligence, frequently resulting from their fear of missing out on a well-publicized opportunity (Witek, Jr & Klein, 2023).

Under cross-examination regarding the office's due diligence lead, it was acknowledged that they had yet to examine patent applications, consult regulatory or legal professionals, or understand the many kinds of scientific testing found in review papers. Relying on Holmes and not wanting to "upset" her was stressed more than the usual extensive scrutiny associated with such big investments (Witek, Jr & Klein, 2023).

4.5 Management Systems

The final strategic choice of the cascade focuses on the management systems, since they are responsible for fostering, supporting, and measuring the strategy (Lafley & Martin, 2013).

4.5.1 From leader to employee

Regarding start-ups and organisations, the operation mode occurs in dynamic settings where they are subject to rapid changes and entrepreneurship colliding with the need for information. So, for a timely response to these market changes, information access must be well combined with work. As a parallel circumstance, the leadership is responsible for creating a culture that sustains high performance and integrity (Williams, 2022).

Unfortunately, Elizabeth Holmes's ambitious leadership failed to develop a governance structure that respected ethical values, while the company utilised a board of directors (BoD) structure which relied too heavily on management's word instead of fully comprehending day-to-day operations and overarching culture (Williams, 2022). By forcing out anyone who would ask critical questions, Elizabeth applied extensive control over the company's operations, including minimal accountability; she also tried to cultivate a persona modelled by Steve Jobs (Tourish & Willmott, 2023). Theranos' board composition comprised "formers", such as former senators, chief executive officers, and federal cabinet officials. The homogeneity of the group may be a factor, so it is less likely to probe topics and uncover potential issues. Nowadays, modern boards try to utilise a skills matrix and a board composition. Aggravating the lack of social diversity, the board was also short on biotechnology and medical expertise (Witek, Jr & Klein, 2023).

4.5.2 From employee to leader

When discussing character-based leadership, trust is the key component, and when it comes to Theranos, there are several examples of its absence. Over the years, there were several warnings from the employees due to the product's direction regarding the results achieved. During the trial testimony, it was revealed that a whistleblower in the company approached Balwani to warn him about the erroneous test results, but she was not taken seriously, and suffered the penalty of having her competence put into question. Adding to this testimony, a former lab director also testified that the firm's quality control program failed, which would have had an impact on patients. Holmes tried alternative explanations for the data, but he considered them implausible (Witek, Jr & Klein, 2023).

From this type of behavior arises the necessity to place some faith in the people working for the organization and establish an optimal practice of having various departmental leads presenting directly to the Board (Witek, Jr & Klein, 2023).

As a result of collective experience, most firms use clinician-scientists as advisors, and given the critical nature of biochemistry and laboratory science needed for Theranos' platform, it would have been essential that the professional staff involved could put the clear performance objective in order. After the resignation of the firm's lab director, the CEO's dermatologist was hired as one of two co-directors of the lab, who would spend less than ten hours working in the company (he considered it a part-time job) and never reviewed the lab's policy (Witek, Jr & Klein, 2023).

5. Facade of Success

5.1 The Signs Were Always There

How did this big lie go unnoticed for over a decade? Were there any warning signs? The first red flag is the lack of peer-reviewed or research articles about the 'revolutionising machine' developed by Theranos (Diamandis, 2015). No one was expecting this unicorn to tell the world about this innovative technology they invented, but they took it to the extreme and did not divulge any details about it. There should have been external quality assurance to monitor the blood testing data over sustained periods. It is incredible that a device in the medical field did not undergo any independent evaluations (Diamandis, 2015). Elizabeth and Theranos were questioned about it sometimes, but they always threw the "We have FDA approval" card, which was an easy way out, but the truth was that they had the FDA approval to test for herpes, and the remainder of the tests were not in the FDA field (Ho, 2021).

There were also red flags in the daily life at Theranos' headquarters. The work environment was characterised by employee isolation and high staff turnover, fostering a culture of fear. Scientists that were concerned with the company's practices and questioned its methods faced marginalisation and, in some cases, contract termination. They were also obligated to sign non-disclosure agreements (NDA) (The Lancet, 2022).

Given this environment description, it is safe to say that Theranos did not have a pleasant work environment, with many former employees reporting bullying, intimidation, deception, and cold-blooded threats (Ward, 2022). The former Theranos chemist, Erika Cheung, said that she had reservations about the company since day one and observed a pervasive atmosphere of paranoia and secrecy within the leadership, which was shown when all employees were mandated to sign an NDA when hired. The questions continued to pile up as time passed, and scientists were demanded to process samples around the clock, with the necessity of conducting tests multiple times to achieve the company's desired outcomes. The lack of interdepartmental transparency did no good to relieve Cheung's suspicions, as Theranos implemented a silo mentality in the company, which is a cognitive framework wherein the various departments within an organisation refrain from sharing information; this was done to maintain secret the absence of advancements in their product development (Ward, 2022).

Another example is the story of Tyler Schulz, who got an internship due to his grandfather's influence in the BoD. Tyler contacted Holmes via e-mail to expose the malpractices he saw in the laboratory testing. A few days later, he had a response from Balwani threatening him. The young man followed by leaving Theranos without signing an NDA and being one of the leading whistleblowers for John Carreyrou's piece, which brought down Theranos (Ward, 2022). However, the most tragic event of Theranos' toxicity is the sad story of Ian Gibbons, who committed suicide due to the pressure the company put on him.

When Theranos had a patent theft case involving Richard Fuisz, he noticed that Gibbons was almost in all patents filed by Theranos, so he had placed him to testify. This resulted in Gibbons facing a choice where he would always end up on the loser's side: or he would tell the truth and be fired by Theranos (losing his healthcare insurance, which he desperately needed due to previous cancer complications), or he would lie and hurt people's lives due to compacting with Theranos' lies. This situation made Gibbons nervous and depressed, which resulted in him taking his own life (The Lancet, 2022), (Ward, 2022), (Heaven, 2019), (Kirsch, 2022).

5.2 How to Legitimise Fraud

Even though all of this happened, Theranos was still one of the most beloved start-up stories in the entire USA, and they got more investment and endorsement from many powerful and important people in the country. For that to happen, Elizabeth Holmes' major role was to legitimise the company for outsiders because if the impression of the audience was positive, the company would continue to gain credibility and its image would

not be easily shattered. Theranos, like other firms involved in fraud, aimed to achieve legitimation as a goal (Ho, 2021). As Joutsenvirta (2013) stated, legitimation is "very much about discourse and ongoing struggles over meaning".

According to Ho (2021), 19 interviews with the Theranos CEO were analysed, and it is demonstrated that Holmes constructed a corporate image and cultivated an entrepreneurial personality cult to highlight a distinct market niche, foster a shared sense of identification, and normalise expectations. Albeit how did she "build a corporate image"? First, she started to paint a beautiful picture using abstract adjectives where Theranos was pioneering and life-changing: "We have an opportunity to do good in the world, […] by building a business as a vehicle for making a change in the world to help to shape our healthcare system and to shape it in such a way, in which we empower individuals to get access to information that […] means you do not have to say goodbye too soon" (Elizabeth Holmes Mission – *Fortune*) (Ho, 2021). Holmes' piece explores Theranos' ambiguous missions, highlighting their aspirations to positively impact the world, empower individuals, and effect global change. The use of abstract corporate goals may indicate a potential inability to support these claims with concrete facts. Then she communicated the idea that they were amongst the elites and therefore trustworthy, endeavouring to establish cultural resonance with the other corporations in Silicon Valley. Finally, she stated to the audience that Theranos was here to revolutionise: "Over the last 11 years, we have reinvented the traditional laboratory infrastructure" (Elizabeth Holmes Mission – *Fortune*) (Ho, 2021). Elizabeth attempted to instil in the people that they would change the reality of the US healthcare system; with Theranos' innovative blood-drawing technology, fostering a people-oriented image within the corporation (Ho, 2021).

6. Conclusion

With this article it was possible to understand the aspects behind the fall of Theranos, and that this tragic end could have been prevented. Even though the idea of the product that Theranos sold to the public was promising, the company was accountable for its own ending since an absence of ethics was registered. The corporation failed to act in a way that would have allowed it to implement its proposal in a just and compassionate manner. Besides, Elizabeth Holmes always tried to create a false image of herself, which in itself represents a major red flag because transparency and honesty were never valued. If all these values were to have been considered, Theranos would have had every reason to succeed.

After a careful analysis of the case in question, it emerged that Elizabeth Holmes is serving her prison sentence in a federal prison in Bryan, Texas and her scheduled release date is 29 December 2032 (1 year and 9 months before she completes the time given to her) (Silva, 2023). That said, and considering Holmes is leaving prison at a young age, what does the future hold for her? She told *The New York Times* that she still has ambitions to work in the biomedical industry: "I still dream of being able to contribute to that space", "I still feel the same calling that I've always felt, and I still think the need is there" (Silva, 2023). Will she try to return to the original idea? Will she bet on a new way of innovating in the same field? And if so, what support will she receive after what is considered a cold-blooded lie?

The fact that the information offered in this study is based on information that already exists and that there is always a chance that information will be conveyed biasedly are some of its limitations. Additionally, this is a situation in which conflicting viewpoints may emerge and obstruct the plain truth. We suggest personal interviews to be performed, if possible, in future research efforts, with Elizabeth Holmes and some of her former colleagues, at Theranos. To ascertain their views after the difficult court case and the consequences suffered.

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Is Formalisation Enough to Achieve Growth in SMEs?

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Abstract: The objective of this research is to determine whether the formalisation (FORM) of small and medium-sized enterprises (SMEs) has an impact on the growth, and determine which aspects of SMEs management, when formalised, are associated with and contribute to the growth of these organisations. A survey was applied to 403 proxies of SMEs in Lima, Peru. A structural equation model was used to validate the hypotheses. The results indicate that there is a positive and significant association between the FORM of SMEs management and the growth of these organisations. The main finding of this research is to determine that the formalisation of SME management in Lima, Peru explains their growth by only 27%, leaving 63% explained by other factors that could be not only management aspects, but also aspects of the SME environment. State institutions, companies and academia should analyse the low economic contribution of SMEs from a broader approach and not only from the position that formalisation is the only reason for growth. Other aspects should be studied, such as education in management issues by entrepreneurs, development of collaborators' competencies, improvement in the efficiency in the management of State institutions, among other factors; and thus, find the appropriate mechanisms that contribute to the growth of SMEs. This research is the first to analyse, in a single study, whether the formalisation aspects of SMEs management contribute to their growth. Finally, this research has contributed to the construction and conceptualisation of the SME growth variable.

Keywords: Management formalisation, Informality, Growth, SMEs, Emerging country

1. Introduction

SMEs are the main source of employment in emerging countries (Wang, 2016). However, the economic contribution of these organisations in terms of gross domestic product (GDP) is lower than in developed countries, employment conditions are not in line with labor regulations, and there are high levels of informality in their operations (Vasilescu, 2016). Despite efforts to strengthen the SME sector, these enterprises face several financial and regulatory barriers, especially in emerging countries (Berger and Udell, 1998). SMEs are of considerable economic importance in emerging economies and play an important role in the economic development of these countries; however, the performance of SMEs and the factors that contribute to this performance have received limited attention. The role of SMEs is critical to any country, but their declining contribution to GDP in recent years has been a cause for concern.

The phenomenon of unregistered businesses is a major global problem that has generated a great deal of attention in recent years. It is estimated that a substantial proportion of businesses around the world are not registered at the time of their creation, and an even larger percentage operate in the informal sector, evading reporting their production and sales to the authorities (Williams et al., 2017). This trend has sparked renewed interest in business research, with a specific focus on the challenges associated with operating in the informal sector (Krasniqi & Williams, 2020). The lack of comprehensive data on the number of unregistered businesses makes it difficult to obtain accurate figures. However, conservative estimates suggest that at least half of all businesses are unregistered, with approximately two-thirds of businesses operating without registration at the time of their creation (Williams & Liu, 2019).

In this context, promoting the formality of Peruvian SMEs is a major task for the economic development of the country; in this way it will be possible to reduce inequality and poverty levels (Williamson, 2009). Regarding the impact of entrepreneurs choosing to operate formally, numerous research has consistently shown that firms operating in the formal institutional environment tend to show superior efficiency and performance compared to those operating in informal institutional frameworks (La Porta and Schleifer, 2008). It is evident that new legitimate firms not only demonstrate higher revenues and profits, but also employ more workers and require more capital investment compared to their informal counterparts (Fajnzylber et al., 2011). In addition, studies indicate that registering firms to formalise them can improve firm performance compared to unregistered firms (Demenet et al., 2015).

In conclusion, although there is an extensive literature that explores the challenges faced by SMEs and the formalisation (FORM) of these companies in emerging countries, the evidence regarding the assured growth resulting from FORM is still incomplete, since the various studies only measure specific factors of FORM and growth, but not a more complete model that reflects the real context of regulation and management challenges that Peruvian SMEs are facing. As mentioned above, there is a great interest in analysing the

problems of SMEs to identify mechanisms and policies to promote their growth, and the same interest is perceived in the intention to formalise SMEs in emerging countries; previous studies have developed the analysis of the FORM and its advantages from specific aspects such as the payment of taxes, the registration of the company before government institutions, and the generation of contracts and recognition of payments with its collaborators; there is no previous evidence that, if the FORM at an integral level of SMEs guarantees their growth, there is also no evidence of which aspects of the FORM guarantee it.

In view of the above, the following research questions are posed:

- What factors are considered for SME FORM?
- What are the FORM factors associated with SME growth?
- Is FORM decisive and sufficient to achieve SME growth?

2. Literature Review

FORM of SMEs has been shown to have a positive and significant impact on several aspects of their performance. Studies have confirmed that after FORM, SMEs experience higher levels of revenue, profits, employment and capital intensity (Yazdanfar and Öhman, 2015). Formal SMEs have been found to provide a considerable number of employment opportunities and contribute significantly to GDP in high-income countries (Gombarume, 2014). Moreover, FORM has been positively correlated with firm performance, especially in terms of the probability of belonging to the group of growing firms (Kraus et al., 2006). In addition, the literature has highlighted the economic benefits associated with SME growth, such as improved productivity, employment generation, and increased tax-to-GDP ratios, which ultimately provide a competitive advantage to the economy (Khan et al., 2021). It has also been highlighted that SMEs play an important role in promoting rapid economic growth, and to the development and stability of many emerging economies (Karadag, 2015).

On the other hand, access to credit is a crucial element for SME growth (Ogoi, 2017). It has been confirmed that SMEs face significant difficulties in accessing credit, especially in developing countries, hindering their profitability and growth. The critical role of SMEs in driving the private sector and global economies suggests the importance of addressing the challenges they face in accessing credit. Previous studies have highlighted the impact of financial literacy, management competence, and overall business climate on SME performance (Agyapong and Attram, 2019). In addition, financial management practices, including working capital management, accounting information and financial reporting practices, as well as capital structure management, have been identified as influential factors on the growth and profitability of SMEs (Musah et al., 2018). The ability to access credit has been found to be influenced by factors such as collateral availability, financial literacy and payment capacity, which significantly affect the competitive growth of SMEs (Onkundi et al., 2023). In this regard, the importance of access to credit for SMEs and the various challenges they face in obtaining financing is evident. To facilitate the growth and sustainability of SMEs, it is essential to address these challenges, including improving financial literacy, collateral availability, and financial management practices.

SME learning processes are often informal and accidental, which may not contribute to their long-term sustainability. To solve this problem, it is proposed to apply knowledge-based learning methods that provide a formal structure for learning within these organisations. Furthermore, Valentim et al. (2015), confirmed the positive effects of formal learning in the learning process of inter-firm alliances, supporting the idea of incorporating formal learning structures in SMEs. On the other hand, the literature often suggests that the competitive advantage of smaller firms arises accidentally due to their informal management (Cagliano et al., 2001). However, it is essential to recognise that SMEs have unique constraints that impede their ability to actualise their learning (Saad et al., 2017). Therefore, formalising the learning process becomes crucial for their sustained growth and competitiveness. Moreover, the positive impact of inter-firm cooperation on the innovative performance of SMEs has been highlighted (Rezaei et al., 2014), which further increases the need for structured knowledge-based learning methods. This suggests that FORM of the learning process can improve organisational learning outcomes in SMEs, further supporting the need for structured learning methods in SMEs.

The use of intellectual property, such as patents, trademarks, copyrights and design registrations, has been the subject of interest in relation to SME growth. While some studies have found that patents do not necessarily lead to higher economic and financial performance of firms (Agostini et al., 2016), others have highlighted the positive influence of IP activities on SME performance (Andries and Faems, 2013). Moreover, it has been observed that SMEs tend to use their patents more actively than large firms, indicating a possible positive

impact on their performance. The FORM of these protection methods is indeed a costly process, especially for SMEs with limited resources; the high cost of formal protection methods, such as patent applications, coupled with low innovation output and patent-related uncertainty, often deters SMEs from investing in these mechanisms (Rehman and Yu, 2018). This is further supported by the fact that patents are expensive, leading SMEs to be selective in deciding whether patent protection is necessary. Trademark registration is cheaper to obtain than patents, making them a more feasible option for resource-constrained SMEs (Agostini et al., 2016).

3. Theoretical Framework

3.1 Growth of Small and Medium-Sized Enterprises

SME growth is a major research topic in emerging countries; however, there is no consensus in the literature on how to define and measure growth in these organisations (Tehseen et al., 2019). There are different theories and different methods used in the literature to measure growth; some analyses have developed theoretical constructs, others have used direct financial information from organisations, and others have used indicators validated by international organisations. Studies have estimated the growth of SMEs using variables created from data from the entrepreneurs themselves, such as the level of sales, market share, cash flow, and number of workers (Tehseen et al., 2019). SME growth is also analysed and measured using subjective perceptions of the entrepreneur, i.e., with only the entrepreneur's idea that his or her business is successful and growing (Chowdhury et al., 2013). On the other hand, other research has used direct information from the firm, such as growth in the level of sales using over a specific time (Macas et al., 2013). While there is controversy about the ways in which firm growth can be measured, there is a consensus on the factors that influence growth; according to the theory of firm growth proposed by Penrose (1959), growth depends on the application of managerial knowledge and entrepreneurial capabilities of firm leaders, and how this knowledge and capabilities are applied to their organisations.

3.2 Economic Formalisation of SMEs

Previous studies have presented some approximations to the criterion of informality, but there is still no consensus or single idea of how to define this phenomenon. The economic FORM of SMEs is the process for reducing informality. To identify the elements of the economic FORM, the concepts proposed by Gërxhani (2004) will be used; in this study it was possible to identify 5 common criteria within informal organisations. The economic criteria are the following:

- Unreported income or tax evasion. This criterion considers all taxable monetary income not declared for the purpose of tax evasion (Schneider and Enste, 2000).
- The labor market (undeclared jobs, lack of social benefit payments, sub-minimum wage payments, poor working conditions). Other studies have also emphasised this criterion (Harding and Jenkins, 1989).
- Size of the activity (size of the organisation in relation to the number of personnel hired). It is stated that an organisation with less than 10 workers is an informal organisation (Ferraro and Rojo, 2018).
- Professional status (measured by the number of self-employed, family workers and domestic workers). This criterion considers all workers in conditions of underemployment in these organisations (Hart, 1970).
- Regulation or registration of an activity (considers government regulation). This criterion considers unregistered and unlicensed establishments (Swaminathan, 1991).

3.3 Access to Formal Credit and Transparency of Financial Information

It is confirmed that access to credit facilitates the growth of SMEs and, therefore, is a fundamental element for these companies (Beck and Demirguc-Kunt, 2006). SME financing is a relevant aspect for the financial management of an organisation, SMEs resort to formal financing such as loans from regulated financial institutions, and informal financing such as loans from friends, relatives or informal moneylenders. Resorting to informal banking where financing costs are very high, affects the cost of capital of entrepreneurs (Wasiuzzaman and Nurdin, 2018); it has been found that, in developing countries, high interest costs of financing is an obstacle to the growth of SMEs (Wang, 2016). The decision to use formal credit in SMEs, and not informal credit, is influenced by the financial infrastructure and tax regulation of each country, i.e., the decision to use formal credit is also influenced by factors exogenous to management (Lin et al., 2020).

Additionally, there is a behavior in SMEs called Opacity of Financial Information (OIF); this practice of these companies for not generating financial and commercial information is linked to young companies (Hyytinen

and Pajarinen, 2008). The lack of information of SMEs affects their performance, not only because of the lack of financing, but also because the managers of these organisations do not have the necessary information for decision making (Sarapaivanich and Kotey, 2006); there is even a certain fear and lack of motivation on the part of the owners of these companies to apply for financing because they consider that they do not have enough information for a formal institution to finance them. It is stated that entrepreneurs owning SMEs, in their first years of operation, must try to make their information transparent, if they have the economic growth of their business as a goal (Zambaldi et al., 2011). Formal banking considers OFI as a risky behavior, there is evidence that confirms that the probability of defaulting on loans is higher for SMEs with higher OFI, this probability increases when these companies have a weak credit history (Gao et al., 2020).

For a formal institution to finance a company, it must have accounting and economic information; most SMEs, especially the smallest ones, do not have this information (Britzelmaier et al., 2013), which makes it difficult to measure the level of intrinsic risk. In some cases, not knowing the level of risk of SMEs, above-average financing costs are assigned to them; in Peru, the average SME financing cost rate is 32.9% (Choy et al., 2015). Initially, it was confirmed that the probability that banks are more willing to grant credit is positively related to the quality of accounting information (Palazuelos et al., 2018). However, when studies began to identify that this relationship is valid only for companies that have audited financial information, the lack of OFI was not a determining factor for accessing credit and better credit conditions; in these cases, trust between institutions was the determining factor for accessing credit and better credit conditions.

3.4 Formal Learning

Traditional training methods in the work environment must be questioned, studies confirm the importance of using competence development strategies that are based on an integration of formal and informal learning (Kock and Ellström, 2011). The learning theory points out 2 types of learning; the first is formal learning that is characterised by being a planned learning, certified and developed in courses provided in higher education institutions; and the second informal learning is the one that is learned in daily work activities, where learning is given by the active participation of workers in the organisation's projects, as well as the rotation of personnel within the organisation (Marsick and Watkins, 2016). Prioritising formal learning can undermine the spontaneous nature of learning, claims that one type of learning is better or worse than another should be avoided, both types of learning can be applied in organisations, both have advantages (Malcolm et al., 2003).

3.5 Formal Methods of Intellectual Protection

The literature indicates that another way to formalise organisations is through the FORM of different protection methods. Intellectual property represents knowledge that can be protected by recognised rights, called intellectual property rights (IPR) that encompass elements such as patents, trademarks, design and copyrights. There is extensive literature that studies the importance of IPR use in the performance of SMEs (Jensen and Ebster, 2006). It has been determined that the use of PM such as patents, trademarks, copyrights and design registration positively influence the growth of SMEs (Jensen and Ebster, 2006).

Considering the above, this research work formulates the following hypotheses.

H1: FORM is positively and significantly associated with SME growth.

H2: Labor FORM is positively and significantly associated with SME growth.

H3: Tax FORM is positively and significantly associated with SME growth.

H4: Financial transparency is positively and significantly associated with SME growth.

H5: Formal learning is positively and significantly associated with SME growth.

H6: The FORM of intellectual property rights is positively and significantly associated with the growth of SMEs.

4. Methodology

For SME growth, 5 items will be used such as growth in sales, growth in personnel, growth in facilities, growth in product and service offerings, and growth in customer base (Altinay et al., 2016). The Tax FORM (FT) which indicates whether the firm started paying one or more of the following taxes: corporate income tax; and/or, value added tax (Berkel et al., 2022). Labor FORM (FL) measured by a situation where workers have a declared job; workers have employment benefits from local regulation; minimum wages required by local regulation are respected; and good working conditions are available (Gërxhani, 2004). Transparency of financial information

(TIF) measured by 5 items such as: budgeting the company's fiscal year earnings; accuracy of earnings forecast; analysts' forecasts differ from each other (i.e., their diversity of forecasts, the less variation the more transparency); auditors' supervision; displaying the company's earnings flow (Maffett, 2012). Formal Learning (FL) measured by the investment of hours dedicated to activities such as conferences, seminars, workshops and trainings to a company's workers in the last year of operation (Froehlich et al., 2020). Formal protection rights (IPR) used by firms such as patents, inventions, design right, trademarks, and trade name right (Päällysaho and Kuusisto, 2016). Responses for the constructs were measured via binomial scale, under a 2-point scale (1 = meets, 0 = does not meet).

Table 1: Descriptive statistics

	Freq.	%		Freq.	%
Number of employees per company			**Industry**		
Less than 10	*187*	*46.4%*	*Commerce*	*223*	*55.3%*
Between 11 to 20	*50*	*12.4%*	*Accommodation and restaurants*	*71*	*17.6%*
Between 21 to 50	*166*	*41.2%*	*Telecommunications*	*38*	*9.4%*
Company's Operating Time			*Maintenance and repair*	*22*	*5.4%*
3 to 5 years	*260*	*64.5%*	*Construction*	*21*	*5.2%*
5 to 10 years	*67*	*16.6%*	*Transport, storage, mail and courier*	*10*	*2.5%*
More than 10 years	*76*	*18.9%*	*Others*	*18*	*4.6%*

5. Results

5.1 Validity and Reliability

The conceptual model (Figure 1) was tested using Smart PLS 4.0, a sophisticated and widely recognised software tool). To assess the efficacy and reliability of the model, a comprehensive evaluation was conducted, including measurement of item loadings, internal consistency, reliability, convergent validity, and discriminant validity. The detailed results of these evaluations are presented in detail in Tables 2 and 3, which provide an overview of the model's performance.

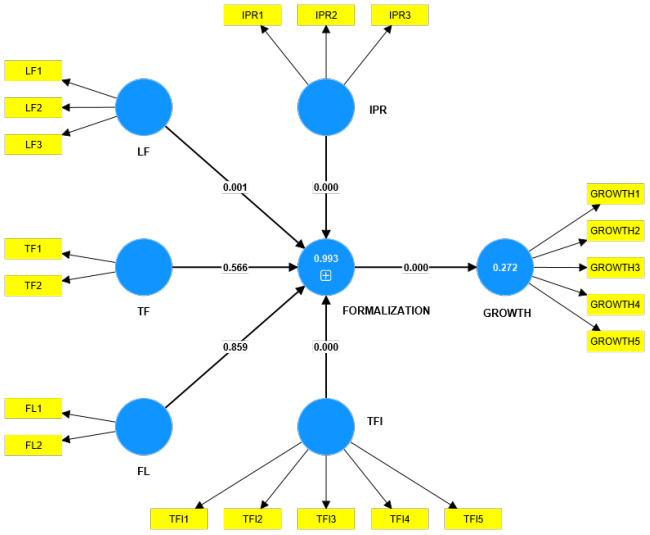


Figure 1: Structural Model

A crucial aspect that was examined during the evaluation was the loadings of the items used. It was observed that all item loadings exceeded the threshold of 0.50, which is considered statistically significant and indicative of convergent validity (Hair et al., 2014). This finding is very relevant and reinforces the validity of the model, as it demonstrates that the constructs investigated accurately measure the intended concepts.

Reliability was another important criterion evaluated in this study and was assessed using two widely accepted metrics: Cronbach's alpha and the composite reliability of the AVE. The results of these assessments revealed that the model exhibits a high level of reliability. Specifically, an AVE value equal to or greater than 0.5 and a

Cronbach's alpha indicator greater than 0.7 are considered indicative of an adequate model. In this case, all AVE values and Cronbach's alpha indicators exceeded these thresholds, which further reinforces the reliability and validity of the conceptual model investigated (Hair et al., 2014).

In addition to assessing the reliability and convergent validity of the model, an analysis was also performed to determine its discriminant validity. This analysis was intended to measure the differences between each construct and to assess whether they were distinct from each other. The results of the discriminant validity assessment were very encouraging, as they indicated that the square root of each AVE was greater than the correlations of the constructs.

Table 2: Measurement properties

Variable	Item	FL	Cronbach's alpha	CR (rho_a)	CR (rho_c)	(AVE)
Growth	GROWTH1	0.517	0.705	0.748	0.795	0.546
	GROWTH2	0.801				
	GROWTH3	0.810				
	GROWTH4	0.519				
	GROWTH5	0.632				
Laboral Formalisation	LF1	0.761	0.779	0.711	0.738	0.589
	LF2	0.769				
	LF3	0.545				
Tax Formalisation	TF1	0.774	0.706	0.707	0.771	0.627
	TF2	0.810				
Transparency of Financial Information	TFI1	0.672	0.721	0.738	0.717	0.544
	TFI2	0.731				
	TFI3	0.529				
	TFI4	0.565				
	TFI5	0.683				
Formal Learning	FL1	0.760	0.854	0.755	0.756	0.607
	FL2	0.798				
Intellectual Property Rights	IPR1	0.727	0.751	0.759	0.769	0.527
	IPR2	0.667				
	IPR3	0.779				

Note: Factor loading (FL), Average variance extracted (AVE), composite reliability (CR).

Table 3: Discriminant validity Fornell - Larcker analysis

	FL	GROWTH	IPR	LF	TF	TFI
FL	0.779					
GROWTH	0.208	0.668				
IPR	0.256	0.360	0.726			
LF	0.275	0.337	0.267	0.700		
TF	0.263	0.246	0.319	0.474	0.792	
TFI	0.401	0.432	0.373	0.387	0.390	0.587

Note: Formal Learning (FL), Average Intellectual Property Rights (IPR), Laboral Formalisation reliability (LF), Tax Formalisation (TF), Transparency of Financial Information (TFI).

5.2 Structural Equation Model and Hypothesis Testing

The coefficient of determination was 0.272 (see Figure 1), indicating a weak level of determination (Hair et al., 2014) generated by FORM. That is, there are other determinants for SME growth that will need to be the product of further research. The first hypothesis, H1, indicates that FORM has a positive and significant effect on GROWTH. Table 4 indicates that a positive and significant effect can be traced between the variables (β = 0.548; T-value = 15.060 and p = 0.000). Therefore, H1 should be accepted. The second hypothesis, H2, indicates that LF has a positive and significant effect with GROWTH. Table 4 indicates that a positive and significant effect can be traced between the variables (β = 0.355; T-value = 3.421 and p = 0.001). Therefore, H2 should be accepted. The third hypothesis, H3, indicates that TF has a positive and significant effect with GROWTH. Table 4 indicates that a negative and non-significant effect can be traced between the variables (β = -0.059; T-value = 0.575 and p = 0.566). Therefore, H3 must be rejected. The fourth hypothesis, H4, indicates that TFI has a positive and significant effect with GROWTH. Table 4 indicates that a positive and significant effect can be traced between the variables (β = 0.587; T-value = 6.107 and p = 0.000). Therefore, H4 should be accepted. The fifth hypothesis, H5, indicates that LF has a positive and significant effect with GROWTH. Table 4 indicates that a negative and non-significant effect can be traced between the variables (β = -0.017; T-value = 0.178 and p = 0.859). Therefore, H5 must be rejected. The sixth hypothesis, H6, indicates that IPR has a positive and significant effect with GROWTH. Table 4 indicates that a positive and significant effect can be traced between the variables (β = -0.017; T-value = 0.178 and p = 0.859). Therefore, H6 should be accepted.

Table 4: Hypothesis testing

	Coefficients	T-Value	p-Value	Hypothesis
FORM → GROWTH	0.548	15.060	0.000	H1 - Accepted
LF → GROWTH	0.355	3.421	0.001	H2 - Accepted
TF → GROWTH	-0.059	0.575	0.566	H3 - Not Accepted
TFI → GROWTH	0.587	6.107	0.000	H4 - Accepted
FL → GROWTH	-0.017	0.178	0.859	H5 - Not Accepted
IPR → GROWTH	0.416	4.763	0.000	H6 - Accepted

Note: Formal Learning (FL), Average Intellectual Property Rights (IPR), Laboral Formalisation reliability (LF), Tax Formalisation (TF), Transparency of Financial Information (TFI).

6. Discussion

The main finding of this research is to have determined that the formalisation of the management of SMEs in Lima, Peru determines their growth by only 27%, leaving 63% explained by other factors that could be not only management aspects but also aspects exogenous to the SMEs.

It was determined which specific management FORM factors contribute to the growth of SMEs. Among the most important, first and foremost, is TFI. TFI is among the most important management formalisation factors contributing to SME growth, as confirmed by the studies of (Tong and Serrasqueiro, 2020). It has been established that proper bookkeeping, financial reporting and management accounting practices are important for the survival of SMEs (Musah et al., 2018). Furthermore, the association between financial disclosure, transparency and firm performance has been found to be statistically significant, indicating that financial disclosure and transparency are significant determinants of SME performance (Musah and Padi, 2022). Formalisation of IPR, such as patents, trademarks, designs and copyrights, are confirmed to be specific management formalisation factors that contribute to the growth of SMEs, as could also be determined in the findings of (Jensen and Ebster, 2006). Trademarks play an important role in the growth of SMEs, as they are linked to the degree of product differentiation, product quality and overall firm performance (Agostini et al., 2015). Labor formalisation is confirmed to be one of the specific management formalisation factors contributing to SME growth; as stated in the study by (Dung et al., 2017) where he concludes that formalisation of labor relations can lead to increased productivity, improved working conditions and better access to finance; these aspects contribute to SME growth.

In addition, evidence has been found on the significant relationship between Tax Formalisation, Labor Formalisation, Registration Status, Transparency of Financial Information, Formal Learning and Intellectual Protection Methods, with the growth of SMEs. For example, the study findings (Ayyagari et al., 2007)

determined that labor formalisation, financial formalisation and registration formalisation are positively associated with SME growth; however, these relationships when measured separately fail to fully explain the dependent variable, i.e., they explain the growth variable in a weak way. Therefore, it is important to consider a holistic approach to SME growth that considers multiple factors, including formalisation in various areas, as well as other factors that contribute to SME growth.

On many occasions it has been stated that the main cause of the lack of growth of companies in Peru is the high level of informality; however, this research has contributed to shift the debate to other aspects of management, given that informality and, consequently, the formalisation of companies is not the main cause, or at least, it does not explain most of it. As supported by (Schneider and Enste, 2000) who affirms that there are other causes that can drive the growth of the informal economy in SMEs, such as higher taxes, high social security costs and government regulations.

Future research should focus on determining how formalisation is associated with other expected results of an organisation such as labor productivity, customer loyalty, business sustainability, among others. On the other hand, new studies should add efforts to determine what other factors generate the growth of SMEs and how these factors reinforce or correct the results of this research. Finally, future research can use the validated constructs of this research and apply them in other research related to business and economics.

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The Perception of Corporate Social Responsibility and Employee Flourishing: Cultural Diversity as an Underlying Mechanism

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Abstract: Corporate social responsibility (CSR) has been a field of interest over the past couple of decades. The challenges posed by rapidly evolving technology and frequently changing market conditions along with well-informed customers, have compelled firms to pay greater attention to their stakeholders and address social, economic, and environmental issues. This heightened focus on CSR reflects a growing perception that success transcends financial gains and encompasses broader benefits to communities and society. Moreover, there is growing recognition of the impact of internal CSR practices, which not only enhance a firm's reputation, assets, and customer retention but also significantly influence the well-being, engagement, and satisfaction of their workforce. Currently, for some firms, particularly multinational corporations (MNCs), promoting internal CSR practices becomes particularly complex amidst diverse workforces encompassing varied languages and cultures. This study, thus, explores the relationship between perceived CSR practices and workplace outcomes, including the mediating role of cultural diversity. Based on data collected from 211 employees in 19 different countries, the results reveal that perceived CSR effects on employee well-being, satisfaction, and engagement are driven by diversified cultural settings. Accordingly, these findings reinforce the urgency to delve deeper into the implications of cultural diversity within CSR frameworks.

Keywords: Corporate social responsibility, Cultural diversity, Employee engagement, Job satisfaction, Employee well-being

1. Introduction

A corporate concern for social and environmental responsibility has exponentially increased since firms have started to understand that they can reach a level of success by performing activities that contribute to the well-being of the communities and societies (Al-Ghazali and Sohail, 2021). In recent years, corporate social responsibility (CSR) has attracted the attention of organizations and started to become an important component of business. CSR can be considered as a complete range of policies and practices that are embedded into a company's operations and decision-making process. It reflects the organization's commitment to integrity and ethical conduct and may include considerations of business ethics, environmental sustainability, human rights, community engagement, and consumer and employee rights (Hsu *et al*., 2017).

Although the study of CSR is increasingly focusing on its results at the individual level (Donia and Sirsly, 2016), employees' perceptions and the real impact of the implementation of CSR strategies on them is still a path to explore (Aguinis and Glavas, 2019, Gotsch *et al*., 2023, Rodrigues *et al.*, 2024). Thus, this research aims to explore the effects of perceived CSR policies and practices on workplace outcomes, such as job satisfaction, employees' well-being, and employees' engagement, mitigating the existing gap in the literature at this level and extending previous studies (e.g., Cunha *et al.*, 2022, Rodrigues *et al.*, 2024).

As demonstrated in the extant literature, employees' perceptions of CSR play a central role in well-being and job satisfaction and are a key feature of the broader concept of decent work (Adu-Gyamfi *et al.*, 2021, Al-Ghazali and Sohail, 2021, Kim *et al.*, 2018). It similarly presents organizational-level advantages, such as increased employee engagement and commitment, which in turn will be more productive (Al-Ghazali and Sohail, 2021, Azim, 2016, Chaudhary, 2017, Ramdhan *et al.*, 2022). Thus, employees' satisfaction, well-being, and engagement through work prove to be a key piece for organizations, so this study will focus on workplace outcomes at the organizational level. By choosing these outcomes, we intend to contribute to a better understanding of the importance attributed by employees to CSR policies and practices, as well as to guide organizations so that they can manage them more effectively.

Grabner-Kräuter *et al.* (2020) point to the possibility of considering cultural diversity when implementing CSR practices, helping employees to achieve a level of integration, bringing them job satisfaction, and engagement, as well as enhancing their well-being (Neto *et al.,* 2018). It therefore indicates a research question to guide future research, which links perceived CSR practices, workplace outcomes, and cross-cultural dimensions of CSR (Ivanova-Gongne *et al.*, 2022). Adopting this view, we intend to shed light on this pressing question: *Can CSR perception towards cultural diversity affect employees' satisfaction, well-being, and engagement?* By answering this question, this research aims to contribute to expanding knowledge on this subject.

The remainder of this paper is structured as follows. Section two briefly characterizes CSR practices and then discusses the interrelations between perceived CSR, cultural diversity, and workplace outcomes. Section three introduces the data collection and analysis methodology used. The results are covered in section four and discussed in section five. The study closes with the implications drawn and suggestions for future research.

2. Theoretical Background

The employee perceptions of CSR are subjective including their interpretation of the organization's CSR activities which can differ from the actual activities employed (Azim, 2016). According to Tian and Robertson (2017), it is important to comprehend *how* and *when* employees perceive CSR practices, as the circumstances determine the impact on employees' engagement. The social identity theory (SIT) posits that a strong correlation exists between an employee's perception of CSR and how they evaluate the internal and external image of their company (Azim, 2016, Tian and Robertson, 2017). This theory suggests that when an organization's internal and external image positively affects identity, consciousness, and self-enhancement, an employee is more likely to view that organization's image as attractive, feeling that the firm's values are similar to their own (Tian and Robertson, 2017).

Therefore, employees are considered one of the most important stakeholders of any organization and must be prioritized, since the organization's success or failure can be strongly influenced by its workers (Azim, 2016). The top management team should consider employees' responses to CSR activities since they have the potential to transform the company's CSR expenses into value-adding investments (Aggarwal and Singh, 2021). Accordingly, CSR perceptions have a significant impact on employees' emotions because they are more likely to feel engaged in their jobs when they believe that an organization's CSR efforts are focused on improving society and the environment (Al-Ghazali and Sohail, 2021). Their perceptions of CSR activities, especially their judgment of how valuable the company's social responsibility initiatives are to its customers, society, and their own have an impact on the relationship they create with the organization (Al-Ghazali and Sohail, 2021, Lee *et al.*, 2013).

When CSR activities are fair and accurate with the organization's culture, employees can positively perceive those activities, thus they will be more committed and satisfied (Lee *et al.*, 2013). Indeed, firms that adopt CSR practices are seen as more attractive to bring the best employees, since socially responsible activities help to build a positive image and reputation (Al-Ghazali and Sohail, 2021). Employees experience a greater sense of job purpose and importance when the organization performs CSR. When they see their company engaged in the community's well-being, creating a positive image in society, they also want to be a part of it (Azim, 2016). CSR practices, when properly implemented, can have a positive impact on all company decisions, consequently, creating circumstances that would improve the working conditions (Kim *et al.*, 2018). Based on these findings, the present study's first hypothesis was formulated as follows:

Hypothesis 1: *Employees' perceptions of CSR have a positive effect on their satisfaction at work.*

Most employees are motivated and satisfied in the organization when they become aware of internal CSR practices regarding their well-being (Adu-Gyamfi *et al.*, 2021, Al-Ghazali and Sohail, 2021, Kim *et al.*, 2018). According to several scholars (e.g., Bryson *et al.,* 2017, Page and Vella-Brodrick, 2008, Sironi, 2019), social well-being (SWB) is used to describe the positive state of an individual's mind. It is measured by self-evaluations of an emotional state of satisfaction in different areas of life (Bryson *et al.,* 2017), usually defined as the feeling of happiness, derivative of personal fulfilment and expressiveness (Page and Vella-Brodrick, 2008). Thus, rising levels of SWB can impact an employee's physical health, elevate creativity and the ability to problem-solving, also encourage pro-social behaviour, and enhance the level of work engagement (Bryson *et al.,* 2017).

Based on the above, employees are more likely to support their company when they feel happy and satisfied. They may also engage in voluntary actions becoming involved in a reciprocal exchange to show their appreciation for the treatment they receive (Azim, 2016). The factors that can influence the feeling of well-being at work are the opportunities for employees to apply their abilities, the relationship with supervisor and co-workers, the chances of career progression, and job security (Sironi, 2019). A positive workplace promotes

employee productivity, prevents or reduces absenteeism, and labour turnover, and improves work performance (Adu-Gyamfi *et al.*, 2021). The current research thus included the following hypothesis:

Hypothesis 2: *Employees' perceptions of CSR have a positive effect on their well-being at work.*

CSR is one of the key factors in constructing employee engagement (Cunha *et al*., 2022) and has been solidly established in the literature as the organizational context, directly influencing the individual's *sense of belonging* (Lee, 2021). A recent research stream has found a positive relationship between CSR and employee engagement (Al-Ghazali and Sohail, 2021, Azim, 2016, Chaudhary, 2017, Ramdhan *et al.*, 2022). Job engagement refers to the psychological presence of the individual as an indicator of workers' commitment to developing their duties as members of the organization (Azim, 2016). Hence, they can perform to the best of their abilities because of the motivation and commitment that come with work engagement (Chaudhary, 2017).

A company is more likely to enhance employee performance while strengthening the organizational culture when prioritizing CSR goals towards its employees (Ramdhan *et al.*, 2022). Organizations that perform CSR can make their workers engaged because of their improved self-perception or increased sense of justice, which makes them respond by engaging in voluntary behaviour and positive attitudes at work (Azim, 2016). The effects of CSR on employee engagement will, therefore, depend on the level of employees' meaningfulness and sensemaking that they associate with CSR (Cunha *et al*., 2022). Accordingly, the present study's next hypothesis postulated that:

Hypothesis 3: *Employees' perceptions of CSR have a positive effect on their engagement at work.*

Many organizations are starting to be more concerned about managing workplace diversity because an organization that prioritizes diversity can expand its creative talent becoming more innovative and competitive (Al Amri *et al.*, 2019). According to Orsini and Magnier-Watanabe (2023), diversity has been defined as a combination of attributes that make a person different from others associated as gender, age, race, education, knowledge, religion, ethnicity, or culture. Cultural diversity is a significant phenomenon that impacts organizational cohesion and effectiveness along with social and political harmony (Lozano and Escrich, 2016), facilitating the exchange of information and providing a wider variety of opinions and knowledge (Dodd *et al.*, 2022). Consequently, managing cultural diversity is considered an extremely important strategy for organizations, requiring the integration of distinct values and beliefs (Lozano and Escrich, 2016).

Some studies provide evidence of cultural influences on CSR, but most of the CSR research is about the importance of diversity on the board of directors and how they influence CSR (Shatnawi *et al.*, 2022). Bocquet *et al.* (2019) indeed highlight that extant research provides limited insights into CSR and diversity challenges, although this subject is crucial for businesses, their primary stakeholders, and their employees. Comparatively to gender or ethnic variety, cultural diversity is less prominent, even though several scholars have investigated the impacts of an organization's board of directors' diversity, there has been limited research on cultural diversity's role in employees (Dodd *et al.*, 2022).

A diverse workforce allows the organization to implement CSR cultural-related activities that are compatible with its structure, supporting identity and moral standards (Bocquet *et al.,* 2019). Furthermore, cultural diversity among the board of directors improves and expands the understanding of employees' demands and supports more effective adoption of CSR policies that are created to meet those needs (Dodd *et al.,* 2022). By cultivating a climate conducive to CSR awareness, understanding, and implementation, cultural diversity engenders a virtuous cycle wherein CSR initiatives resonate with employees' values (Grabner-Kräuter *et al.*, 2020, Neto *et al.,* 2018), fostering a sense of organizational commitment and enhancing workplace outcomes, namely, employees' satisfaction, well-being, and engagement. Thus, the current study's last hypothesis was as follows:

Hypothesis 4: *Cultural diversity mediates the direct relationship between employees' perceptions of CSR and their (a) satisfaction, (b) well-being, and (c) engagement at work.*

The four hypotheses defined were incorporated into the research model (see Figure 1).

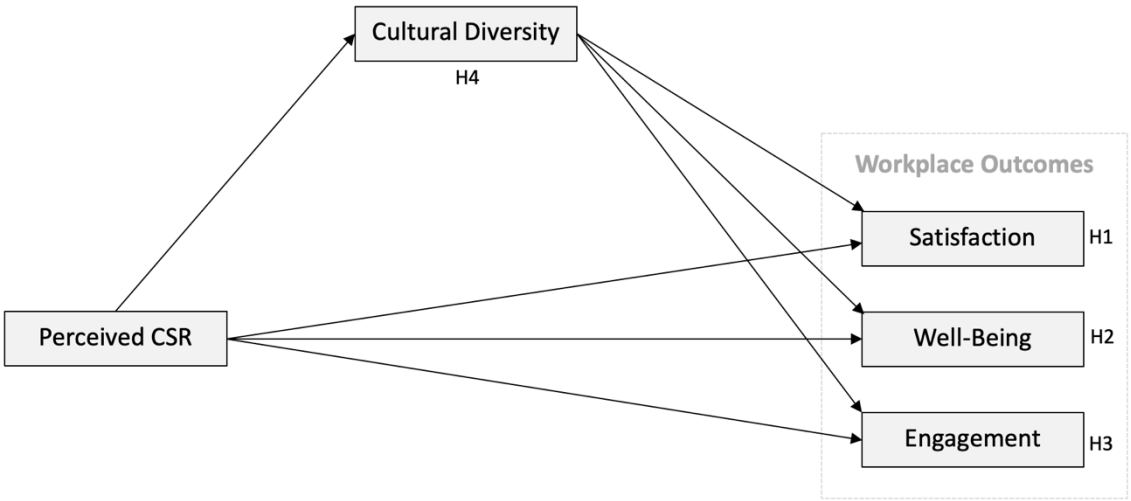


Figure 1: Research model

3. Methodology

3.1 Data Collection and Sample

To achieve the pre-defined objectives, data were collected via a large-scale survey of selected companies in the service sector that have CSR practices and a culturally diverse environment. The questionnaire was administered to international employees of four firms headquartered in the North of Portugal. We opted for a quantitative methodology applied to international employees who recognize the existence of CSR policies and practices in the organization where they work. In addition, variables such as gender, age, country of employment, seniority in the organization, possible managerial responsibilities, and sector of activity were controlled for, as these are variables that may influence the effects of CSR on employee outcomes (Rupp and Mallory, 2015).

A convenience sample technique was used to distribute the survey between April and June 2023 through the Amazon Mechanical Turk (MTurk) platform (English version). By the end of the data collection period, the sample included answers from 211 employees working in 19 different countries. Well-tested scales were employed and respondent confidentiality and anonymity were ensured to mitigate the common method bias. This bias occurs when data is collected from the same source and at a single time, causing variance to result from the measurement method, which can determine the relationship between two variables, leading to incorrect perceptions and affecting hypotheses testing (Podsakoff *et al.*, 2003). Accordingly, we also examined the potential common method bias in our data by resorting the Harman's single-factor test (Podsakoff *et al.*, 2003). The results indicated that no single factor accounted for the majority of the variance, suggesting that common method bias was not a significant concern in this study (Podsakoff *et al*., 2003).

Since our model simultaneously assumes a series of interrelated relationships, we apply structural equation modelling (SEM) rather than often-used multiple regression, which is restricted to examining a single relationship at a time (Cheng, 2001). Accordingly, we followed the recommendations of Marôco (2014) to validate the research model through a two-step strategy. First, the measurement model was validated by confirmatory factor analysis (CFA), and then the fitting coefficient and path coefficients were measured by SEM. Measurement model validation performed via an SEM-based CFA produces some additional advantages (e.g., more favourable psychometric properties) because the relationship between the constructs' indicators is studied jointly (Cheng, 2001) and because measurement error is considered when statistically analysing data (Lomax and Schumacker, 2004). We used SPSS 29.0 and Amos 29.0 for SEM analysis.

3.2 Variables

3.2.1 Dependent variables

The target variables were employees' satisfaction, well-being, and engagement at work. Employees' satisfaction was assessed using the scale developed by Macdonald and MacIntyre (1997). This scale includes ten items and focuses on the workers' reactions to the events rather than the events themselves. Participants were asked to rate their degree of satisfaction with their job on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Employees' well-being, in turn, was measured using the scale presented by Pradhan and Hati (2019). Since this research aims to assess the workers' perceptions of the aspects related to the workplace environment, we focused on *workplace well-being* and *social well-being.* On the one hand, *workplace well-being* includes five items work-life safety, employee assistance, employee growth, work facilities, and work climate (Pradhan and Hati, 2019). On the other hand, the *social well-being* dimension is defined as the degree of belongingness and attachment towards society, consisting of five items related to social acceptance, actualization, contribution, and integration (Pradhan and Hati, 2019). The researchers surveyed scored each item on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

Engagement at work was determined based on the scale designed by Saks (2006) that investigates the relationships between an organization and its employees using the social exchange relationship model. The scale is divided into two dimensions to assess the employee's psychological engagement in their job and organization with five and six items, respectively. The answers were rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

3.2.2 Independent variable

The explanatory variable was the perceived CSR. This was determined using the stakeholders-based CSR scale developed by Turker (2009) which includes four dimensions: (1) six items for social and non-social stakeholders (community and environment), (2) five items for CSR to employees, (3) three items for CSR to customers, and (4) two items for CSR to government. Responses were rated on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

3.2.3 Mediating variable

The mediating variable was cultural diversity assessed through the benefits and threats of diversity (BTDS) scale developed by Orsini and Magnier-Watanabe (2023). The BTDS scale measures the *benefits* of cultural diversity which include the perception of diverse groups in society and the analysis of the social environment, each one comprising three items. Further, this scale also explores the *threats* that may arise from the inclusion of distinct cultures in the workplace comprising three items to assess symbolic threats and another three to analyse intergroup anxiety. The responses were coded on a 5-point Likert scale ranging from 1 ("strongly disagree") to 5 ("strongly agree").

4. Results

4.1 Factor Analysis

4.1.1 Exploratory factor analysis

To ascertain whether the factor analysis method can be used, two tests were performed: the Kaiser-Meyer-Olkin (KMO) test and Bartlett's test of sphericity. Having obtained good values for these tests, we proceeded with the exploratory factor analysis, where, for the extraction of the factors, the Principal Component Method was applied, using the Varimax factor rotation method, removing all coefficients below 0.5 (Marôco, 2014). Perceived CSR (PCSR) and cultural diversity (CD) were presented with three factors, while employees' satisfaction (EJS), well-being (EW), and engagement (EE) at work presented two factors. Furthermore, Cronbach's alpha (CA) values exceed the established threshold of 0.70 (Marôco, 2014). The CA found for these constructs, PCSR, EW, EJS, EE, and CD, were 0.931, 0.922, 0.915, 0.889, and 0.785, respectively.

4.1.2 Confirmatory factor analysis

Twelve models were designed in SPSS Amos with different numbers of factors, from a model with only one factor to the measurement models with the number of factors that emerged from EFA. Confirmatory factor analyses (CFA) were then performed on each model to understand the changes to model fit when a different number of factors were considered. As the number of factors increased and approached the respective measurement models, we found an improvement in model fit. Overall, the models presented an acceptable quality fit (see Table 1).

Table 1: Model fit summary

Constructs	χ^2/df	CFI	GFI	RMSEA
CD	2.938	0.940	0.901	0.096
EJS	3.778	0.935	0.895	0.115

Constructs	χ^2/df	CFI	GFI	RMSEA
EE	3.724	0.925	0.885	0.114
EW	2.618	0.962	0.931	0.088
PCSR	1.993	0.951	0.900	0.069
Norm*	< 5	≥ 0.95	≥ 0.95	< 0.05

*** Source: most conversative thresholds of Marôco (2014). CFI = comparative fit index, GFI = goodness of fit index, RMSEA = root mean square error of approximation.**

Associated with CFA, there are other validation measures – composite reliability (CR), average variance extracted (AVE), and discriminant validity – that were also determined. Besides Cronbach's alpha (CA), construct reliability is assessed considering the values of CR which should be higher than 0.70 (Marôco, 2014). In our study, CA and CR values were above the recommended thresholds (Marôco, 2014), ensuring the constructs' internal reliability. Regarding AVE, in our study, the constructs fulfilled the minimum recommended value of 0.50 (Fornell and Larcker, 1981). The correlations between each pair of constructs were also checked to ensure the values did not exceed the square root of AVE for each latent variable (Fornell and Larcker, 1981). The current results thus indicate that the measurement models have adequate convergent and discriminant validity.

4.2 Descriptive Statistics and Correlation Analysis

Table 2 shows the mean, standard deviation (SD), and correlation coefficients between the variables. PCSR is positive and significantly associated with the three variables that make it up the workplace outcomes (EJS, EW, and EE), and these variables are also associated with each other, which allows us to anticipate a possible confirmation of hypotheses H1, H2, and H3. Likewise, we also found a positive and significant correlation of CD with PCSR, EJS, EW, and EE, allowing us to anticipate a potential validation of H4 (a-c).

Table 2: Descriptive statistics and correlational analysis

Constructs	Mean	S.D.	1	2	3	4	5
1. CD	3.43	0.553	1				
2. EJS	3.65	0.769	0.475**	1			
3. EE	3.42	0.752	0.569**	0.794**	1		
4. EW	3.73	0.760	0.421**	0.879**	0.796**	1	
5. PCSR	3.78	0.636	0.469**	0.767**	0.717**	0.780**	1
**** p < 0.01.**							

4.3 Structural Model Analysis

We performed an SEM analysis (see Figure 2). This model presented reasonable global adjustment values (Marôco, 2014). Depending on the indicators, the adjustment values varied between acceptable (χ^2/df = 4.945) and sufferable (CFI = 0.858, GFI = 0.787). Therefore, this was the model that served as the basis for the remaining analysis. We began the hypotheses testing by analyzing H1, which represents the effects of PCSR on EJS (see Table 3). From the analysis of the results, it is possible to verify that PCSR has a positive and significant impact on employees' satisfaction at work ($p < 0.001$), lending support to hypothesis H1.

Next, hypotheses H2 and H3 were analyzed, which address, respectively, the direct effects of PCSR on EW and EE. We began by testing H2 which reflects the effects of PCSR on employees' well-being at work. We find a positive and significant effect ($p < 0.001$), confirming hypothesis H2. To test H3 the same reasoning was followed. From the analysis of these results, it can be seen that PCSR has a positive and significant effect on employees' engagement at work ($p < 0.05$), supporting hypothesis H3.

Table 3: Direct effects - H1, H2, and H3

Hypotheses	β	S.E.	ρ value	Result
H1: PCSR → EJS	1.152	0.103	***	Confirmed
H2: PCSR → EW	1.004	0.113	***	Confirmed
H3: PCSR → EE	0.292	0.142	0.039	Confirmed

Finally, we tested hypothesis H4 (a-c), which corresponds to mediation, through cultural diversity (CD), of the relationship between PCSR and workplace outcomes, namely, EJS, EW, and EE. For this we analyzed the indirect effect of PCSR on EJS, EW, and EE, mediated by CD. As can be seen from the analysis of Table 4, the indirect effects of PCSR on EJS, EW, and EE, mediated by CD, are positive and statistically significant ($p < 0.001$), offering support to hypothesis H4 (a-c).

Table 4: Indirect effects - H4

Hypotheses	β	S.E.	ρ value	Result
$H4_a$: PCSR → CD → EJS	1.235	0.127	***	Confirmed
$H4_b$: PCSR → CD → EW	1.232	0.115	***	Confirmed
$H4_c$: PCSR → CD → EE	1.142	0.131	***	Confirmed

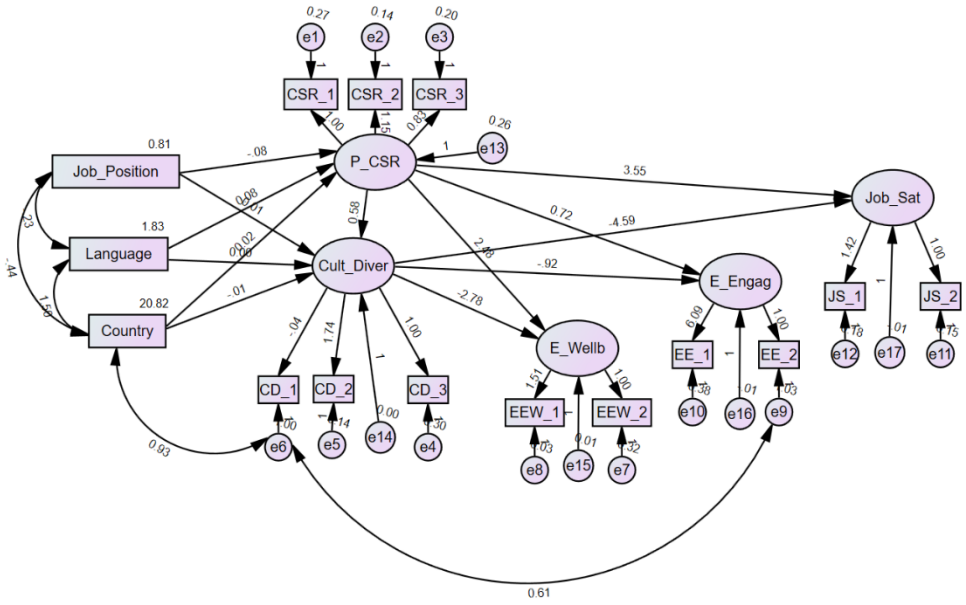


Figure 2: Structural model

5. Discussion

Consistent with what was indicated by the literature, that perceived CSR was positively related to satisfaction at work, our study allows us to prove this relationship (H1). We infer that employees' perceptions of CSR, by itself, influence how satisfied they feel at work. Employees are more likely to be engaged in their jobs when they believe that an organization's CSR efforts are focused on improving society and the environment (Al-Ghazali and Sohail, 2021, Lee *et al*., 2013). Therefore, the fulfilment of societal obligations by the organization fosters a psychological contract wherein employees feel valued and respected, thus enhancing their overall satisfaction and well-being in their employment.

The perception of CSR as more embedded, such as the inclusion of CSR in the organization's strategy and mission or the management and performance evaluation systems, positively affects employees' well-being, as tested in hypothesis H2. This relationship was also found in the correlation analysis, where there was a positive and significant association between PCSR and EW. As studied in the literature and according to SIT, the perception by employees that CSR activities are genuine and present in the organization's daily life drives the feeling of well-being through work (Adu-Gyamfi *et al.*, 2021, Al-Ghazali and Sohail, 2021, Kim *et al.*, 2018). CSR initiatives serving as outward manifestations of organizational values and ethics, bolster employees' perceptions of organizational integrity and moral standing when they impact employees more directly.

Likewise, according to the data collected, the perception of CSR as more embedded also has a positive impact on employees' engagement, which supported hypothesis H3. This result is understandable because employees who perceive their organization as socially responsible are more likely to identify with the organization's mission and values, leading to heightened engagement driven by a desire to contribute to its societal impact. This

alignment of personal values with organizational goals fosters a sense of purpose and meaning in work, enhancing employees' intrinsic motivation and engagement (Chaudhary, 2017, Cunha *et al.*, 2022).

Finally, it was possible to verify a positive and significant effect of perceived CSR in EJS, EW, and EE, through CD (H4). This relationship has been proved by Grabner-Kräuter *et al.* (2020) who pointed out that considering cultural diversity (CD) when implementing CSR practices, helps to achieve a level of integration, bringing job satisfaction and engagement, as well as enhancing well-being (Neto *et al.,* 2018). Also, in the analysis of correlations between variables, it was found that perceived CSR was positively associated with workplace outcomes (EJS, EW, EE) and CD. Thus, we prove that CD partially converts CSR practices' effects into higher levels of employee satisfaction, well-being, and engagement at work.

6. Conclusion

This study explored the relationship between perceived CSR practices and employees' satisfaction, well-being, and engagement, including the mediating role of cultural diversity. Our problem statement is of huge relevance because, as explored earlier, the positive effects of CSR implementation on employees are dependent on their perceptions (e.g., Bachrach *et al.*, 2022, Rodrigues *et al*., 2024). With organizations having an important role in shaping these perceptions, they should consider this when selecting, designing, and communicating their CSR policies and practices (Bachrach *et al.*, 2022).

Our results have theoretical implications including that companies focusing on diversity and inclusion as a part of their CSR strategy are better positioned to create effective, adequate, and harmonious workplaces. The significant mediating effect of cultural diversity emphasizes the importance of considering cultural nuances in CSR program design. Accordingly, these findings contributed to the empirical research of CSR and workplace outcomes by exploring the existing gap in the literature (e.g., Grabner-Kräuter *et al.*, 2020, Ivanova-Gongne *et al.*, 2022) of the actual process of *why* and *how* cultural diversity must be considered within CSR frameworks. Exposure to divergent cultural settings cultivates a heightened appreciation for social and environmental concerns, increasing employees' receptivity toward CSR initiatives. Such increased awareness is pivotal in shaping employees' perceptions of the organization's commitment to ethical conduct, thereby enhancing the salience of CSR within the workplace.

From a managerial perspective, the findings highlight that firms recognizing and accommodating cultural diversity in CSR practices will be able to foster a more inclusive and equitable work environment wherein all employees feel valued and engaged, regardless of their cultural mindset. According to this research, organizations should use CSR initiatives strategically, focusing on including CSR in the company's daily practices, going against a symbolic approach, and genuinely committing to their social and environmental responsibilities. Thus, for CSR policies and practices to be present in the organization's daily activities, managers should actively involve employees in designing and implementing CSR, by creating platforms for feedback and participation. These platforms will ensure that CSR practices are inclusive and reflective of the workforce's diverse needs. Concurrently, organizations should prioritize cultural diversity as a key component of their CSR strategies. This can involve implementing diversity training programs, promoting inclusive hiring practices, and fostering a workplace culture that values and respects diverse perspectives. By doing so, managers can enhance employee satisfaction and productivity, leading to a more harmonious and effective workplace.

The practical implications of CSR policies extend beyond individual firms and their employees, permeating broader institutional dimensions that warrant consideration. A notable consequence entails the potential metamorphosis of legal and regulatory frameworks. Proficiently executed CSR practices, such as those presented above, pose the potential to encourage government revaluation and refinement of laws, fostering an environment conducive to CSR implementation. Additionally, CSR initiatives have the power to establish new industry benchmarks and conventions, cultivating a *milieu* of ethical business behaviour on an institutional scale. As enterprises implement and showcase efficient CSR, these practices become an example to follow for others within the sector, catalysing the development of best practices.

Even considering the contributions made by this research, it is necessary to recognize that it also presents some limitations. The analysis only covered international employees working in four firms headquartered in the North of Portugal. Future research should compare data on other regions and even European nations to determine whether the current results apply to other contexts. The sample size could also be larger. Thus, future studies could obtain a more representative sample of the population employed in organizations with CSR practices and policies. Another limitation to be addressed is the short period that our data was collected. The questionnaire answers were gathered at a single point in time, which limited our ability to capture the dynamic nature of EJS,

EW, and EE. To comprehensively assess these dimensions, future research could perform data collection at multiple time intervals.

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The Interplay Between Digital Artifacts and Value Creation in the Ecosystem Design

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Abstract: Since Satoshi Nakamoto's first publication of the Bitcoin whitepaper in 2008, blockchain based technologies has gradually permeated various aspects of our lives. From the emergence of cryptocurrencies like Bitcoin to the development of platforms such as Ethereum, and the rise of phenomena like NFTs and Fan Tokens, the impacts of this technology has been diverse. While speculation surrounding these innovations persists, there exist successful use cases that have breathed new life into industries and enhanced customer interaction with established brands. One such domain where this is evident is the sports industry. Historically, sports teams, particularly football clubs, have sought avenues to capitalize on their fan base, aiming to diversify revenue streams. The advent of Fan Tokens has facilitated this endeavour, allowing teams to monetize fan engagement effectively. Consequently, an exploratory study comprising multiple case analyses was undertaken to examine how digital artifacts, exemplified by Fan Tokens, contribute to value creation within an ecosystem, fostering innovation and monetization for sports enterprises. The findings of this study elucidate the correlation between the characteristics of digital artifacts and the sources of value creation within an ecosystem. Furthermore, they underscore how these characteristics catalyse the formation of such ecosystems, thus propelling innovation and revenue generation within the sports industry.

Keywords: Ecosystem, Digital artifact, Value creation, Value capture

1. Introduction

In the ever evolving and closely interconnected landscape of contemporary digital society, the advancement of technology has brought forth novel digital tools that not only mirror technological advancement but also actively shape individuals' interactions with their surroundings. Particularly within the realm of sports, we encounter a domain marked by its broad appeal and emotional engagement. Sports serve as a universal language, transcending cultural and linguistic barriers. The fervour surrounding sporting occasions serves as fertile ground for the exploration and implementation of technologies aimed at amplifying the emotional bond between fans and teams (Fonti et al., 2023). Additionally, sports teams benefit from a vast supporter base that, owing to globalization and digital connectivity, can be accessed and engaged with globally, presenting a distinct opportunity for the implementation of technology solutions that enhance fan interaction.

An exemplary illustration of this phenomenon is the advent of Fan Tokens, which have heralded a new era in fan engagement by converting the traditional passive relationship into an active and personalized involvement. These tokens, often leveraging blockchain technologies, empower fans to directly partake in the team's dynamics and access exclusive privileges. This presents an avenue for entrepreneurs and established firms to capitalize on the opportunities afforded by these Fan Tokens, as identified in digital artifacts (Kallinikos et al., 2013), thereby devising innovative ways to monetize their customer base and offer novel services and value propositions (Autio et al., 2018; Sanasi et al., 2021; Silva et al., 2021). Nevertheless, despite the nascent exploration in literature regarding the potential of digital artifacts (Kallinikos et al., 2013; Ojala et al., 2023; Sanasi & Ghezzi, 2022) and the scrutiny of ecosystems and their internal dynamics (Adner, 2017; Felch & Sucky, 2022; Ghezzi et al., 2009), the assessment of a digital artifact's impact on ecosystem formation remains an uncharted territory. Consequently, this research endeavors to bridge the gap between digital artifacts and ecosystems by addressing the question: "How do digital artifacts enable the creation of an ecosystem?" Through an exploratory multiple case study, this research assesses how the introduction of Fan Tokens has facilitated the formation of ecosystems transcending the conventional boundaries between sports and technology, thereby fostering a synergistic relationship among technology providers, sports clubs, and fans.

This study contributes to existing literature in three key aspects. Firstly, it delves into how the inherent attributes of digital artifacts (such as Fan Tokens) have spawned new business prospects and avenues of engagement for technology providers. Secondly, it sheds light on how traditionally sports-centric clubs have embraced technological advancements through the adoption of these innovations, elucidating the activities and resources involved. Lastly, it examines the positive impact of digital artifacts on fan engagement and the

resultant creation and capture of value sources within and beyond the ecosystem stemming from the development and utilization of digital artifacts.

2. Literature Review

2.1 Ecosystem Theory

The ecosystem theory has encountered a proliferation of concepts, leading to redundancy and overlap across theoretical domains, resulting in confusion regarding the definition and value addition of an ecosystem perspective within a specific environment (Adner, 2017). Adner (2017, p. 4) defines an ecosystem as "the alignment structure of the multilateral set of partners that need to interact in order for a focal value proposition to materialize." Adner (2017) further distinguishes between ecosystem-as-affiliation, viewing the ecosystem as a community of associated actors, and ecosystem-as-structure, perceiving the ecosystem as a configuration of activities centered around a focal value proposition.

From Adner's definition, four elements characterize ecosystems: activities, actors, positions, and links. In ecosystem theory, the locus of value creation resides in the presence of interdependencies and complementarities among actors, contributing to the creation of a focal value proposition for customers (Kapoor, 2018). Complementarities denote an economic relationship between offers in terms of value creation potential (Felch and Sucky, 2022), while interdependencies represent a structural relationship between offers in terms of their interconnectedness for value creation and the impact of changes in one offer on the contribution of others to value creation (Kapoor, 2018). Kapoor (2018) also identifies three fundamental objects for an ecosystem: bottlenecks, complementors, and platforms. These aspects, including technology architecture, interdependencies, and integration systems, significantly influence value creation within an ecosystem (Kapoor, 2018).

Value creation mechanisms have garnered attention from various perspectives (e.g., Amit and Zott, 2001). Zott and Amit (2010) and Amit and Zott (2001) delineate the four sources of value creation: novelty, lock-in, complementarities, and efficiency. Amit and Han (2017) discuss new sources of value creation in a digitally enabled world where digital platforms and ecosystems play a pivotal role. Lepak et al. (2007) also contribute to the understanding of different types of value, distinguishing between use value and exchange value. Use value pertains to the quality perceived by customers concerning their needs (Bowman and Ambrosini, 2000), while exchange value refers to the monetary amount realized at a specific point in time (Bowman and Ambrosini, 2000).

2.2 Digital Artifacts Theory

Despite attempts by several authors to define digital artifacts (Ekbia, 2009; Zittrain 2008), only Kallinikos et al. (2013) explicitly outline their characteristics. Kallinikos and colleagues (2013) highlight the distinctions between digital artifacts and physical entities of non-digital constitution across dimensions such as editability, openness, distributedness, and interactivity. Additionally, digital artifacts are often embedded in mutable interdependencies with other entities in broader digital ecosystems and can generate other digital objects distributed in the same or other ecosystems, thereby linking with ecosystem theory (Kallinikos et al., 2013). These findings suggest the ever-evolving nature of digital ecosystems due to the incomplete and mutable nature of digital artifacts (Kallinikos et al., 2013). Ojala et al. (2023) develop a framework based on these characteristics to leverage digital artifacts for the internationalization of new ventures.

Thus, the concept of "ecosystem" has gained significant attention among scholars and practitioners, particularly in the past two decades (Adner, 2017; Jacobides et al., 2018). Moreover, several authors concur on the pivotal role played by digital artifacts (Kallinikos et al., 2013; Ojala et al., 2023) in ecosystem development. However, while the literature has elucidated the definition, structure, and internal dynamics of ecosystems, the question of how actors within an ecosystem (Adner, 2017) interact and align to create value in the presence of a digital artifact (Kallinikos et al., 2013) remains unanswered. Hence, this research will focus on how digital artifacts, through their characteristics, facilitate ecosystem creation. This inquiry is encapsulated in the research question: *How do digital artifacts enable the creation of an ecosystem?*

3. Methodology

This study utilizes a qualitative (Gartner and Birley, 2002) and exploratory research design employing a multiple case study approach (Yin, 1984; Eisenhardt, 1989; Eisenhardt & Graebner, 2007) to examine the emergence of ecosystems facilitated by digital artifacts. Specifically, the multiple case study approach is

selected because literature acknowledges its greater robustness compared to a single case study (Yin, 1984), and it facilitates the derivation of generalized findings, allowing for comparisons among diverse manifestations of the phenomenon (Eisenhardt & Graebner, 2007). The digital artifact (Kallinikos et al., 2013) serves as the primary unit of analysis (Yin, 1984), pivotal in the formation of an ecosystem wherein actors collaborate around a shared value proposition (Adner, 2017). In this study, the Fan Token, defined as a utility token (Glossario blockchain, 2022) created utilizing blockchain technology (Glaser, 2017; Nakamoto, 2008; Ante et al., 2023), is regarded as the digital artifact.

3.1 Case Sampling

In this study, a heterogeneous approach was adopted for case selection, aiming to encompass cases representing diverse patterns of behaviour, outcomes, decisions, and evolutionary stages within the analyzed process. Heterogeneity is pursued to recognize and compare various types associated with the same phenomenon, offering a comprehensive understanding of the involved dynamics (Yin, 1984). To implement this approach effectively, it was crucial to pre-determine the number and nature of cases to be examined (Yin, 1984). Following the identification of the research question, key stakeholders involved in the ecosystem were identified. These include technology providers responsible for creating and selling Fan Tokens, sports teams collaborating with technology providers to enhance fan engagement, and the sports team supporters, who are the end users of digital artifacts. Among the various types of sports teams engaged in Fan Token initiatives, the decision was made to focus solely on football clubs. This decision stems from the global popularity and widespread following of football, with approximately 3.5 billion supporters and over 250 million players across more than 200 countries. Additionally, football accounts for 40% of the overall market value of the sports industry, exceeding $500 billion in 2022 (Fonti et al., 2023).

During the initial phase of case study selection, a geographical criterion was applied, limiting the selection to European football clubs. This geographical focus was deemed significant due to the varying dynamics and opportunities within the Fan Token industry across different regions. To ensure accuracy and reliability, the official FIGC database was utilized. The research identified 70 football teams engaged with Fan Token platforms. To refine the selection process, the focus shifted to technology providers, aiming to identify the most prominent and established ones to narrow down the selection field for football teams. The selection criterion was based on the technology providers with the highest Fan Token market cap in the European landscape. Selection of Socios and Binance was prioritized to focus on companies with greater significance and impact in the industry, ensuring the analysis is more meaningful and representative, particularly in the European context. Moreover, Socios and Binance were chosen for their heterogeneity, with Socios representing a more diversified player and Binance a more focused one. From the numerous teams associated with Socios, Juventus FC, AC Milan, and Lega Serie A were selected as the subjects of study. This selection aimed to explore highly diverse cases to provide a varied representation of the Fan Token context in football. Among the two European teams partnered with Binance, FC Porto was chosen over S.S. Lazio to introduce a foreign team into the set of cases studied, offering a comprehensive and diversified overview of interactions between the platform and football teams, both domestically and internationally. Additionally, supporters were selected for AC Milan, Juventus FC, and FC Porto to better understand the overall environment surrounding Fan Tokens (see Appendix for further details on informants).

3.2 Data Collection

The data collection phase of the study employed a thorough strategy encompassing both primary and secondary sources to ensure data triangulation. Secondary sources such as YouTube videos, podcasts, whitepapers, and press releases were utilized to provide just confirmation to the primary sources, which include in-depth semi-structured interviews conducted with key informants. These 10 interviews, categorized into sections corresponding to the topics outlined in the literature review, were recorded, transcribed, and carried out in an interactive manner involving technology providers, sports teams, and sports team supporters. During the data collection phase, interviews with various stakeholders in the ecosystem were conducted while maintaining a neutral stance to uphold objectivity. Informants were perceived as knowledgeable agents, and the research aimed to conduct a generalizing analysis, treating the case studies as multiple experiments (Gioia et al., 2013). Following Yin's methodological approach (Yin, 1984), "analytical generalization" integrated existing theories with empirical evidence, contributing to a comprehensive understanding of the impact and dynamics of the digital artifact on the ecosystem. This approach allowed for flexibility in exploring emerging themes spontaneously. The richness of the dataset was further enriched by the inclusion of secondary data from external documents, ensuring a robust foundation for subsequent analysis.

3.3 Data Analysis

Following the completion of the data collection phase, the research progressed to the analysis and interpretation of the gathered data, aiming to develop a discussion based on the findings. Adhering to the "logic of replication" (Eisenhardt and Graebner, 2007), each case was treated as an independent experiment in both internal and cross-case analyses. The emphasis was placed on comprehending the ecosystem mechanisms and interactions facilitated by the digital artifact. Subsequent to the analysis of individual cases, a cross-case comparison was conducted to identify similarities and differences, addressing the research question. The analysis employed coding, utilizing an inductive Grounded Theory methodology (Glaser and Strauss, 2017). An inductive coding tree, incorporating constructed and in vivo codes (Glaser and Strauss, 2017; Gioia et al., 2013), was employed to capture the language of the informants, both from primary and secondary analysis transcripts. Through an iterative process, the codes were consolidated into first-order concepts, followed by a second-order analysis that aggregated the categories into overarching themes. This iterative process ultimately led to the development of an empirical model (Eisenhardt, 2023) illustrating how the digital artifact enables the creation of an ecosystem.

4. Results

Following an in-depth analysis of the results obtained from interviews conducted with key stakeholders across the ecosystem, a systematic process has been delineated concerning the development of Fan Tokens and their associated ecosystem by the involved firms. This process is delineated into two main phases: Phase 1 – *Focal Value Proposition Creation*, wherein the primary actors within the ecosystem synchronize their efforts in terms of aligning activities, resources, and competencies, envisioning, and exerting efforts to enhance the added value of the focal value proposition. Phase 2 – *Ecosystem Alignment Structure* involves the incorporation and activation of sports team supporters, who through the utilization of Fan Tokens, generate value for the technology provider (e.g., Binance and Socios) and for the sports teams (e.g., FC Porto, AC Milan, Juventus FC). Additionally, this phase encompasses the establishment of new partnerships with other actors (e.g., NFT Kings and Lega Serie A) for the provision of resources and inputs to develop complementary products aimed at delivering value to the sports team supporters.

4.1 Focal Value Proposition Creation

The catalyst for the formation of this type of ecosystem is the Fan Token. Both technology providers interviewed (Binance and Socios) have asserted that the Fan Token serves as the catalyst for establishing a new business venture. For instance, the Partnership Manager at Socios stated: "*As far as the token [Fan Token] is concerned, it was the simplest and most easily applicable decision at the time because it did not require a lot of effort.*" Additionally, the CEO of Socios, in a YouTube interview, mentioned: "*So, we decided to create an ecosystem based on blockchain in order to engage and monetize sports fans all over the world.*" During this phase, technology providers recognize the Fan Token as an opportunity to establish a new business unit (e.g., Binance) or initiate a new digital startup from scratch (e.g., Socios). Subsequently, they determine which technological infrastructure to utilize, whether leveraging existing infrastructure (e.g., Binance) or developing an entirely new one (e.g., Socios). As elucidated by the Head of Marketing and BD at Binance: "*There is no separate technical department. The technicians in Binance are generalists, so they carry out the tasks. As I mentioned earlier, at a technical setting level, the fantoken part is not different from the Binance core; it's essentially the same thing, but more focused on the fantoken.*"

During this phase, technology providers start collaborating with other actors to co-create the Fan Token, as explained by Socios' Partnership Manager: "*Together with the collaborative teams, we propose a poll, and once we decide on it and receive approval from the team, we upload that poll with all the associated experiences and rewards onto the platform.*" Throughout the alignment process between the technology provider and the actors, interdependencies are established, determining what each firm will provide to the other and vice versa, as stated by AC Milan's Associate Strategy Manager: *"...what we give Socios when we enter into a partnership with them is access to a fanbase of hundreds of millions of fans around the world... They have resources dedicated to Milan, we have a resource dedicated to Socios, and then we agree on what activities to do, when to do them...*".

4.2 Ecosystem Alignment Structure

In this phase, the overall structure of the ecosystem is nearly finalized with the involvement of sports team supporters and the inclusion of other stakeholders (e.g., Lega Serie A), who contribute relevant inputs to the ecosystem, as articulated by Lega Serie A's Partnership Manager: "*To conclude, with Socios, which is a very*

active partner and wants to activate a lot of users to make them interact in their platform, we did the activity related to matchball, so the NFC ball.". During this phase, the alignment structure is established where actors engage with each other to realize a central value proposition.

With the engagement of sports team supporters, the sports teams can interact with their fans through the capabilities provided by the Fan Token, as described by the Juventus FC's Head of Operations and Strategy: "*Then over time we saw that it works more what it involves. In fact, as we did on 'design your own shirt' which we then made, marketed and so on, you leave the grids much more open, but the ingredients you go for are controlled. So you leave space and you leave freedom…*". Additionally, they can now connect with fans worldwide, who were previously inaccessible to their favorite football team, as highlighted by AC Milan's Associate Strategy Manager: "*Now we are able to reach foreign fans such as fan from Turkey, Indonesia, etc., that previously was impossible to reach.*"; and FC Porto's Marketing Manager: "*So, for our fans across the world, we do think it will bring us new fans and share our image throughout the world…*".

With the opportunity to engage and reach a broader audience, both sports teams and other stakeholders, including technology providers, can extract value through the utilization of Fan Tokens and other digital assets (e.g., Matchball NFC from Lega Serie A, or NFTs), as stated by Juventus FC's Head of Operations and Strategy: "*On an economic level there was a huge benefit because we did a very important revenue sharing …So we benefit economically and in terms of value from what? From the fans! That's something we like anyway, it's a more direct channel…*". Moreover, sports team supporters themselves are more involved due to the interaction possibilities enabled by the Fan Token, as expressed by Subject A: "*I do believe that fan tokens can open an incredible door to the sporting world and not just to fans. As I said before, the ability to access luxury areas … made me realise the power of constant work and commitment in using tokens*".

5. Discussion

In our swiftly advancing digital era, where digital artifacts are supplanting physical counterparts (Kallinikos et al., 2013; Ekbia, 2009; Kallinikos and Mariategui, 2011), and the establishment of ecosystems (Adner, 2017; Jacobides et al., 2018) is imperative for both existing and emerging firms to thrive and innovate, there arises a crucial need to illuminate the connection between these previously disparate research realms. Furthermore, it is essential to examine this nascent phenomenon that is breathing new life into the sports industry with notable success stories, reshaping its rapport with customers (sports team supporters), and generating novel revenue streams alongside conventional ones in this "traditional" sector.

This study underscores that digital artifacts have the potential to foster the development of business ecosystems. Specifically, the attributes of digital artifacts (Kallinikos et al., 2013) facilitate the emergence of a business ecosystem (Adner, 2017; Jacobides et al., 2018) owing to their associations with mechanisms for value creation (Amit and Zott, 2001) and value capture (Lepak et al., 2007; Cortimiglia et al., 2011). Each of these attributes, and their correlations with value creation and capture mechanisms, exhibits distinct relevance within the two phases delineated in the preceding section (Phase 1 – Focal Value Proposition Creation, and Phase 2 – Ecosystem Alignment Structure).

5.1 Theoretical Contributions

The empirical model derived (Table 1) illuminates how the inherent attributes of digital artifacts (Kallinikos et al., 2013) can stimulate the activation of mechanisms for both value creation and capture (Amit and Zott, 2001; Lepak et al., 2007) within each represented phase. Put simply, the characteristics of digital artifacts can promote the establishment of a business ecosystem through their correlation with these mechanisms.

The characteristics of editability and openness inherent in digital artifacts (Kallinikos et al., 2013) encompass the ability to modify and update digital elements and to be accessible and modifiable by a program. These attributes can trigger sources of value creation, such as novelty and efficiency (Amit and Zott, 2001), during the initiation of interdependencies among actors in the initial phase of "Focal Value Proposition Creation". Through these characteristics (editability and openness), firms engaged in crafting a focal offer can innovate and enhance efficiency in conducting transactions with customers. Moreover, these features (editability and openness) facilitate the design and arrangement of elements constituting the focal value proposition (digital artifact), thus ensuring efficiency and novelty. This is achieved by reducing transaction costs through faster and easier transmission of information and enhancing transaction efficiency through instantaneous updating and modification of the focal offer. Additionally, these characteristics enable the creation of novel products that introduce new transactional methods and structures with previously unrelated parties, thereby eliminating inefficiencies and fostering new markets.

The characteristics of interactivity and distributedness associated with digital artifacts (Kallinikos et al., 2013) entail the ability for customers to interact with and activate functions embedded in the digital artifact and the nature of being borderless and distributed within a broader digital ecosystem. These attributes can activate sources of value creation, such as lock-in and complementarities (Amit and Zott, 2001), during the "Ecosystem Alignment Structure" phase (Adner, 2017). Through these characteristics (interactivity and distributedness), firms operating within the ecosystem can generate value for customers by leveraging lock-in and complementarity sources (Amit and Zott, 2001). Interactivity fosters increased lock-in value creation by facilitating customer retention and loyalty in repeat transactions. Meanwhile, distributedness fosters enhanced complementarity value creation by providing opportunities to reach various actors (e.g., customers, partners, etc.) without boundary constraints, enabling firms already within the ecosystem to establish new partner networks for co-creation and the provision of relevant inputs for complementary products.

Through customer interaction and access to complementary products worldwide, firms within the ecosystem can capture value from customer utilization of digital artifacts. By leveraging the utilization of digital artifacts by customers, firms can capture various types of value to augment their revenues, acquire new customers, and gain better insights into their audiences through data analysis.

To summarize these findings into the proposition that addresses the question underpinning this study:

The intrinsic characteristics of digital artifacts enable the establishment of an ecosystem through their associations with mechanisms for value creation and capture within each necessary phase for creating the respective ecosystem.

Table 1: Empirical model

Phases	**Characteristics of digital artifacts**	**Sources of value creation and capture**
Focal Value Proposition Creation	Editability and Openness	Novelty and Efficiency
Ecosystem Alignment Structure	Interactivity and Distributedness	Complementarity, Lock-in and Value capture

6. Conclusion

This study explored how digital artifacts can facilitate the establishment of an ecosystem. It was determined that digital artifacts, owing to their inherent attributes, have the capacity to stimulate mechanisms for both value creation and capture within an ecosystem. Furthermore, these attributes prove beneficial across each phase required for ecosystem development. In addition to this finding, the research contributes to enriching the Ecosystem theory. The motivation behind this study stemmed from a recognized gap in the literature between two previously disconnected streams: ecosystem theory and digital artifacts. Through this research, these two theories have now been integrated, laying the groundwork for future investigations.

The study employed an exploratory approach, utilizing multiple case studies involving a sample of four cases, identified with six companies and three sports fans interviewed. The sports business sector was selected as the industry of focus due to its distinctive characteristics (Fonti et al., 2023) and significant market value. Specifically, the application of Fan Tokens within the football industry (a subset of the sports industry) served as the foundation for addressing the research question. The result of this endeavour is an empirical model that aids in comprehending how to develop a business ecosystem by leveraging the attributes of a digital artifact.

In conclusion, this study has yielded new and original insights, albeit with limitations stemming from the small sample size and subjectivity inherent in qualitative research. Indeed, future studies could benefit from a larger sample size to facilitate more precise generalization of the findings. Nonetheless, the integration of ecosystem and digital artifact theories has opened up a new avenue for research, offering opportunities for the development of novel theories and frameworks.

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Appendix: Table

Data type		Quantity	Original data source
Primary	**Semi-structured interviews**	10 in-depth interviews	Informants
		Socios	
		(2 interviews)	Alexandre Dreyfus - Founder & CEO Alberto Crespi - Partnership Manager Italy
		Binance	
		(1 interview)	Lorenzo Capone and Filippo Balsano - Head of Marketing and BD
		Lega Serie A	
		(1 interview)	Enrico Scavini - Partnership Manager
		Juventus FC	
		(1 interview)	Tomas Arico - Head of Strategy and Operations
		FC Porto	
		(1 interview)	Barbara Borges - Marketing Manager
		AC Milan	Riccardo Martinelli – Associate Strategy Manager
		(1 interview)	
		Sports team supporters	
		(3 interviews)	Subject A, Subject B and Subject C
	Asynchronous communication	57 informal emails	Informants

Success Factors of Deep Tech Incubators: A Qualitative Study

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Abstract: Deep tech start-ups, characterized by their focus on groundbreaking technologies and scientific advancements, face unique challenges that demand specialized support systems for their development and market entry. This paper presents a qualitative analysis based on ten interviews with managers of deep tech incubators, exploring the services offered, critical success factors, challenges and anticipated future changes. The services provided by incubators are comprehensive, ranging from technical and business mentorship to assistance in regulatory processes and access to financial resources. The study identifies that the success of deep tech incubators depends on customized support for start-ups, access to expertise and facilities, and a strong ecosystem and community network. Customized support ensures that the unique needs of each start-up are met, while access to technical resources and a vibrant network facilitates innovation and growth. Challenges such as cultural and mindset differences, operational difficulties, and regulatory navigation underscore the complex landscape in which these incubators operate. Anticipated changes within the next few years include a shift in investment focus towards projects with significant societal impact, an increase in international collaboration, and a deeper recognition of deep tech's role in solving global challenges. This paper contributes to the understanding of deep tech incubation, highlighting the support required to foster innovation in this sector. The insights from this study can inform policymakers, investors, and managers of deep tech incubators on fostering a conducive environment for innovation and growth in the deep tech sector.

Keywords: Incubator, Entrepreneurship, Start-ups, Deep tech, Start-up support

1. Introduction

The number of incubators has risen tremendously over the past 50 years and so has the number of research published on the topic. Incubators provide support services and resources to early-stage companies to help them grow and succeed. The definition and approach to incubators varies greatly and therefore, also the research is fragmented and the impact often difficult to compare (Aernoudt, 2004). As the landscape evolves, new models of incubation are emerging, tailored to specific industries and technologies, further diversifying their impact and reach.

A remarkable example is the so-called deep tech-sector, which has risen to prominence over the past decade. Start-ups in this sector work on disruptive technologies that require big capital investments and have traditionally long research and development processes (Kask & Linton, 2023). As with start-ups itself, also the number of incubators focusing on deep tech have increased.

There have been studies on the success factors of support programmes for start-ups in various contexts, for example general business incubators (Theodorakopoulos et al., 2014), accelerators (Mann et al., 2020) or science and technology parks (European Commission, 2014). We are not aware, however, of a study looking at the niche of deep tech-incubators. Therefore, we focus on deep-tech incubators with the following research questions:

- What is success for a deep tech-incubator?
- What are the success factors of deep tech incubators?
- What are challenges and barriers for deep tech incubators?
- What are the expected changes in the field of deep tech-incubators?

This paper firstly reviews literature on the state of knowledge and to clarify the different usage of the deep tech terminology, proposing an analytical definition. Secondly, the methodology is described on how the ten interviews were conducted and analysed. After, the results are presented followed by a discussion and conclusion.

2. Background

2.1 Towards a Definition of Deep Tech

The term deep tech has been used for about a decade by start-ups, venture-capital firms, and policymakers to indicate a special class of high-tech companies. Earlier uses of the term “deep technology“ do exist (Storms 1998,

Lee, 1999, Christensen 2002) but do not seem to be directly related to the current usage of this term. Despite its interest and wide usage, a discussion on the notion of deep tech is missing in the scientific (academic) literature. By comparing four definition attempts (Chaturvedi 2015; De la Tour et al. 2017; Portincaso et al., 2019; European Startups 2021) we notice that some basic aspects of deep technologies appear in all cases, but as a mix of business and technological characteristic attributes, for example the quality and novelty of the technology, its innovation potential, and the impact and the risk characteristics of the business built around it. However, a such characterization is in our view insufficient as clear, analytical, definition.

The other apparent feature in the current use of the term, is that per se it does not refer or restrict to a specific industry, although some industrial sector seems are naturally associated with deep technology, as shown in table 1 (Chaturvedi, Swati, 2015, Portincaso et al. 2019, European Startups 2021). We propose to systematise the existing definitions by defining deep technology based only on substantial features of the technology itself (intrinsic definition), and subsequently derive a definition of deep tech business, however keeping it separated of all the typical traits of it (characterization), which are usually but not always or not entirely associated to it.

Table 1: Own definition of deep tech for this research

Intrinsic Definitions: **Deep technology & deep tech business**	**Typical traits Deep tech business (Characterization)**	**Examples of Industry**
Deep technologies: based on substantial and unique scientific or engineering advances, either with protected IP or hard-to-reproduce. Deep tech-business: addresses an unmet market need or disrupts and existing market by leveraging on deep technology.	- Usually result of intense R&D. - Require a significant amount of capital in R&D and beyond: R&D, industrialization, commercialization - Take a long time to reach market-ready maturity - High market risk, as the market demand for the product is not proven - Expected to have a big impact (economic, societal, environmental)	- Advanced materials - Artificial intelligence - Biotechnology/life-sciences - Blockchain - Cleantech& energy - Drones and robotics - Medtech - Photonics and electronics - Space - Quantum Technologies

We adopted a definition of high-tech businesses that does not assume a high market risk, although it implies it as a usual trait. With the intrinsic definition we adopted, strictly speaking there is not a deep tech industry per se, but rather industries that are more or less likely to be impacted by deep tech technologies, and markets more or less likely to be entered or even disrupted by deep tech companies. Although similar traits are present in terms of technology development, market risk and needs for investment and business support, there is also a significant in-group diversification. For example, Biotech has a higher need for investment in all stages, while Artificial intelligence start-ups need relatively low financing in early phases. Hardware-oriented startups rely predominantly on non-equity funding until the prototype phase, while the needs of investment differ hugely in later phases (Portincaso 2019). We therefore propose a secondary categorization of deep-tech based enterprises based on their industry-related growth needs:

- Hardware: Advanced materials, drones and robotics, cleantech& energy, medtech, photonics and electronics, space, quantum technologies (sensing), computing hardware
- Software: Blockchain, quantum technologies (computing, simulations, quantum information), artificial intelligence
- Biotech: Biotechnology, life-sciences

2.2 Incubators

The terms incubator and accelerator have often been used interchangeable, as they both focus on the development of early-stage businesses. Taking the overall topic of deep technology into consideration, also the

term science park is added, as it is often used in connection with tech start-ups and has its own incubation programmes.

There are many definitions of incubators and the services a typical incubator offers, many of them similar. In general, "business incubation is regarded as an entrepreneurship development tool for promoting innovation, economic growth, and employment generation" (Theodoarkopoulos et al, 2014). Incubators support early-stage businesses in their development to become market-ready through a combination of offerings. The goal is to get proof-of-concept, set up the start-up team and minimise the risks around the newly founded company (Miller & Stacey, 2014). While there are differences in some aspect, such as the financing model, there are also typical recurrent traits in membership requirement and offer. Membership is usually open-ended, without a fixed duration, and the admission process is less strict. The following elements are usually offered by incubators (Bergek & Norman, 2008; Bone et al. 2017; van Weele, 2020):

- Shared office space and other physical facilities
- Shared support services (IT, admin, etc.)
- Business support: coaching, mentoring and training
- Access to the incubator's network
- Legitimacy and reputation

Accelerators offer many similar services like incubators, but usually have a fixed duration for which participants can apply until set dates and include a financial contribution of the accelerator, often in return for equity (Bone et al., 2017). Additionally, Cohen & Hochberg (2014) distinguish accelerators from incubators through "its intensity, the provision of a stipend and services and the cohort-based nature of accelerator program" with a highly selective admission process (Cohen & Hochberg, 2014; Bone et al. 2017). Accelerators can also be associated to different organisations. Early programmes were mostly set up by venture capitalists and business angels. Today, also governments, corporations, universities, or NGO's run accelerators. (Cohen & Hochberg, 2014) They mostly do not charge fees to the start-ups, but rather finance themselves through equity of the participants. Therefore, accelerators look for scalable businesses to finance their activities.

Science parks have the offerings of a traditional incubator, but typically also have additional services, especially on transfer of and collaborations within R&D as they focus on technologies as well (IASP, n.d.). Science parks may or may not have a focus on a particular industry, based on their partner institutions. The main technology sectors that are based within science parks are ICT & communications, biotechnology, computer science and hardware, electronics, software engineering, health & pharmaceuticals. (IASP, 2018) They are usually funded by the organisation that they are affiliated with and through private and corporate sponsors.

2.2.1 Success factors of incubators

Various success factors have been identified by scientific works on incubators:

- The selection and admission policy of the incubatees (Alzaghal & Mukhtar, 2017)
- The exit / graduation policy (Theodorakopoulos et al., 2014).
- The provided resources (often as shared office space and other shared resources)., including mentorship for example on regulations or technologies. (Theodorakopoulos et al., 2014; Alzaghal & Mukhtar, 2017)
- Access to capital, either through incubators' own fund or through relationships with business angels and venture capitalist (Theodorakopoulos et al., 2014)
- Networking opportunities (Alzaghal & Mukhtar, 2017; Mann et al., 2020)
- The competences of the team, the methodology and the organisational setup of the incubator (Theodorakopoulos et al., 2014).
- And lastly the monitoring of the performance of the incubated firms (Theodorakopoulos et al., 2014).

2.3 Deep Technology Incubation Programme

When compared to a traditional incubator, a deep-tech incubator shows major differences. The most evident is the focus: while many incubators do have a specific industry focus, deep tech incubators focus – as the name suggest – on deep technologies. Moreover, deep tech incubators have some additional services regarding to R&D and knowledge transfer, such as access to lab spaces. Also, deep tech incubators are connected to universities, research institutions or a corporate with a strong R&D-department, while none-deep tech incubators can have ties to universities or other corporations, but many also stand alone. A study analysed the needs of deep tech start-ups and where they would most likely go for to satisfy them (Harlé & Sousson, 2017).

Incubators and accelerators are the preferred partner for business knowledge and expertise, access to facilities and talent acquisition. For market access, the start-ups would choose corporations as partners, for funding business angels and venture capitalists, while universities are preferred for technical knowledge and expertise. Through the connection to universities and corporations, deep tech incubators can offer a broad range of the services required by deep tech start-ups.

In the present study we focus on deep tech incubators based on the following definition. Deep tech incubators:

- are an entrepreneurship development tool for start-ups that are based on substantial and unique scientific or engineering advances, either with protected IP or hard-to-reproduce, and address an unmet market need or disrupts an existing market by leveraging on deep technology.
- typically offer mentoring, training, office and lab space, access to the incubator's network, access to funding and technical support.
- are associated with a university or another research institution, including corporations.

3. Methodology

3.1 Sample and Data Gathering

This qualitative study focuses on European deep tech incubators. A sample of 23 incubators from 13 countries (list available from the authors) has been constructed. to include examples of incubators affiliated to European big science networks, as well as to leading research institutes or universities and with a clear history of success. The sampling also took care to be able to discriminate between incubation models, and to represent several of the major and most innovative European Countries. All incubators were contacted via e-mail and where possible via phone. Ten incubators agreed to be interviewed.

The interviews were semi-structured and were conducted online. The interviews lasted between 45 and 60 minutes. They were recorded and transcribed to allow a detailed analysis.

3.2 Measures of Variables

The survey was based on a questionnaire developed based on the research questions and the literature. The focus areas where the details of the interviewed incubators, their success factors as well as anticipated changes within the incubator, but also in the ecosystem.

3.3 Data Analysis Procedure

A qualitative content analysis of the ten interviews was done, using the software atlas.ti, which facilitated systematic organization and categorization of the extensive interview transcripts. A coding system was developed based on key themes and questions from the interview guide. The coding process consisted of multiple iterative stages, beginning with open coding to identify initial patterns. Through constant comparison and refinement, these codes were then organized into subcategories, allowing for a higher level of abstraction and thematic grouping.

4. Results

Based on the ten interviews, we analysed the services offered, definitions of success, success factors, barriers, and challenges as well as expected changes in the next five years.

The interviews reveal a comprehensive range of services offered by deep tech incubators. These services are designed to address both the technical and business aspects of start-up development.

- Access to technical resources and facilities as well as labs.
- Technical and business mentorship: These are mostly intense programmes tailored to the needs of the start-ups. A few take in cohorts on regular basis.
- Coaching for all legal aspects, specifically about the protection of intellectual property.
- Offering financial support directly to start-ups, including investments and guidance on securing additional funding. Increasing the investor readiness of the start-ups is also an important factor here.
- Assisting start-ups in finding a market for their ideas, transforming ideas into viable products, and identifying the most promising industries for their technologies.
- Help to develop a product that can be delivered to the market, training them in business aspects while they develop their technology.
- Networking and matchmaking with potential partners, investors, and customers.

- After the incubation phase, some incubators offer acceleration programs to further support start-ups in scaling their business, market validation, product marketing, and engaging with real customers.

4.1.1 What is success?

To understand success factors, we first have to look at what the incubators understand as success.

One of the most mentioned factors is the creation of start-ups, which can be measured in different ways. It is mentioned that the number of teams in the incubators, successful financing rounds and the survival rate of start-ups are used as measurement tools, of which the successful financing rounds seem most important as one interviewee said *"our number one metric is the capital raised by the start-ups that we support"* and another *"our success metrics are really the amount and the number of those series A capital raises"*. Also, reaching different stages in technology and market validation are considered, for example the readiness in technology, team, or business model.

A second important factor is job creation and the broader impact in economy and society that the incubator and its ventures have. Not to be neglected are the financial returns. The incubators can get shares in the ventures they support. With successful financing rounds and/or exits the incubators receive a financial reward that will allow them to continue with their operations. These factors show that success goes beyond financial measurements and also look at the impact on society or the number of start-ups that reach technological readiness.

4.1.2 Success factors

There have been many success factors mentioned and most are connected to the offered services.

Firstly, the connection to a collaborative ecosystem. In particular, institutes of higher education are crucial and with it comes access to expertise on the one hand, but also to facilities on the other hand, which can include labs and specialized equipment. This access can significantly reduce the capital required for the teams to develop their technologies. Partnerships to raise capital also come into play here, which can be business angels, venture capitalists or also organisations that provide grants. These two points are also part of a needed collaborative ecosystem, that should also have a strong network of start-ups supporting each other.

Secondly, a strong strategy in regard to intellectual property is also crucial, as it helps to protect the innovations and provides start-ups with a competitive edge in the market.

Thirdly, the selection of start-ups is important, as the start-ups are obviously the basis for the successful incubation. The two main factors are the technology and the team. Most of the incubators have strict selection processes and very low acceptance rate.

Fourthly, a customized approach in supporting the start-ups is essential as the needs of all of them are different. An important factor herewith is a pool of experts that contains subject matter experts on the technological side, but equally important also successful entrepreneurs, who can share their experiences and knowledge. One manager mentioned that *"also a success factor for me would be: are you responsible [as an incubator] and are you delivering what the team needs? Or are you just telling people that you are a good service provider?".* This leads to the success factor of how the incubator itself is organised. It needs a strong methodology with a strong team that accompanies and challenges the start-ups regularly to ensure that they reach their milestones.

4.1.3 What are the challenges and barriers?

The cultural and mindset challenges are a hurdle for the incubators. The teams are traditionally very diverse in terms of background and cultures. This can lead to difficulties in finding a common language. The mindset of the universities can also be a challenge on two sides. They have often slower processes and are less adaptable to the dynamics of a start-up, which can slow everyone down. Also, they sometimes lack the motivation to create spin-offs. This makes it difficult for the incubators to find the technologies and people within the universities. However, this seems to change recently. One manager mentioned that *"I can see that more and more academic people are interested in trying out to spin off a company or start the company. That has changed […] especially during the last five to six years so the newer generation is kind of interested in alternatives to the academic career"*.

Once the technologies have been found, there is the challenge of bridging the gap between the technology, its application by a start-up and the market access. In this factor, also a lack of business awareness of the founders plays a role. One incubator said that *"second, [and] I would even put it as even more important [success factor],*

is that business awareness of these teams is missing, the ability to understand how to generate or to create a company, how to create a business out of their ideas". It is therefore necessary for the incubators to find business-minded people that can join the teams.

The incubators also face operational challenges. One is the lack of space to accommodate the start-ups. Second is the team composition of the start-ups and their ability to keep up with the speed of the incubation programmes. And third is the funding for the incubators themselves, which are often partly dependent on government funding or on funds that are tied to a certain programme. This can be uncertain at times. Lastly, there are also regulatory challenges. The start-ups often face difficulties navigating regulatory environments, and incubators may struggle to provide adequate support in this area, despite having a voice in relevant ministries or governmental bodies. These challenges highlight the complexity of operating deep tech incubators, which have to find a balance between supporting the start-ups, ensuring financial sustainability, fostering a conducive cultural and operational environment, and engaging effectively with broader ecosystems and networks.

4.1.4 What changes are expected?

The interviewees expect several changes in the deep tech landscape in the next few years, highlighting shifts in investment priorities, technological development, and the broader ecosystem. The increasing recognition of deep technologies in addressing societal challenges will likely continue and lead to a shift in start-up-creation and investment towards sustainability. This includes the trend of having more "zebras" rather than "unicorns". Zebras are start-ups that are not solely focused on financial gains but prioritize a positive impact in the world. In regard to the investment, there is an expected shift towards an even longer-term mindset. The development of deep technologies can span over a decade or more and investors need to be ready to have a long breath.

Another expected change is towards even more internationalization and global collaboration of the incubators and their start-ups. A change from a competitive to a more collaborative mindset will happen. This should lead to a pooling of resources and expertise, which bring better and quicker developments. This is also seen as crucial to establish Europe as a global player in the deep tech landscape. These expected changes reflect a broader understanding of the need for innovation that not only offers financial returns but also addresses the pressing challenges facing society today. The emphasis on collaboration, societal impact, and long-term investment strategies indicates a maturing of the deep tech ecosystem towards more sustainable and impactful innovation.

5. Discussion

Firstly, the proposed definition of a deep tech-incubators has been confirmed as effective and useful by the interviews. In deep-tech incubators start-ups work on substantial and unique scientific and engineering advances that disrupt existing markets or create new markets altogether. The offerings can be summarized as proposed with mentoring, office and lab space, networking, funding, and technical support. Training has not been mentioned often but is based on the websites also part of the incubators. And lastly, they are all connected to a university or other research institution. Interestingly, the majority of incubators do not have focus industries, but is rather broad in the areas of deep tech. Therefore, the validated definition is:

> *"Deep tech incubators are an entrepreneurship development tool for start-ups that are based on substantial and unique scientific or engineering advances, either with protected IP or hard-to-reproduce, and address an unmet market need or disrupts an existing market by leveraging on deep technology. They typically offer mentoring, training, office and lab space, access to the incubator's network, access to funding and technical support and are associated with a university or another research institution including corporations."*

For the definition of success, it can be summarized that the number of successfully funded start-ups are the most important metric. This number of start-ups is a used metric in every incubator, including also derived indicators like start-ups reaching market readiness or that are established on the market (Doga-Mirzak & Naval, 2014); however, the strong focus on successfully funded start-ups and start-ups that reach later stage funding seems to be stronger in deep tech-incubators. A second component that becomes more important is the societal impact of the start-ups, which has been part of incubators focusing on sustainability. One metric that is often mentioned in the literature is the economic impact including the creation of jobs (Mubarak AL-Mubaraki & Busler, 2014), which has also been mentioned by the deep tech-incubators. Hence, success is defined very similar to traditional incubators with a stronger focus on later stage financing rounds and the impact on society.

One of the most important success factors for an incubator is the selection of its start-ups. This has also been confirmed in other literature on incubators and accelerators. (Theodorakopoulos et al., 2014; Mann et al., 2020). They build the basis and without them the best mentorship or networking opportunities will not help in supporting successful start-ups. For deep tech-incubators, this factor is even more important, as their start-ups have long research and development times and require large capital investments. Part of this is the importance of looking at the team and ensure that they are capable of developing the respective start-up. Therefore, all of the incubators have rigorous selection processes and low acceptance rates. However, there is no generally agreed way of selecting start-ups, neither in the interviews nor in the literature (Alzaghal & Mukhtar, 2017).

The connection to a research institution or a corporate is also seen as crucial for the incubators, which is less the case in traditional incubators, as they are often independent. This connection is crucial for two reasons. Firstly, it is a way for the incubators to source technologies and talents for their programmes. Secondly, as deep tech-start-ups usually need more than just a shared office space, it gives the start-ups access to research facilities, such as specialised labs, and expertise from the academic staff. These partnerships should then be part of broader ecosystem that the incubators can mobilize to get additional resources in. While the ecosystem is an important part of every start-up, strong connections to research institutions and other ecosystem players seem to be even more important for deep tech-incubators. The partnerships with universities have also been mentioned as a challenge. There is a reluctance to create spin-offs in certain departments or universities; however, it is mentioned that the newer generation of researchers is more open towards these possibilities.

There were other success factors mentioned. A strong strategy in intellectual property is also more needed in deep tech. While all companies have to think about the topic, it is often the technological advancement that have to be protected. Therefore, a traditional incubator with a less tech focus needs less resources in this area. The customized approach and the strong team and methodology are also a success factor for other incubators and do not seem to be specific for the deep tech-landscape. Thus, another important factor is that deep tech-incubators need a strong team to protect the research results of their start-ups.

The expected changes could influence the success factors in the future twofold. It will lead to more start-ups that focus on societal impacts and incubators need to find a way on how to deal with zebras instead of unicorns. Through the focus on impact and less on financial returns, there might be different investors needed or also a shift in the priorities of the investors. Also, a more collaborative approach around the globe means that it will become crucial to develop international networks for exchange of knowledge, resources, and talents. Thus, these two factors might be added to a list of success factors in the future.

6. Conclusion

This paper examines incubators that focus on start-ups in the deep tech space. It shows that the success factors are very similar to those of traditional incubators. They can be summarized as a rigorous selection process, strong ties to a research institution or company, a functioning local ecosystem including investors, a customized approach to incubation, and a working strategy regarding intellectual property. The operational set-up of the incubator, including its methodology and team, is also crucial. In the future, it is expected that incubators increasingly focus on societal impact and international collaboration.

This research has certain limitations. It only looked at 12 incubators, which can lead to certain biases. Also, interviews with managers of traditional incubators can be added to allow a direct comparison and not just a comparison with existing literature. Further studies can investigate the details of the success factors and develop best practices for them. For example, how does a good selection procedure of start-ups look like and how can the relationships with research institutions be implemented in the best way.

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Navigating the Fourth Industrial Revolution: Generational Differences, COVID-19 Impact, and Knowledge Sharing in the Modern Workplace

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Abstract: This systematic literature review examines the intricate interplay between generational differences, the Fourth Industrial Revolution (4IR), and the unanticipated effects of the COVID-19 pandemic on the contemporary world of work. In response to the pandemic, organizations worldwide rapidly reevaluated their work processes, embracing digital technologies and remote work. This unforeseen shift underscored the world's capacity for rapid adaptation to unforeseen challenges. However, the 4IR extends beyond technological advancements, involving non-technological aspects such as evolving business models, workforce well-being, job security, and the changing nature of work. Understanding these dimensions is vital in shaping the modern workforce. Generational differences add another layer of complexity. Each generation, from Baby Boomers to Millennials, brings distinct worldviews and work values. This review explores how different generations perceive and adapt to the evolving nature of work, especially in the context of the 4IR. In addition, the 4IR highlights the critical role of knowledge in driving innovation and competitiveness. Knowledge-sharing practices within organizations have become pivotal in staying ahead in this era of rapid technological change. By addressing both technological and non-technological dimensions of the 4IR and considering generational perspectives, this review offers a comprehensive understanding of how these forces intersect and influence the modern workplace. It provides insights and recommendations to guide organizations, policymakers, and individuals in navigating the complexities of the modern world of work, harnessing 4IR opportunities, and addressing its multifaceted challenges.

Keywords: Generational difference, Fourth Industrial Revolution, COVID-19 Impact, Workplace adaptation, Business models, Knowledge sharing, Digital technology, Workforce preparedness

1. Introduction

The contemporary work landscape is experiencing transformative shifts due to the Fourth Industrial Revolution (4IR) and the global disruption caused by the COVID-19 pandemic. These forces are fundamentally changing organisational processes, workforce dynamics, and the overall approach to business and employment (Schwab, 2017). This paper addresses the critical need to understand these changes, particularly the intersection of generational differences with the technological and non-technological aspects of the 4IR.

The rapid shift to digital technologies and remote work during the pandemic has accelerated the adoption of 4IR technologies, reshaping business models, workforce well-being, and job security (Tang & Wang, 2018). However, the 4IR encompasses more than just technological advancements. It involves significant non-technological dimensions such as evolving business models and changing work nature, necessitating a comprehensive exploration beyond the technological scope (Al-Ayash et al., 2020).

Furthermore, generational differences add another layer of complexity. Each generation, from Baby Boomers to Millennials, brings distinct worldviews and work values. Understanding how these generational dynamics intersect with the 4IR is essential for effective organizational management, leadership, and collaboration. This study aims to fill the research gap by examining these generational perspectives and providing insights into how different age cohorts adapt to and navigate the evolving work environment brought about by the 4IR and the pandemic.

By exploring these dimensions, the paper offers valuable recommendations for organizations, policymakers, and individuals better to manage the multifaceted challenges of the modern workplace and leverage the opportunities presented by the 4IR.

2. Rationale

The rationale for this systematic literature review stems from the need to examine the complex interplay between generational differences, the Fourth Industrial Revolution (4IR), and the unexpected impact of the COVID-19 pandemic on modern work environments. The rapid adoption of digital technology and remote work during the pandemic has reshaped workplace norms, highlighting the urgency of understanding organizational

adaptations and their readiness for the technological upheavals of the 4IR. These shifts have prompted a reassessment of not just technology but also non-technological aspects like business models, workforce well-being, and job security (Schwab, 2017; Tang & Wang, 2018; Martin & Hughes, 2020; Kumar et al., 2021).

Moreover, generational differences have become more pronounced within the workforce, affecting perspectives, attitudes, and behaviors across age groups from Baby Boomers to Millennials (Lyons & Schweitzer, 2017). This generational dynamic intersects significantly with the technological and cultural shifts driven by the 4IR, necessitating a deeper understanding of how these factors converge to influence leadership, management, and collaboration within organizations.

The research problem centers on the knowledge gaps regarding how the COVID-19 pandemic has catalyzed significant changes in economic activities and work processes, reflecting the global adaptability to sudden and severe disruptions (Al-Ayash et al., 2020; Hlatshwayo, 2020; Ebekozien et al., 2022). Additionally, while the 4IR is often viewed through the lens of technological innovation, its broader implications encompassing non-technological dimensions such as the transformation of business models, job security, and the overall nature of work require comprehensive exploration (Aggestam et al., 2017; Schwab, 2017).

This study aims to bridge these gaps by exploring the impacts of the 4IR on business models and investigating how generational differences affect workplace dynamics within this context. It also examines knowledge-sharing practices essential for maintaining competitiveness in a rapidly evolving technological landscape (Hidalgo et al., 2017; DeFelice & Harris, 1998). Ultimately, this research seeks to provide a nuanced understanding of the forces shaping modern workplaces, offering insights and actionable strategies for navigating the complexities of the 4IR, thereby aiding organizations, policymakers, and individuals in effectively responding to these ongoing changes.

3. Research Questions

- How has the COVID-19 pandemic influenced the adoption of digital technology and reevaluation of work processes across various countries, including South Africa, to maintain productivity during lockdowns?
- What non-technological concerns, such as changes in business models, workplace well-being, job security, and the evolving nature of work, arise in the context of the Fourth Industrial Revolution (4IR) alongside technological advancements?
- How does the 4IR impact existing business models, and what adaptations are necessary for organizations to thrive in this era of technological transformation?
- What knowledge-sharing practices are essential in the 4IR era, given the rapid pace of technological innovation, to ensure that organizations and individuals remain competitive and adaptable in this evolving landscape?

4. Methodology

This systematic literature review (SLR) explores how generational differences influence the transition to the Fourth Industrial Revolution (4IR) and examines the potential impact of COVID-19 on readiness for the 4IR. Following a systematic approach as outlined by Massaro et al. (2015), the research commenced by formulating specific questions centered on generational differences, COVID-19, the 4IR, and knowledge transfer. A detailed research protocol was then established, delineating the methodology, article selection criteria, and information extraction procedures.

The article selection phase involved conducting an extensive search through databases such as Scopus, Emerald, and Web of Science, covering publications from 2000 to 2023 and focusing on socio-economic impacts of COVID-19 rather than health aspects, as recommended by Torraco (2005). Initial searches using a combination of key terms with "AND" yielded no results, prompting a refined strategy using "OR" among keywords to enhance relevance and retrieval efficiency.

Screening of articles included reviewing abstracts, introductions, and conclusions to determine their relevance, resulting in 58 of the initial 183 articles being selected for further analysis. A detailed content analysis followed, where a codebook was used to categorize and synthesize information, leading to the identification of patterns and the development of a comprehensive code framework.

This systematic methodology facilitated the creation of a coherent storyline that synthesized findings and insights, thus enriching the discussion on how generational nuances and the unforeseen challenges of COVID-

19 are shaping readiness for the 4IR. The SLR thereby provides valuable perspectives on the dynamics at play in the modern workforce's adaptation to technological and generational shifts.

5. Generational Dynamics in the 4IR era

As the Fourth Industrial Revolution (4IR) unfolds, marked by significant technological shifts like digitization, robotics, and biometric technologies, it intersects profoundly with generational dynamics, reshaping economic and work landscapes (Schwab, 2017; Hermann et al., 2016; Bienhaus & Haddud, 2018). This era introduces not only advancements but also challenges that necessitate a reevaluation of business models and work processes, influenced heavily by the digital revolution and e-commerce (Mourtzis et al., 2016; Shamim et al., 2016).

These technological and economic shifts are paralleled by a transition in generational workforce dynamics. Baby Boomers, known for their loyalty and traditional work values, are gradually making way for Millennials and Gen Z, who bring a different set of values and technological fluency to the workplace (Lyons & Schweitzer, 2017; Watts, 2010). This younger generation is better aligned with the 4IR's demands due to their comfort with digital technologies and remote work, presenting both opportunities and challenges for workplace integration (Kaifi et al., 2012).

Significant generational differences are evident as each cohort brings unique traits and expectations to their roles, impacting workplace behaviors and productivity criteria (Lu & Gursoy, 2016; Smola & Sutton, 2002). The rapid pace of technological change necessitates that employees adapt, requiring changes in skill sets across all generational divides (Schwab, 2017; Wilkesmann & Wilkesmann, 2018).

This evolving scenario underscores the importance of aligning competencies with the technological imperatives of the 4IR—physical, digital, and biometric. Organizations must navigate these generational shifts and technological advancements effectively to harness the full potential of their diverse workforce, optimizing workplace benefits and addressing the unique challenges presented by emerging technologies (Botha, 2018). As such, the interplay between generational dynamics and technological evolution is critical for organizational adaptation and success in the modern economic landscape.e.

6. Baby Boomers Exist in the Workplace

Baby Boomers, entering the workforce during the heyday of mass production, were instrumental in driving efficient manufacturing processes. Their dedication was evident in punctuality, as they were the main contributors to mass production, with time clocks at workstation entrances (Lu & Gursoy, 2016). Success for this generation was synonymous with long hours and unwavering effort, fostering a deep loyalty to employers and the workplace (Macky et al., 2008). Much of their work took place on assembly lines, where speed and adherence to strict specifications were paramount, leaving little room for creativity.

Born around the time of World War II, Baby Boomers witnessed social unrest and the behavior of leaders, motivating them to prioritize family life and economic prosperity (Smola & Sutton, 2002). They facilitated the shift from a focus on military activities to an emphasis on economic endeavors, playing a crucial role in shaping economic prosperity. To adapt to the era's industrial advancements, they established business models compatible with the introduction of steam engines and electrical innovations (Drath & Horch, 2014).

While many Baby Boomers have reached retirement age, they continue to wield significant influence in numerous multinational and local organizations. These organizations often reflect their work values, rooted in loyalty, long hours, punctuality, respect for hierarchies, and adherence to prescribed routines. As younger generations, characterized by different work values, increasingly populate the workplace, generational conflicts may arise. Baby Boomers' values could face additional challenges during the Fourth Industrial Revolution as they approach retirement.

7. Building Bridges with Generation X

Generation X represents the first cohort to encounter and appreciate the significance of application technology capabilities in the workplace aimed at enhancing efficiency (Rani & Samuel, 2016). Similar to Baby Boomers, Generation X places considerable emphasis on the production process, but they also recognize the value of injecting creativity into production through thoughtful planning. The integration of technology during their time primarily targeted the automation of existing business processes, with limited innovation directed towards altering business models. Their work values bear similarities to those of Baby Boomers, but with a slightly greater emphasis on achieving a work-life balance (K. K. Kim, 2016). They acknowledged the importance of social aspects and introduced business models that incorporated this dimension into their

respective industries. Generation X actively introduced social activities within the workplace, even if some perceived them as a potential misuse of organizational resources (Stewart et al., 2017). Some organizations went as far as establishing on-site daycare centers, which didn't necessarily change the culture of long working hours but offered a sense of comfort, knowing that families were within reach in case of emergencies.

In contrast to Baby Boomers, Generation X demonstrates a greater adaptability to changing norms and routines if it leads to working more efficiently and achieving established business objectives (Rani & Samuel, 2016). The era marked by the entry of Generation X into the labor market witnessed significant growth in the automation of office-based business functions. In some sectors, hard labor remained predominant, particularly in areas like mining, manufacturing, and vehicle assembly (Drath & Horch, 2014). Nevertheless, technological advancements varied across sectors, often influenced by the vision of individual organizations. This divergence gave rise to new careers, such as plant operators responsible for operating large machinery, a role that used to require multiple workers but was eventually streamlined to a single operator, leading to workforce reductions.

Globalization posed both challenges and opportunities, particularly in sectors like textiles, where designs could originate in one country and production and shipping take place in another. This era underscored the importance of cost-effectiveness, achieved through automated processes, cost-effective labor, and mass production. Generation X thrived in this business environment, partly due to their work values, which emphasized loyalty and commitment to their employers (Rani & Samuel, 2016). As Generation X transitioned with their unique social inclinations, personal traits, and work values, they paved the way for Generation Y, which brought a different perspective to the workplace, diverging from the values held dear by their predecessors.

8. Navigating the Workplace with Generation Y (Millennials)

Millennials, or Generation Y, have been shaping the workplace since their emergence in the late 20th century (Kaifi et al., 2012; Kosterlitz & Lewis, 2017). As they now occupy everything from entry-level positions to middle management, their influence is pivotal as we navigate the Fourth Industrial Revolution (4IR) (Teng et al., 2019). This generation contrasts sharply with Baby Boomers, displaying a distinct approach to work-life balance, loyalty, and hierarchical respect, and is characterized by a strong preference for a balanced approach to work and life and a pronounced need for individual recognition and appreciation (Hauw & Vos, 2010; Kosterlitz & Lewis, 2017; Sungdoo Kim, 2018).

Raised during the ascent of the Information Age, Millennials were early adopters of technology in education, seeing devices like smartphones and laptops as basic necessities (Liu et al., 2019; Van Tulder et al., 2018). Their comfort with technology extends to the workplace, where they view digital tools as enablers rather than obstacles (Jones & Lee, 2020). This tech-savviness is further demonstrated in their approach to social media and online platforms, which are often preferred over traditional face-to-face interactions (Chua, 2016; Usluel & Mazman, 2009). Millennials have also leveraged these platforms to forge new career paths that capitalize on digital popularity and entrepreneurial spirit without substantial capital investment (Smith et al., 2020).

The 4IR has introduced new work paradigms that resonate well with Millennials, who favor flexible and remote work arrangements over the traditional office-bound models associated with previous generations (Berkery et al., 2020; Jung, 2019). They tend to see job security not in terms of long-term employment with a single company but in adaptable, skills-based employment, often preferring freelance or project-based roles (Lu & Gursoy, 2016; Araujo & Minetti, 2011).

As we move deeper into the 4IR, the potential for technological unemployment grows, with many predicting that AI and robotics will phase out routine jobs. However, Millennials' adaptability and tech proficiency may afford them a competitive edge in an evolving job market that values digital literacy and flexible work arrangements (Botha, 2018; Schwab, 2017; Smith et al., 2020). Their capability to navigate these changes is crucial as businesses and economies strive to harness the full potential of the 4IR, emphasizing the need for continuous learning and adaptability in the modern workforce.

9. Generational Differences in the Face of the Fourth Industrial Revolution and Evolving Work Nature

Adapting to changing environments is crucial for organizational survival. The COVID-19 pandemic accelerated the need for businesses to swiftly adopt new working methods and technology tools to maintain productivity, often without adequate training (Rosenbloom & Markard, 2020). This demand for rapid adaptation is

becoming the new global norm, requiring consideration in future business continuity plans (Singh et al., 2020; Bhuiyan et al., 2023).

Generational differences are another key factor, particularly with the emergence of the Fourth Industrial Revolution (4IR). Older generations may perceive the 4IR as a threat to their job security due to their lower technological proficiency compared to Millennials (Myers & Sadaghiani, 2010). The 4IR's three key drivers demand technological competencies for individuals and companies to thrive, making technology unemployment a significant risk, especially for older generations (Schwab, 2017).

Technology unemployment results from technology replacing labor-intensive jobs, including robotics, automation, artificial intelligence, and biometric systems. Millennials may adapt more readily to complementing technology-driven business processes compared to preceding generations (Sung-jin Kim et al., 2012; Sungdoo Kim, 2018; Wilkesmann & Wilkesmann, 2018). Exceptions exist within each generation, with individuals displaying characteristics associated with other generations, as seen in successful technology-based companies led by Baby Boomers and Millennials (Price Waterhouse Coopers, 2014).

The nature of work is undergoing a profound transformation, characterized by agile business models demanding greater employee adaptability and competence (Agostini & Filippini, 2019; Botha, 2018; Schwab, 2017; Wilkesmann & Wilkesmann, 2018). While technology like robotics is expected to handle routine tasks, creative professions will remain resilient until Artificial Intelligence advances enough to perform creative and intuitive tasks (Agostini & Filippini, 2019). Artificial Intelligence and neural science are already demonstrating capabilities in executing creative tasks based on mathematical algorithms.

10. Transferring Knowledge Across Generations for Future job Success

The impending Fourth Industrial Revolution (4IR) underscores the critical importance of technological competencies for survival and success. However, beyond technological prowess, preserving institutional memory and ensuring business continuity are equally vital for sustained success (Kotlarsky & Oshri, 2005; S. Ryan & O'Connor, 2012; Sharon Ryan et al., 2013). Older generations possess invaluable institutional memory and tacit knowledge, which are indispensable for ensuring business continuity and achieving success (Hau et al., 2013; Nezakati et al., 2015). While Millennials exhibit a natural aptitude for technology, it is essential for gaining and maintaining a competitive edge in the 4IR era (Hau et al., 2013; Kosterlitz & Lewis, 2017). Business triumph in this era is likely to hinge on the organization's ability to facilitate knowledge transfer both within and between different generations. This approach leverages the wealth of tacit knowledge from older generations and the technological competence inherent in Millennials.

Organizations would be wise to comprehensively understand the distinct traits of each generation to harness these traits effectively and restructure their business models to capitalize on them profitably (Kaifi et al., 2012; Rani & Samuel, 2016). Failing to capture and comprehend the characteristics of each generation and subsequently failing to facilitate innovative knowledge transfer represents a missed opportunity for business leaders (Stewart et al., 2017). Among the intriguing attributes of the youngest generation is their non-linear and less structured outlook. They prefer agile methods of operation, resisting confinement to specific spaces and times, and are motivated by clear instructions and deadlines (Claus, 2019). Millennial team members may often question instructions that appear unclear, not out of defiance, but as a form of inquiry seeking clarity, which might be misconstrued as challenging authority.

11. Contribution and Conclusion of the Review

This review significantly enhances our understanding of the contemporary work landscape, the Fourth Industrial Revolution (4IR), and the impact of the COVID-19 pandemic. It highlights several critical areas:

Reassessing Work Processes Amidst COVID-19: This study underscores the transformative influence of the COVID-19 pandemic, showcasing how societies adapted to unforeseen challenges. It provides insights into how organizations rapidly integrated digital technology to maintain productivity, emphasizing the pandemic's impact on global economic activities.

Non-Technological Dimensions of the 4IR: While much focus on the 4IR revolves around technological advancements, this review emphasises the importance of non-technological aspects. These include shifts in business models, employee well-being, job security, and the evolving nature of work. It broadens the understanding of the 4IR by incorporating these critical dimensions.

Insights for Business Model Adaptations: The review explores the impact of the 4IR on business models, offering practical insights for organizations aiming to redefine their strategies and structures in response to technological transformation. This guidance is invaluable for businesses navigating the complexities of the 4IR.

Generational Dynamics Unveiled: By examining how generational disparities influence approaches to the challenges and opportunities of the 4IR, this study provides a deeper understanding of generational dynamics in the workplace. It illuminates the multifaceted interplay of generational perspectives, aiding in effective organisational management.

Navigating the Knowledge Sharing Landscape: Addressing the importance of knowledge sharing in the 4IR era, the review highlights the need for rapid knowledge and skills acquisition in a swiftly evolving technological landscape. It equips organizations and individuals with essential insights for thriving in an environment where knowledge is a vital currency.

Future Research Directions: The review calls for further exploration into how emerging technologies beyond 2022 are shaping work processes and organizational structures. Additionally, investigating the long-term effects of the COVID-19 pandemic on work dynamics and further examining the role of generational differences in adapting to ongoing technological advancements would provide deeper insights.

In conclusion, this review underscores the intricate relationship between generational differences, the 4IR, and the COVID-19 pandemic's impact on the world of work. It calls for comprehensive, adaptive strategies to address these dynamics' multifaceted challenges and opportunities. Doing so provides valuable guidance for individuals and organizations to harness the full potential of the 4IR while addressing non-technological aspects of this transformative era.

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Cultivating Collective Armor: Towards a Collaborative Cybersecurity Resilience Framework for SMEs

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Abstract: As Small and Medium-sized Enterprises (SMEs) increasingly integrate digital technologies into their operations, they face escalating cybersecurity threats that challenge their limited financial and human resources. Historically, cybersecurity was not a primary concern for many SMEs due to their minimal reliance on cyberinfrastructure. However, the growing dependency on digital systems has exposed them to significant risks, necessitating robust cybersecurity measures. This research introduces a cybersecurity resilience framework specifically designed to enhance the cybersecurity posture of SMEs through collaborative efforts. Drawing upon principles of collective intelligence, shared resources, and shared responsibility, the proposed framework promotes a holistic approach that merges advanced technological solutions with collaborative practices among SMEs, industry stakeholders, and governmental entities. By enabling SMEs to pool their cybersecurity resources and capabilities, the framework aims to provide a comprehensive defence against cyber threats that could not be achieved by individual entities alone. The research delves into key collaborative literature to ground the framework in proven strategies and existing successful models of collaboration. It highlights how collective action can be a powerful tool in overcoming the inherent vulnerabilities of SMEs to cyber threats. To validate the effectiveness and applicability of the framework, it went through an expert review process involving cybersecurity professionals and stakeholders in the SME sector. This study not only underscores the necessity for SMEs to adapt to the evolving cybersecurity landscape but also provides a practical blueprint for collective defence. The framework's emphasis on shared responsibility and mutual aid presents a shift from traditional, isolated cybersecurity approaches to a more integrated and cooperative strategy. This has the potential to significantly enhance the resilience of SMEs against cyber threats, safeguarding their operations and contributing to the overall stability of the digital economy. Future research directions include the application of the framework across various industries and global contexts to evaluate its versatility and impact under different regulatory and threat environments.

Keywords: SMEs, Small and medium-sized enterprises, Cybersecurity resilience, Collective intelligence, Collaboration, Information sharing

1. Introduction

In today's interconnected world, the proliferation of digital technologies has significantly transformed the business landscape, offering unprecedented opportunities for innovation, scalability, and market reach (Shahadat *et al.*, 2023). However, this digital integration also comes with heightened vulnerabilities, particularly for Small and Medium-sized Enterprises (SMEs) (Gundu and Mmango, 2024). As these enterprises increasingly depend on digital infrastructures for their operations, they become prime targets for cyber threats that are both sophisticated and relentless. Unlike larger corporations, SMEs often lack the necessary resources (financial, technical, and human) to effectively combat these cyber threats. This disparity not only places them at greater risk of cyber incidents but also potentially jeopardises their financial stability, customer trust, and long-term viability.

Traditional cybersecurity approaches, which primarily focus on individual organisations fortifying their defences, are proving insufficient under the current threat landscape. The dynamic nature of cyber threats requires more than just isolated efforts; it demands a collaborative approach to cybersecurity (Safitra, Lubis and Fakhrurroja, 2023). Recognising this need, this paper proposes a Collaborative Cybersecurity Resilience Framework specifically tailored for SMEs. This framework is designed to leverage the collective intelligence, resources, and capacities of various SMEs, industry partners, and governmental entities.

Drawing from the principles of collective intelligence and shared responsibility, the proposed framework advocates for a holistic approach that integrates technological solutions with collaborative practices. This approach not only aims to enhance the individual cybersecurity postures of SMEs but also seeks to fortify the broader business ecosystem against potential cyber threats. By fostering a culture of information sharing, collaborative threat intelligence, and joint response mechanisms, the framework empowers SMEs to collectively defend against and respond to cyber incidents.

This introduction sets the stage for a detailed exploration of the proposed framework, including its conceptual underpinnings, operational mechanisms, and potential benefits. It also outlines the structure of the paper, which will delve into relevant literature, describe the framework's components, and discuss the findings from an expert review. The ultimate goal of this research is to offer SMEs a viable solution to enhance their cybersecurity resilience and ensure their sustainable growth in the digital age.

2. Related Literature

2.1 Small and Medium-sized Enterprises (SMEs)

SMEs play a pivotal role in driving economic growth, job creation, and social development (Gherghina et al., 2020). With a diverse and vibrant entrepreneurial landscape, SMEs contribute significantly to the country's Gross Domestic Product (GDP) and provide employment opportunities, particularly in sectors such as manufacturing, agriculture, retail, and services. However, SMEs in South Africa face a unique set of challenges that can hinder their growth and sustainability. These challenges include limited access to finance, inadequate infrastructure, regulatory burdens, skills shortages, and market access constraints. Additionally, factors such as political instability, economic uncertainty, and social inequality can further exacerbate the challenges faced by SMEs.

Despite these obstacles, SMEs in South Africa demonstrate resilience, innovation, and entrepreneurial spirit. Many SMEs leverage technology and digital platforms to overcome traditional barriers and access new markets. Moreover, the COVID-19 pandemic has heightened both the vulnerabilities and resilience of SMEs in South Africa. Many SMEs have faced unprecedented challenges due to lockdown measures, supply chain disruptions, and reduced consumer demand. However, the crisis has also spurred innovation and digital adoption among SMEs, accelerating trends towards e-commerce, remote work, and digital transformation.

2.2 Challenges Faced by SMEs in South Africa

Government initiatives like the Small Enterprise Development Agency (SEDA) and the Department of Small Business Development (DSBD) provide crucial support to SMEs in South Africa (Meyburgh, 2022), though many still struggle due to limited access and extensive need. Key challenges include restricted access to finance, exacerbated by high-interest rates and stringent lending criteria (Nanziri and Wamalwa, 2021), and significant infrastructural constraints such as unreliable power and poor internet connectivity that hinder operational efficiency and growth. Additionally, SMEs face a critical shortage of skilled labour, particularly in technology and innovation-driven sectors (Shaikh et al., 2021), compounded by the brain drain phenomenon (Ahlbäck, 2015). Market access is another significant barrier, with SMEs contending with limited marketing budgets, regulatory hurdles, and intense competition from larger corporations (Scheers, 2011). The socio-political environment further complicates the landscape, requiring SMEs to be adaptable and resilient amid political and economic instability (Griffiths, Gundry and Kickul, 2013; Hamiza, Takwi and Rashid, 2020). Cybersecurity also poses a growing challenge as SMEs become more reliant on digital technologies. Many lack adequate cybersecurity measures, making them vulnerable to attacks like phishing and ransomware. Addressing these challenges requires a collective effort from financial institutions, government, and educational bodies to develop tailored solutions and robust cybersecurity frameworks that protect SMEs and ensure their sustainable growth.

2.2.1 Cybersecurity threats

Small and Medium-sized Enterprises (SMEs) in South Africa face a variety of cybersecurity risks, and this study although it has discussed several other challenges faced by SMEs, its main focus is on the cybersecurity threat challenge. One of the most common threats is phishing attacks, where SMEs are targeted with fraudulent emails designed to steal sensitive information (Naqvi et al., 2023). These businesses are also particularly vulnerable to ransomware, a type of malware that locks access to the victim’s data, often forcing them to pay a ransom to regain access (Yuryna Connolly et al., 2020). Data breaches pose another significant risk, especially as SMEs may store critical customer and financial information but typically lack the sophisticated security measures larger corporations might have (Pantelis et al., 2021). Insider threats are also a concern, arising either from negligence or malicious intent, with employees potentially exposing the company to cyber threats by mishandling data or falling for phishing scams (Gundu, Maronga and Boucher, 2019). Additionally, while advanced persistent threats (APTs) are more commonly associated with larger entities, SMEs involved in critical supply chains might also find themselves targets of these prolonged, stealthy cyberattacks. Lastly, the use of outdated and unpatched software can leave SMEs susceptible to a variety of cyber threats, further

exacerbating their vulnerability in a landscape where cyber threats are becoming increasingly sophisticated. Traditional, cybersecurity strategies typically focus on implementing individual defence mechanisms, such as firewalls, antivirus software, and employee training programs. However, these measures often prove inadequate in addressing the dynamic and sophisticated nature of modern cyber threats (Mitrofan, Cruceru and Barbu, 2020). Moreover, SMEs may lack the financial resources and technical expertise required to deploy and maintain robust cybersecurity solutions effectively (Gundu and Mmango, 2024). In light of these challenges, there is a pressing need for a collaborative approach to cybersecurity that leverages collective intelligence and shared responsibility within the SME ecosystem. By pooling resources, knowledge, and expertise, SMEs can enhance their cybersecurity resilience and better defend against cyber threats.

3. Research Methodology

The research aims to establish a robust foundation by integrating the Qualitative Research Approach (QRA) and Design Science Research Methodology (DSRM). Qualitative research was the most suitable for this study as it seeks to uncover underlying meanings and perspectives of collaboration, and cybersecurity issues related to start-up entrepreneurs through literature review. This then highlighted the aspects that will make up the proposed framework for cybersecurity management of start-up entrepreneurs and their collaboration for cybersecurity resilience. Through the thematic analysis technic, this qualitative approach seeks to provide rich descriptions and interpretations of social phenomena, aiding in deriving meaningful conclusions. Design Science Research Methodology (DSRM) offers a systematic framework within Information Systems (IS) research for developing innovative solutions to real-world problems (Dresch, Lacerda and Antunes, 2015). Because DSRM priorities the creation of practical artefacts and solutions, that is the reason it was chosen for this study.

3.1 Design Science Research Methodology

The DSRM process involves problem identification, objective definition, design and development of the artifact, demonstration of its functionality, and rigorous evaluation to assess its performance and impact as dipticted in Figure 1. By communicating the research findings to relevant stakeholders, DSRM ensures the dissemination of outcomes to inform future research and practice. Through the application of DSRM, the research endeavoured to create practical framework aimed at addressing the challenges faced by Small and Medium-sized Enterprises (SMEs) in cybersecurity resilience.

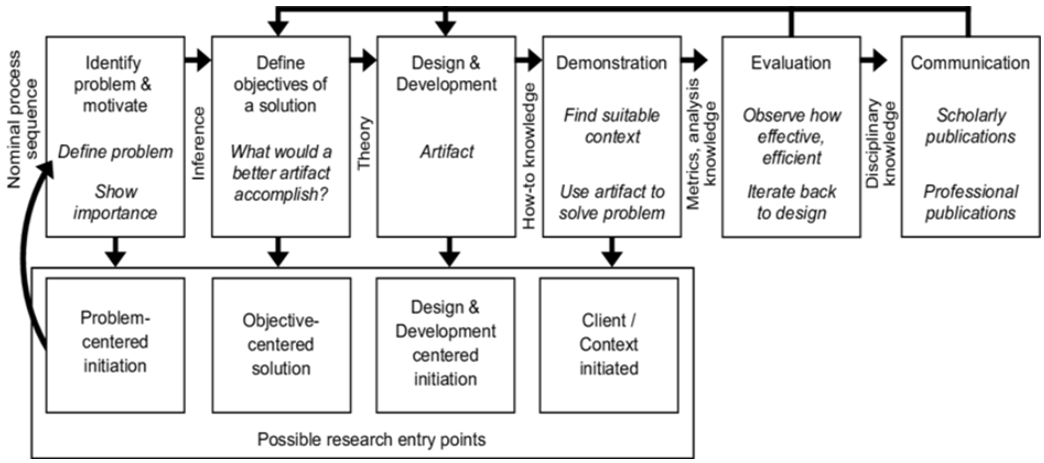


Figure 1: DSRM Process (Dresch, Lacerda and Antunes, 2015)

3.1.1 Problem identification

The identified problem is cyber threats that represent a formidable obstacle to the success of SMEs, presenting a diverse range of risks from cyberattacks to data breaches. Cyberattacks can disrupt essential business processes, leading to costly downtime and productivity losses. Additionally, financial implications such as theft of funds or ransom payments can strain SME budgets and jeopardise financial stability and reputation.

3.1.2 Objectives definition

In addressing the significant threat posed by cyberattacks and data breaches to SMEs, the objectives of this study are to identify and assess potential threats and design a framework, aimed at enhancing cybersecurity resilience among SMEs through a collaborative approach. The framework leverages shared intelligence and resources, improving SMEs' ability to withstand cyberattacks through collective risk assessments, shared threat intelligence, and coordinated incident responses. The last objective involves expert review to refine the framework for practical application.

3.1.3 Design and development

Building on the findings of the literature review, the design and development phase centred on crafting a comprehensive framework aimed at assisting SMEs in enhancing their cybersecurity posture through collaboration. The framework was tailored to give guidance on how they can collaborate to address the specific needs and challenges faced by SMEs, combating their drawbacks in terms of factors such as limited resources, technical expertise, and evolving threat landscapes.

3.1.4 Demonstration

After the development of the first version of the framework, the next critical step was to demonstrate its functionality and effectiveness in addressing the identified problem. This demonstration was provided to the experts who were evaluating the framework.

3.1.5 Evaluation

Experts in cybersecurity and entrepreneurship undertook a rigorous evaluation of the framework, a crucial step in the research or development process. This evaluation aimed to assess the framework's usability and anticipated impact. This thorough evaluation process ensures that the framework effectively enhances cybersecurity measures, mitigating risks and safeguarding against cyber threats while promoting changes in business behaviour towards prioritising cybersecurity.

3.1.6 Communication

This study employs various channels of communication to disseminate research findings, including academic conferences, journal publications, social media platforms, SMEs imbizo (conventions), business summits, business blogs, and other relevant platforms. The aim is to ensure that the insights gained from the study, including the developed framework, reach a diverse range of stakeholders. The study utilises social media platforms to reach a wider audience, including SMEs, policymakers, and practitioners, facilitating broader discussions and knowledge dissemination.

4. Introducing the Proposed Framework

The section outlines the proposed framework aimed at strengthening the cybersecurity defences of SMEs through a collaborative approach. It details the essential components of the framework, including its foundation based on literature.

4.1 Foundation in the Literature

The constructs of the "Collaborative Cybersecurity Resilience Framework for SMEs" framework are deeply rooted in established literature on collaboration as summarised in Table 1. This section outlines how each component of the framework aligns with recognised practices, principles, and research findings from the literature on collaboration. By grounding our approach in a strong theoretical basis, we ensure that the strategies implemented are not only practical but also supported by academic and professional studies.

Table 1: Summary of Literature review

Theme	Short Description	Articles
Define the Need and Scope	**Identify Risks:** Assess the common cybersecurity risks facing start-ups in your network or region. **Determine Scope:** Decide whether the collaboration will focus on specific sectors, technologies, or geographical areas.	(Nguyen *et al.*, 2020; Pedersen *et al.*, 2021; Busch *et al.*, 2024)
Build a Core	**Assemble a Leadership Group**: Gather a small team of committed individuals	(Sun *et al.*, 2020; Tang, Vezzani and

Theme	Short Description	Articles
Team	from different start-ups who are passionate about cybersecurity. **Define Roles**: Assign roles such as project leader, financial advisor, technical expert, and communications officer.	Eriksson, 2020; Devi *et al.*, 2023)
Conduct Preliminary Research	**Understand Best Practices:** Research existing cybersecurity frameworks and best practices. Consider frameworks like NIST or ISO/IEC standards as references. **Survey Potential Participants**: Engage with other start-ups to understand their specific needs and the challenges they face in cybersecurity.	(Andrews-Todd and Forsyth, 2020; Ramezani and Camarinha-Matos, 2020)
Prepare a Clear Value Proposition	**Highlight Benefits:** Emphasize the mutual benefits such as shared knowledge, reduced costs through pooled resources, and enhanced collective security. **Address Specific Needs:** Tailor your message to show how the collaboration addresses specific cybersecurity challenges faced by each startup.	(Afifi, Kalra and Ghazal, 2020; Penuel *et al.*, 2020; Xu, Wang and Wang, 2023)
Use Existing Networks	**Leverage Contacts**: Start with your existing business contacts, industry groups, and professional networks to find interested parties. **Attend Industry Events**: Participate in startup conferences, cybersecurity seminars, and business networking events to meet potential collaborators.	(Ramezani and Camarinha-Matos, 2020; Sun *et al.*, 2020)
Organise an Introductory Meeting or Event	**Host a Webinar or Workshop**: Provide a platform where startups can learn about cybersecurity threats and the importance of collaborative defence strategies. **Facilitate Discussions**: Allow for open discussion so that participants can voice their concerns and interests.	(Soller, Wiebe and Lesgold, 1994; Steiber and Alänge, 2020; Busch *et al.*, 2024)
Follow Up Persistently	**Regular Updates:** Keep potential collaborators informed with updates on progress, developments, and upcoming meetings. **Personal Engagement**: Engage personally with key decision-makers to understand their reservations and work through any objections.	(Hwang and Cha, 2018; Afifi, Kalra and Ghazal, 2020; Nguyen *et al.*, 2020)
Facilitate Easy Onboarding	**Simplify Joining Process**: Make the process of joining the collaboration as simple and straightforward as possible. **Provide Support**: Offer support for new members to integrate into the network smoothly, including technical assistance and access to shared resources.	(Penuel *et al.*, 2020; Sutrisno *et al.*, 2023; Xu, Wang and Wang, 2023)
Develop Shared Tools and Resources	**Identify Resources**: Determine what resources are needed, such as funding, technical tools, and human capital. **Resource Sharing Agreements**: Develop agreements on how resources will be shared and managed.	(Steiber and Alänge, 2020; Tang, Vezzani and Eriksson, 2020; Devi *et al.*, 2023; Sutrisno *et al.*, 2023)
Showcase Immediate and Long-Term Benefits	**Immediate Gains:** Demonstrate quick wins that can be achieved through collaboration, such as immediate access to shared cybersecurity tools or collective bargaining power. **Long-Term Strategy**: Outline the long-term strategic advantages, like ongoing improvement in cybersecurity posture and resilience against future threats.	(Hwang and Cha, 2018; Andrews-Todd and Forsyth, 2020; Al-Omoush, de Lucas and del Val, 2023)
Outreach and Expansion	**Share Successes:** Publicize successful outcomes to attract more participants and support. **Expand Network:** Consider expanding the collaboration as more startups and resources become available.	(Soller, Wiebe and Lesgold, 1994; Pedersen *et al.*, 2021; How and Cheah, 2023)

4.2 Collaborative Cybersecurity Resilience Framework for SMEs

The framework includes actionable strategies and steps for creating a cohesive and proactive collaboration among participating SMEs as illustrated in Figure 2. Each component of the framework is clearly defined and designed for easy adoption and efficient coordination among the interested SMEs.

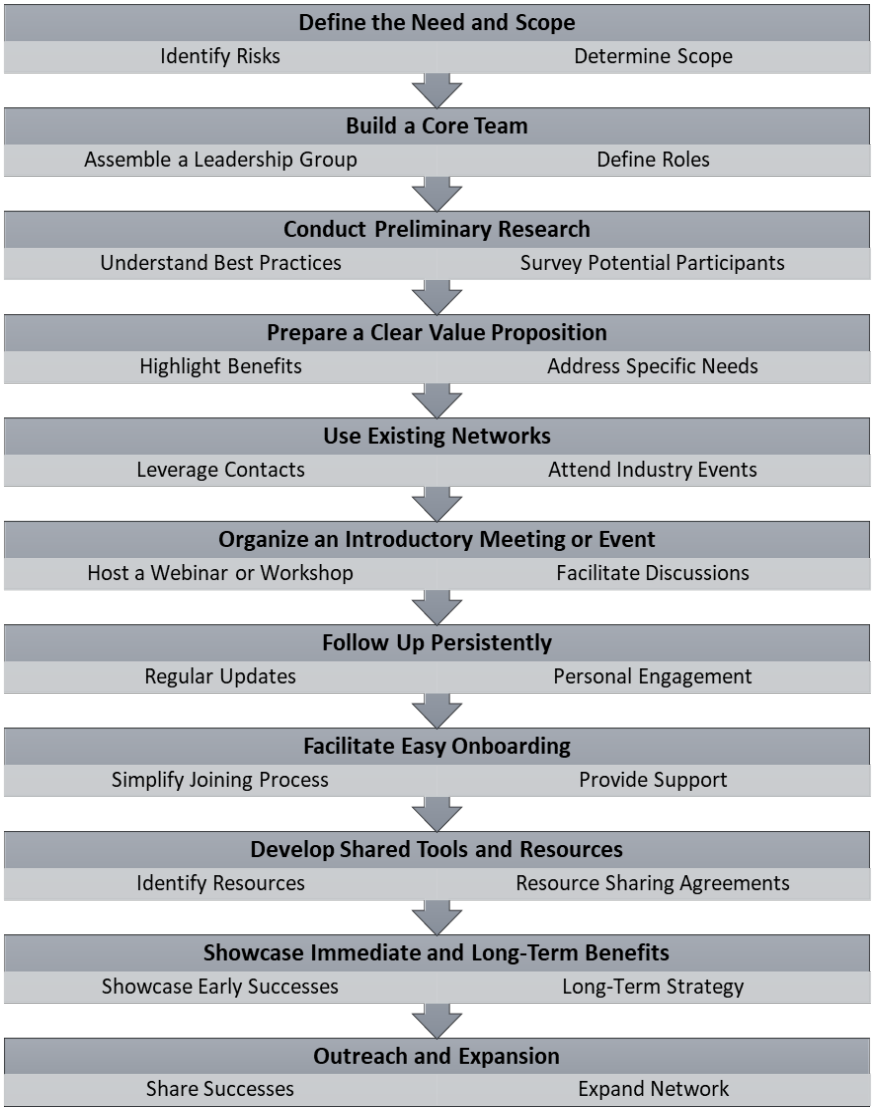


Figure 2: Collaborative Cybersecurity Resilience Framework for SMEs

Implementing the framework provides several significant benefits to SMEs. Through collaborative risk assessments, SMEs gain a comprehensive understanding of potential cybersecurity threats and vulnerabilities. This collective intelligence allows for better-informed decision-making and prioritisation of security efforts, focusing resources on the most critical areas. The shared understanding of risks leads to a more robust defence against cyber threats. The framework leads to Information-sharing platforms that provide a centralized venue for exchanging real-time threat intelligence, best practices, and mitigation strategies. This ensures that all participating SMEs have access to the latest information and can learn from each other's experiences and insights. Such platforms also facilitate rapid dissemination of information about emerging threats and effective defensive measures, keeping all members up-to-date and better prepared.

Engaging in policy advocacy and collaboration with regulatory bodies enables SMEs to contribute to the development of cybersecurity policies that reflect their interests and needs. This active participation helps shape a regulatory environment that supports secure, sustainable growth for SMEs, ensuring that their voices are heard and considered in policy decisions.

5. Discussion

Securing SMEs from cyber threats using collaboration yields a multitude of benefits from safeguarding their operations, finances, and reputation. By ensuring the protection of sensitive customer and business data, SMEs mitigate the risk of data breaches and safeguard against both financial and reputational damage. This is crucial for maintaining the trust of customers and partners, who expect their data to be handled securely. Defending against cyber threats also ensures uninterrupted business operations, minimizing downtime and maintaining productivity levels. This continuity is essential for safeguarding revenue streams and maintaining customer satisfaction, as operational disruptions can lead to significant losses and damage to customer relationships.

Enhanced cybersecurity protects SMEs from financial losses associated with cyberattacks, which can include ransomware payments, legal fees, regulatory fines, and the costs related to data recovery and system restoration. By preserving their financial stability, SMEs can allocate resources more effectively towards growth and development rather than crisis management. A secure operation also preserves an SME's reputation and trustworthiness among customers, partners, and stakeholders. A single data breach can cause irreparable damage to a brand's reputation, making cybersecurity a critical component of reputation management. Demonstrating strong cybersecurity measures can also provide SMEs with a competitive advantage in the marketplace. It instils confidence in customers and partners, distinguishing these businesses from less secure competitors. This advantage is increasingly important as customers become more aware of and concerned about digital security.

Compliance with cybersecurity regulations and standards is another critical benefit, helping SMEs avoid legal liabilities, penalties, and the reputational damage that can result from non-compliance. This fosters trust and credibility within the regulatory landscape, which is becoming more stringent as the digital threat landscape evolves. A secure SME is also better positioned to pursue growth opportunities, expand into new markets, and attract investment. Stakeholders and potential investors recognize a commitment to cybersecurity and effective risk management as key indicators of a company's long-term viability and governance standards. Finally, effective cybersecurity measures provide SME owners and stakeholders with peace of mind, knowing that their business and assets are protected against cyber threats. This allows them to focus more on strategic initiatives and business growth, rather than being preoccupied with the potential for digital disruptions.

5.1 Anticipated Challenges of Implementing the Collaborative Cybersecurity Resilience Framework for Start-Up Entrepreneurs

While the framework presents a promising approach to enhancing cybersecurity resilience among SMEs, several anticipated challenges may arise during its implementation. One significant challenge could be the reluctance of some SMEs to engage in collaborative efforts due to concerns about sharing sensitive information or perceived competition with other businesses. Overcoming this resistance will require fostering a culture of trust and transparency among participants, as well as emphasizing the mutual benefits of collaboration in strengthening cybersecurity defences. Many SMEs operate with limited financial and human resources, making it challenging to allocate resources for cybersecurity initiatives. Implementing the framework's capacity-building initiatives and participating in collaborative activities may require SMEs to invest additional time, money, and personnel, which could strain their already stretched resources.

Compliance with existing legal and regulatory frameworks, such as data protection laws and industry-specific regulations, may pose challenges to information sharing and collaboration among SMEs. Navigating these legal and regulatory complexities while ensuring privacy and confidentiality will require careful consideration and possibly advocacy efforts to address any barriers that hinder collaboration.

SMEs may lack the technical expertise or infrastructure to implement advanced cybersecurity measures or participate effectively in information-sharing platforms. Providing accessible and user-friendly tools and resources, as well as offering training and support, will be essential to overcoming these technical barriers and ensuring broad participation in the framework.

Maintaining long-term engagement and commitment to the framework, as well as adapting it to evolving cyber threats and technological advancements, will be critical for its sustainability. SMEs may face challenges in keeping up with rapid changes in the cybersecurity landscape and may require ongoing support and guidance to remain resilient over time. Addressing these anticipated challenges will require proactive measures, collaboration among stakeholders, and ongoing evaluation and refinement of the framework to ensure its effectiveness and relevance in safeguarding SMEs against cyber threats.

6. Conclusion

SMEs face a unique set of challenges, including limited access to finance, inadequate infrastructure, regulatory burdens, skills shortages, and market access constraints. However, they demonstrate resilience and innovation, leveraging technology and government support initiatives to overcome barriers and drive economic growth. The research highlights the growing vulnerability of Small and Medium-sized Enterprises (SMEs) to cybersecurity threats as they navigate the digital landscape. It emphasises these SMEs do not have adequate knowledge and resources to address these threats. To address this challenge, the study introduces a framework, which advocates for a collaborative approach to bolstering cybersecurity resilience among SMEs. The framework is grounded in principles of collective intelligence and shared accountability, aiming to merge technological solutions with collaborative practices involving SMEs, industry partners, and governmental bodies.

The research methodology in this study integrates the qualitative research approach with Design Science Research Methodology (DSRM), emphasising the development of a practical solution to a real-world problem. The literature review gathered relevant insights from reputable academic databases, employing rigorous selection criteria to ensure the credibility and relevance of sources.

The proposed "Collaborative Cybersecurity Resilience Framework for SMEs" offers a proactive and collaborative approach to cybersecurity, recognising the interconnectedness of SMEs and their shared vulnerabilities to cyber threats. By embracing collective intelligence and shared responsibility, SMEs can enhance their cybersecurity posture and mitigate the risks posed by increasingly sophisticated cyber-attacks.

Future studies could assess the framework's applicability and effectiveness across various geographical regions and industry sectors. This would help to understand how cultural, economic, and regulatory differences impact the implementation and success of collaborative cybersecurity practices.

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Venture Studios: Beyond Entrepreneurial Support Organisations? A Case Study Analysis and Framework

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Abstract: We examine and discuss the rise of the Venture Studio phenomenon (also called Startup Studio), which is receiving increasing attention across the globe. Venture Studios promises to mitigate the high failure rates faced by new ventures by engaging earlier in the new venture creation process, contributing from ideation at pre-venture stage. Venture Studios generate business ideas, and then partner with external entrepreneurs to build and validate the new businesses. Despite their increasing prominence, little is known regarding the design choices, activities, and outcomes of Venture Studios, as well as how they differ from other established organisations such as incubators and accelerators. This research aims to fill this gap, by conducting an exploratory case study involving interviews with 14 Venture Studios in Italy. We introduce an I–P–O framework that provides a comprehensive set of design choices and activities that characterise Venture Studios. Findings reveal significant heterogeneity in design choices, indicating no one-size-fits-all approach. Despite this, consistency exists in their processes and entrepreneurial orientation. Second, we question the nature of Venture Studios as Entrepreneurial Support Organisations (ESOs), proposing that they represent a new category with a more active, co-founder-like role. This study also seeks to equip Venture Studio managers with a framework to understand and strategically navigate the diverse approaches within their field. Also, we offer insights to entrepreneurs, investors, and other stakeholders, enabling them to understand the functioning of this novel form of organisation.

Keywords: Venture Studios, Incubators, Accelerators, New Venture Creation, Entrepreneurial Support Organizations

1. Introduction

> *Venture Studios are an "idea factory" searching for product/market fit and a repeatable and scalable business model (Steve Blank)*

Higher failure rates are a common characteristic of new startups, often stemming from various factors such as the quality and viability of the original idea, the competence and cohesion of the team, the ability to secure funding, the sustainability and adaptability of business models, and the timing of market entry (CBInsights, 2021; Eisenmann, 2021). To address these challenges, several types of organisations have emerged, such as incubators, accelerators, science parks, and venture capitalists (Bergman & McMullen, 2022; Clayton, Feldman, & Lowe, 2018). In recent years, however, a new category of organisation has emerged: Venture Studios (Blank, 2022). Defining themselves as "Startup Factories", Venture Studios create multiple ventures simultaneously. The ideation phase can occur either internally or externally; however, all subsequent stages leading up to the establishment of a startup, such as building the MVP and conducting validation, are managed in-house (Blank, 2022). The process of creating a new start-up is designed with the assistance of potential entrepreneurs who are sourced externally and who will be responsible for guiding the company once it is established. The Venture Studio provides prospective entrepreneurs with extensive hands-on support through core team members, infrastructure, and services. In exchange for this support, Venture Studios typically receive an equity stake similar to that of a founder in the ventures they assist in creating (Patel and Chan, 2023).

Perhaps the ontological difference Venture Studios with all the categories of entrepreneurial support organisations (e.g., incubators, accelerators) is that Venture Studios are founders or co-founders of start-ups, and not only supporters. However, this initial difference leads to many other differences, that we will discuss throughout the research, by the mean of a multiple case study on 14 Venture Studios in Italy.

The sparking promise of Venture Studios is double: (i) on the studio perspective, innovating the way new ventures are created, due to the development of great process synergies thanks to the sharing and recycling of resources and knowledge, resulting in better performances in terms of time to capital and rate of returns; (ii) on the prospect entrepreneur/s perspective, the possibility to find in the studios the perfect co-founding team.

2. Origins and Growth of the Phenomenon

Idealab is widely recognised as the pioneer of all Venture Studios. It was founded by Bill Gross in Silicon Valley in 1996. Since then, they have created more than 150 companies that have had over 45 exits, either through IPO

or acquisitions. However, the first real wave of Venture Studios began in 2007, guided by Rocket Internet and Betaworks. Betaworks, founded in New York City by John Borthwick and Andy Weissman, was the originator of unicorns such as Tumblr and Giphy, while German-based Rocket Internet, founded by the 'Samwer brothers', is famous for the establishment of the 'Copycat model', systematically copying successful ventures in other markets (Köhler & Baumann, 2016). With this model, they have been able to launch more than 100 companies worldwide, demonstrating the high success rates potentially achievable through these organisations.

An analysis of the data of the Venture Studio Index, which is accessible on its dedicated website (https://www.venturestudioindex.com/), demonstrates a significant increase in the number of Venture Studios in recent years, highlighting the rapid growth of the phenomenon. This surge (illustrated in Figure 1) may be attributed to the widespread success stories of Venture Studios and the expanding community, which has drawn more attention to the model.

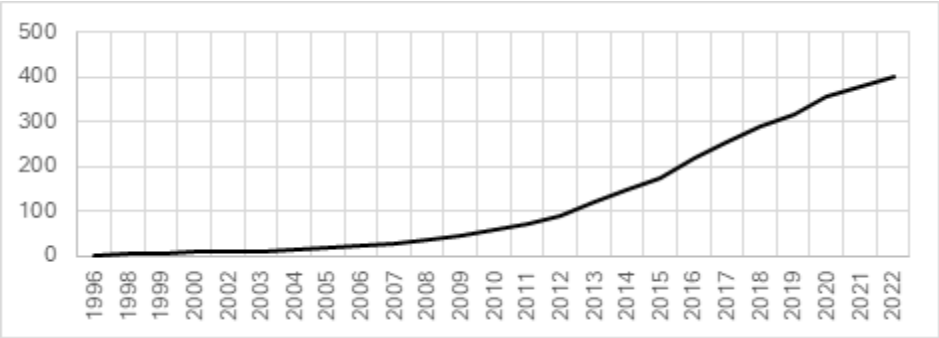


Figure 1: Number of Venture Studio in the Venture Studio Index Dataset

3. An I-P-O analysis of Venture Studios

Limited research exists on the Venture Studios, primarily due to the newness of the phenomenon and limited data availability. We decided to rely on the definition adopted by Rathgeber, Gutmann, & Levasier (2017), that define Venture Studios – that they call 'Company Builder' – as organisations that "*launch new ventures based on a systematic venture creation process. Company builders independently drive the process from idea generation, the hiring of the co-founders to early fundraising. In return, company builders control a substantial part of the new venture's equity, thereby exerting significant influence over the new venture development way beyond the initiation phase".*

Owing to its novelty, there is no unified framework that can describe in a structured way the phenomenon, in terms of what Venture Studios do. In an attempt to frame it, our proposal aims to describe the Venture Studio phenomenon using an Input-Process-Output (I–P–O) analysis (McGrath, 1964). The I-P-O framework was born in psychology to study group activities but has then been used as the basis for other management studies (e.g., Simsek, 2009) due to its ability to differentiate the main antecedents, components, and outcomes of the process under scrutiny. As Venture Studios are often referred to as "Venture Builders" (i.e., a group activity aimed at the generation of new successful ventures), we consider the model very suitable to describe the phenomenon.

The core components of our framework are described in the following.

Input. The design choices that underlie the Venture Studio organisation. We rely on the definition of design choices provided by Cohen, Fehder, Hochberg, & Murray (2019), thus "variation which is likely to be salient both for understanding their impact on and across startups, and their differentiated role in the ecosystem in which they operate" (Cohen et al., 2019"1781).

Process. The main activities that characterise Venture Studios' operations. To this extent, we rely on the Porter Value Chain model (Porter, 1985) as a conceptual toolbox that aligns the studio's view as "a startup factory" – the model allows you to break down the studio's operations into distinct primary and support activities, giving you a clear view of how the product (i.e., the startup) is created and delivered through each stage of the venture building process.

Outcome. The outcomes of the venture studio's operations as a "startup factory" (i.e., in terms of new venture creation and performances).

This paper is divided into three sections. In the first section, the methodology is presented, and the characteristics of the survey sample are summarised. The second section explores the results as related to

achieving a general understanding of the Venture Studios (The resulting I-P-O framework). The third section questions the nature of Venture Studio as Entrepreneurial Support Organisation, such as incubators and accelerators.

4. Methodology

As there is little previous research on Venture Studios, a novel, and relatively unexplored phenomenon, we have chosen an inductive, multiple case study design as our research strategy (Eisenhardt & Graebner, 2007; Yin, 1984). We approached the research design in two steps, combining different sources. First, we studied archival data from various sources, including reports, websites, and third-party interviews in order to get confident with the Venture Studios phenomenon, and we conducted exploratory interviews and conversations with various individuals involved in the industry to understand the main activities performed by studios. Then, we selected a sample of 16 Venture Studios obtained from an original database of Venture Studios based and operating in Italy. This database was set up within a broader research project in 2023, and it has been mapping Italian-Venture Studios by triangulating data from different sources in the entrepreneurial ecosystem – selected according to the definition provided by Rathgeber and colleagues (2017). Thus, we define a venture studio as having the following characteristics: (1) driving the process from business ideation (2) hiring of external co-founders (3) substantial control of the new venture's equity (higher than 10%). Out of the 16 Venture Studio we reached out to, 14 agreed to participate in our study (Table 1).

We thus conducted 14 semi-structured interviews. The interview protocol was drafted according to a semi-structured approach, and remained open to exploring new topics and insights as they arose during the conversations. After analysing the results of these interviews, we coded the interviews and analysed the results. The output of our analysis resulted in 34 codes that were further aggregated following the overarching dimensions of our input-process-output (IPO) framework. Three researchers were involved in the coding process to ensure consistency and reliability. Two researchers coded and clustered independently different elements in the I–P–O framework, and then discussed any discrepancies to reach a consensus on the assignment. The third researcher acted as an arbiter in the process. We also used multiple sources of data, such as third-party interviewees, and archival documents, to triangulate on findings.

Subsequently, we created a questionnaire that we delivered to the 14 studios the questionnaires in order to: (i) collect eventually missing data; (ii) ensure comparability across the different elements of our I–P–O framework; (iii) validate our results.

Table 1: Venture Studios included in our research

Name	Founding Year	Startup created	Interview referent	Questionnaire Confirmation
Studio A	2018	5	CEO and Co-founder	✓
Studio B	2020	3	CEO and Founder	✓
Studio C	2022	1	CEO and Founder	✓
Studio D	2021	3	COO and Co-founder	✓
Studio E	2020	17	CEO and Founder	✓
Studio F	2022	0	CEO and Founder	✓
Studio G	2020	5	CEO and Co-founder	✓
Studio E	2021	4	CEO and Founder	✓
Studio F	2021	3	CEO and Founder	✓
Studio G	2020	3	COO and Co-founder	✓
Studio H	2021	4	CEO and Founder	✓
Studio I	2021	3	CEO and Managing Partner	✓
Studio J	2018	4	CEO and Founder	✓
Studio K	2020	13	CEO and Founder	✓

5. Venture Studio Framework

In this section, the results are described in detail. According to our I-P-O framework, we present the results as follows: given that activities of a Venture Studios include a chain of core activities (i.e., the venture building primary and support activities) that connect antecedents (i.e., design choices) and outcomes (i.e., new venture creation and performances). The final framework is reported in Figure 2.

5.1 Input: Strategic Design Choices

Design choices represent a set of critical decisions regarding the structure of activities. These choices are strategic to the extent to which they are a set of high-commitment choices made that have profound implications on competitive outcomes (Cohen et al., 2019; Pauwels, Clarysse, Wright, & Van Hove, 2016). This first set of choices emerged from the discussion related to the main characteristics of the Venture Studio that were illustrated by the informants while answering to higher order questions such as: *"From whom, and why did the idea of founding your Venture Studio come about? What are your mission and objectives? Do you consider your Venture Studio specialised in a certain sector, business model or technology?"*

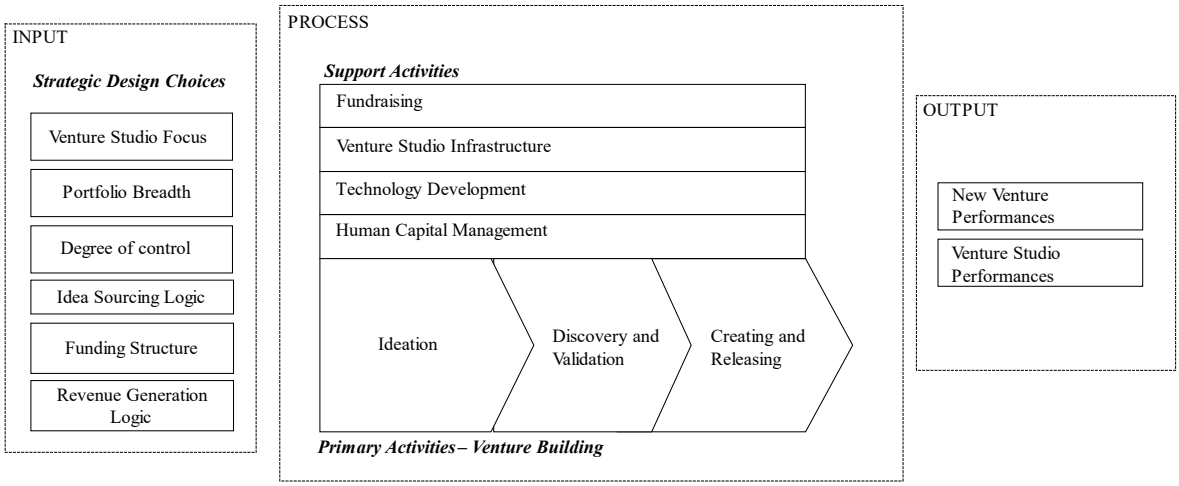


Figure 2: Venture Studio I-P-O framework

Venture Studio focus. Among the most important and characterising choices a Venture Studio could make in its way of doing business is deciding whether to be "generalist" or "specialised" (e.g., focusing on a particular industry, business models, or target customers). First, Industry specialisation allows Venture Studio to exploit past expertise and awareness in that specific sector and ad-hoc networks. Second, Venture Studio could be vertical in building only startups based on a marketplace, or Software as a Service revenue models.. Thirdly, Venture Studio can only focus on a certain type of customer, which may increase the ease of discovery and achievable commonalities in marketing and sales processes and techniques. Specialisation could bring several advantages, such as getting expertise, and economies of scale more easily, repetitively following similar MVP and product developments, or repetitively adopting similar financial models and marketing techniques. Also, generalist Venture Studios highlights the importance to focus on mastering a clear playbook while creating new startups.

Table 2: Venture Studio Specialisation, Degree of Control, Portfolio Breadth

Name	*Industry Focus*	*Business Model Focus*	*Customer Focus*	*Equity Percentage Taken*	*Number of Startups per Year*
Studio A		✓	B2B2C, B2B	30%	2-4
Studio B		✓		15-51%	4
Studio C		✓	B2B	30-40%	2-3
Studio D			B2C	75%	3
Studio E	✓			30%	6-8
Studio F	✓		B2B2C, B2B	50%-85%	2-3

Name	*Industry Focus*	*Business Model Focus*	*Customer Focus*	*Equity Percentage Taken*	*Number of Startups per Year*
Studio G		✓	B2B	45%	4
Studio E				10-15%	no target
Studio F	✓			50-70%	1
Studio G		✓	B2B	37.5%	2
Studio H		✓	B2B	>70%	3
Studio I				15%	1
Studio J			B2B2C, B2B	50-90%	5
Studio K	✓	✓	B2B	51%	no target

Portfolio breadth. Venture Studios could vary on the size of volumes they aim to manage. Most of the Venture Studios in our sample keep volumes between 1 to 8 startups per year but below the chosen threshold of 4 created startups per year. Generic or more experienced Venture Studios would likely manage a higher number of startups, whereas those seeking higher equity control may favor managing fewer startups in parallel. Additionally, Venture Studios that source ideas both internally and externally may have larger pools of potential opportunities to work on.

Degree of control: Among the most important and characterising choices a Venture Studio could make in its way of doing business is deciding when to bring an external co-founder in the process, and which portion of equity to retain. The partition of equity between the Startup Studio and its ventures' co-founders is a pivotal design variable in the hands of such organisations, as it sets the incentives for the development of the new venture. This choice deeply influences the engagement and motivation of the "external" co-founders. As it can be seen from Table 2, the Italian Studios equally split range from 15% to 90%.

Idea selection logic. Venture Studios can source ideas in two ways. Firstly, the firm itself can generate ideas through structured ideation activities, such as brainstorming or research activities. For example, a copycat approach involves sourcing business ideas from successful examples in foreign markets. Alternatively, in an external origination, external entrepreneurs can provide ideas from outside. Venture Studios can also create an opportunity space (e.g., by providing an investment thesis as a starting point to work upon) where ideas emerge from mixed interactions with potential entrepreneurs.

Funding Structure. Venture Studios adopt different funding structures, configuring themselves as either single entity studios (i.e., the Venture Studio entity collects money directly from investors) or dual entity studios (i.e., an external entity handles capital collection). These structures can be open ("evergreen") or closed-ended, similar to a venture capital fund. However, this aspect appears to be evolving rapidly with the development of "best practices," as reported by several informants.

Revenue Generation logic. Although Venture Studios aim to generate revenue from investments in the startups they create, few diversify their models to secure alternative revenue streams for survival. These alternatives include providing consultancy and advisory services to corporations or organising educational events. This diversification may also be necessary because Venture Studios are still relatively new and require time to gain legitimacy through notable exits in their portfolios.

5.2 Process

After analysing the value chain, we identified the studio's core activities in the venture building process, including sourcing ideas and talent, as well as experimentation and validation activities necessary for creating startups. The value chain "disaggregates a firm into its strategically relevant activities" (Porter, 1985), that are sources of competitive advantage. Porter's value chain differentiates between primary activities (i.e., the activities related to the physical creation of the product – the startup – and its sale and transfer to the buyer – the market), and support activities (i.e., that supports primary activities – the venture building process of a startup).

Primary Activities. Primary activities refer to the activities that constitute the venture building process –the development of a startup from the idea conception to its detachment from studio operational influence. These activities are similar for each Venture Studio and differ only to the extent to which some sub-activities are carried

out, and how they are influenced by design choices (e.g., the fact the idea selection is internal or external, or the fact the studio focuses on a certain business model) and support activities.

Often, Venture Studios go through the primary activities through a stage gate (i.e., go/no-go) approach. For example, as explained by a Venture Studio's founder: "*the internal creation of ideas is divided between Lab - Studio - Gallery. The Lab is where the ideas are born: we study the trends, there is already a team of two people working only on that, we have a list of ideas, we prioritise them. (...) in the lab we start the actual activities, i.e. we go to the market first, because we do tests, smoke tests, then once the Entrepreneur in Residence is inside, we also allocate funds, we start to do small developments, there we start in a more concrete way to go and build a business (...) After 6-8 months the start-up must have proven something, and tend to receive capital, public and private. That's the moment when the start-up moves from the Studio to Gallery, it becomes ready for the investors".*

Ideation refers to all the activities related to the identification of opportunities in the market. This can entail some activities such as studying market trends, patent development, SEO activity, data analysis, brainstorming and development of investment thesis. Either, if the idea selection logic is external, the Studios can gather ideas directly from outside, through direct interaction with an external person or organisation, which is bringing them inputs (e.g., by talking with experts or prospect entrepreneurs).

Discovery and validation entail activities aimed at engaging in experimentation activities in order to discover customer problems and validate the solution they want to bring into the market. Sub-activities here refer to interviews with potential customers, developing mock-ups or MVPs. The Prospect entrepreneur can get on board at any point of these activities, depending on the design choices operated by the Venture Studio.

Finally, *Creating and release* refer to those activities focused on setting up the new venture and starting assisting startups in achieving a product market fit by acquiring new customers and identifying appropriate channels for distributing startups' products or services. During this process, the venture team consolidates, and the Venture Studio gradually detaches from the operation support of the venture. Finally, the studio discharges its distinctive burden of execution on the new venture's team, remaining involved only as an advisor and investor. Some employees of the studio may remain part of the new venture's team.

Support activities. Support activities refer to centralised activities at the Venture Studio level, including the development of the Venture Studio itself and support for the business creation process (financial, technological, administrative, legal). *Studio Infrastructure* activities involve managing the day-to-day operations of the Venture Studio team, which include scheduling, resource allocation, and communication. It also entails overseeing budgeting, accounting, and financial reporting for the studio and its startups.

Also, *Fundraising* encompasses all activities related to attracting, developing, and managing financial resources for the Venture Studio, that are needed for the operations of the studio and its startups, according to the choices in terms of funding structure (e.g., single or dual entity). *Technology development* activities involve the maintenance and upgrading of the technological infrastructure necessary for product development and operations. This includes all activities related to creating shared assets for product development, such as the technological stacks used for MVP development. Finally, *Human Resources Management* encompasses all activities related to attracting, developing, and managing talent for both the studio and its startups. It entails the crucial role of selecting the right people for both the Venture Studio and its startups (e.g., the external entrepreneurs that join the Venture Studio).

5.3 Outcomes

First, the new venture creation rate regards the number of new startups built based on innovative ideas and technologies; Second, when asked about the outcome of their businesses, venture studios often equated their success to the ones of the startups they create – for example in terms of fundraising, revenues and profits. Enabling startups to secure funding from venture capitalists, angel investors, and other funding sources (as explained by one informant: "*our startups that come out have to collect on the market, not only the round we help them collect as well, but also in subsequent rounds, that is the key point*"); supporting startups in generating sustainable revenue streams and achieving profitability (as explained by one informant, " *our added value is to give us at least four years to be able to create value with the start-ups and thus have exit gates or at least calls or puts depending on some metric we take into consideration, maybe revenues, customers, market shares, etc.*"); facilitating successful exits through mergers, acquisitions, or initial public offerings (IPOs) that yield significant returns for the studio and its stakeholders. Finally, we discovered that many studios engage in *generating other revenue streams* while waiting for the returns of the startup they create. These alternative revenues are

generated from the provision of the services of the studio 'on-demand' to external customers (e.g., corporates, SMEs, consultancy firms).

6. Discussion

Our study makes significant contributions by examining Venture Studios, a novel organisational category in Entrepreneurial Ecosystems. We introduce an analytic framework that provides a comprehensive set of design choices, processes, and outcomes, that distinguish Venture Studios from other Entrepreneurial Support Organisations such as incubators, and accelerators (Bergman and McMullen, 2022).

Practical contributions

The framework aims to offer Venture Studio managers and stakeholders a tool to comprehend the Venture Studio as a new organisational category (Younger and Fisher, 2020), and to evaluate their positioning and that of their comparables. This contribution will be more significant over time as this organisational category gains popularity. Our study reveals the heterogeneity in design choices that characterise Venture Studios. In doing so, we seek to empower Venture Studios owners by providing a mapping tool to track and navigate their evolution in the Venture Studio landscape. For example, over time, best practices and dominant designs may emerge as the field matures. Also, that same positioning awareness could be interesting for aspiring entrepreneurs and investors who have to decide which Studio they want to work with (Blank, 2022).

Theoretical contributions

We critically explore the extent to which the Venture Studios represent a significant departure from Entrepreneurial Support Organisations such as incubators and accelerators. Bergman and McMullen (2022: 690) provide this definition of an ESO: "*An organisation whose primary purpose is to support individuals and collectives, through (in)direct and im)material assistance, as they seek to initiate and progress through the stages of the entrepreneurial process"*. To be classified as that, an organisation should include the following elements: (i) catalysing entrepreneurial activity and (ii) having as its primary focus providing support to entrepreneurs, and these two aspects should be prioritised in their operations.

Our findings challenge the definition of ESOs. First, venture Studios could be considered 'catalysers' of new venture creation. Indeed, as our findings reveal, they promote entrepreneurship by building new ventures in a parallel and repeatable way. Second, Venture Studio must be either the 'founder' or the 'co-founder', so being considerable as a true entrepreneur. This approach contrasts with the more external support typically offered by traditional ESOs like accelerators and incubators (e.g., Aernoudt, 2004; Cohen and Hochberg, 2014). Therefore, we argue the necessity of considering a spectrum ranging from passive (hands-off) to active (hands-on) support as an additional dimension that can add nuance to the concept of ESO.

7. Conclusions

Venture Studios, especially those managing the whole startup creation process internally, are transforming the concept of entrepreneurship, by shifting it from being an individual endeavor to a process that can be systematically managed by an organisation. This calls for further research on the performance of this model, such as the likelihood of startup success through leveraging shared resources, expertise, and networks within the Venture Studio. Further research could also explore the perspective of external entrepreneurs, examining their motivations and decision-making processes when joining a Venture Studio, including the individual traits of these entrepreneurs. Such studies could reveal important factors that influence entrepreneurs' decisions and their experiences within Venture Studios.

As with any research, our study is subject to limitations. First, our focus was on Venture Studios located in Italy. Given the nuances of different geographical contexts such as the US or other parts of Europe, results may vary due to factors like the maturity of entrepreneurial ecosystems. Second, our study provides a snapshot of Venture Studio inputs, processes, and outputs in a given point in time. A more dynamic, process-oriented approach could offer deeper insights into how Venture Studios rise and evolve. For instance, longitudinal studies tracking the development of Venture Studios over time could illuminate the factors influencing their establishment, growth trajectories, and adaptation strategies in response to changing market conditions. Moreover, comparative analyses between Venture Studios with different specialisations or geographical locations could uncover industry-specific or context-dependent factors shaping their development.

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Blockchain-Based Fraud Detection System for Healthcare Insurance Claims

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Abstract: Healthcare fraud is a huge concern that affects not only the financial viability of insurance companies but also the well-being of patients who may receive compromised care due to fraudulent acts. Addressing this issue demands novel solutions that can detect and prevent fraudulent conduct in healthcare insurance claims. The project intends to establish an automated fraud detection system using blockchain technology, which has advantages such as security, transparency, and data immutability. By leveraging blockchain's decentralized ledger, the system creates a tamper-proof platform for processing healthcare insurance claims, preventing fraudulent alterations and enhancing trust in the integrity of the claims process. Ethereum's blockchain platform and smart contracts play a critical role in ensuring the secure recording of transactions while preventing retroactive alterations. Moreover, an on-chain database is employed to manage relevant claim data, thereby safeguarding its integrity and ensuring accessibility. The decentralized nature of blockchain technology brings additional advantages by eliminating the need for intermediaries, thereby reducing administrative costs and streamlining the claim processing workflow. The adoption of methodologies such as Personal Extreme Programming (PXP) and Design Science Research Methodology (DSRM) fortifies the project's framework. PXP facilitates continuous improvement through incremental and iterative development, while DSRM ensures a structured approach to problem-solving, yielding reliable results. Through rigorous testing and validation, the automated fraud detection system enhances the efficiency and accuracy of fraud identification in healthcare insurance claims. By combining blockchain technology with methodological frameworks, this project offers a promising solution to combat healthcare fraud, safeguarding insurance systems' integrity and ensuring quality care for patients. Future iterations will focus on expanding the system's capabilities and refining its algorithms to counter the evolving fraudulent tactics prevalent in the healthcare industry.

Keywords: Healthcare fraud, Insurance claims, Blockchain, Automated detection system, Ethereum, Smart contracts

1. Introduction

Healthcare fraud is a pervasive issue that affects the financial stability of insurance companies and the quality of patient care. These fraudulent activities not only result in financial losses but also compromise patient safety, leading to potential harm due to unnecessary or falsified medical procedures (Ismail & Zeadally, 2019). Current fraud detection mechanisms primarily rely on manual audits and rule-based systems, which are often inadequate in identifying sophisticated fraudulent schemes. Traditional methods are plagued by issues such as data quality, scalability, and the ability to adapt to new types of fraud (Amponsah et al., 2022). The integration of advanced technologies like machine learning (ML) and artificial intelligence (AI) has shown promise in enhancing fraud detection capabilities. However, these approaches still face significant challenges, including data privacy concerns, the interpretability of complex models, and the high computational resources required (Kapadiya et al., 2022; Kaafarani et al., 2023). Blockchain technology offers a novel approach to addressing these issues. With its decentralized and immutable nature, blockchain provides a secure, transparent, and tamper-proof platform for processing healthcare insurance claims (Ncube et al., 2022). By leveraging Ethereum's blockchain platform and smart contracts, the proposed system aims to fulfill the following objectives: 1. create a tamper-proof ledger for all claims 2. validate claims in real-time 3. verify the authenticity of claims using blockchain 4. identify fraudulent claims in real-time.

2. Literature Review

This literature review explores the current landscape of healthcare insurance fraud and the potential of blockchain technology in mitigating fraudulent activities. Kapri and Venkatesh (2023) define healthcare insurance as a means of providing financial protection against medical expenses, emphasizing its significance in ensuring the well-being of subscribers. However, fraudulent activities, such as filing false claims, pose a threat to the integrity of insurance systems, as highlighted by Ismail and Zeadally (2019).

2.1 Blockchain Technology in Healthcare

The blockchain network is based on a peer-to-peer network where each participant maintains a replica of the shared ledger, which can only be appended to but not edited ensuring the authenticity and integrity of data (Ncube et al., 2022). Scholars leverage two types of blockchain platforms, Ethereum and Hyperledger, in healthcare insurance fraud detection, which are gaining traction. Kapri & Venkatesh (2023) advocated for Ethereum's scalability and security features in managing insurance processes, highlighting its compliance with healthcare standards and ability to handle thousands of transactions per second while securing user data through its permissioned network.

Ethereum is particularly noted for its ability to address existing system challenges, such as verifying insurance records using EDI (Electronic Data Interchange) Validators and adhering to HIPAA (Health Insurance Portability and Accountability Act) standards (Saldamli, 2020). Mackey et al. (2020) further highlighted Ethereum's support for democratic autonomous organizations, smart contract execution environments, and tokens via the ERC-20 standard, crucial for enhancing data security and ensuring tamper-proof transaction auditing in healthcare fraud detection.

In contrast, Hyperledger is also prominent in healthcare insurance fraud detection. Kaafarani et al. (2023) provide a decision-making framework for selecting blockchain platforms, emphasizing mandatory features like support for smart contracts, a permissioned blockchain, and decentralized networks. They highlight Hyperledger's capabilities in supporting enterprise-grade applications with features such as private networks, data privacy technologies, and multi-language support like Java and Golang.

In summary, the integration of blockchain technology in healthcare insurance aims to enhance data security, compliance, and efficiency in fraud detection processes. Both Ethereum and Hyperledger offer distinct advantages that cater to the specific needs and challenges of the healthcare industry. Ethereum's scalability, robust security features, and support for decentralized applications position it as a strong choice for enhancing fraud detection mechanisms in healthcare insurance compared to Hyperledger's emphasis on enterprise-grade applications and data privacy technologies (Elda Hiererra et al., 2022; Kapri & Venkatesh, 2023).

Flagging Fraudulent Claims in Blockchain

Fraudulent claims are effectively flagged and mitigated through the inherent features of blockchain technology, as discussed by Saldamli (2020). The immutability of blockchain data ensures that once a claim is recorded on the blockchain, it cannot be altered or tampered with. This means that if a healthcare professional submits a bogus claim, it is permanently recorded, making it impossible for the supplier to modify or erase the claim later (Kapadiya et al.,2022).

Furthermore, the use of smart contracts, ledger broadcasting, and network consensus enhances fraud detection and risk reduction (Elda Hiererra et al., 2022). Smart contracts, for instance, can be programmed to automatically verify the authenticity of claims based on predefined criteria, flagging suspicious transactions for further review. Additionally, the consensus mechanism employed in blockchain networks ensures reliability and trust among unknown peers, further strengthening fraud detection efforts.

Predefined rules play a crucial role in flagging fraudulent claims on the blockchain. These rules are typically encoded into smart contracts, which are self-executing contracts with predefined conditions and outcomes. By establishing predefined rules within smart contracts, insurance companies can automate the validation and verification process for claims submission. By leveraging predefined rules within smart contracts, insurance companies can streamline the claims processing workflow, reduce the risk of fraudulent activities, and ensure compliance with regulatory standards. This automation not only improves efficiency but also enhances transparency and trust in the insurance ecosystem (Elda Hiererra et al., 2022; Saldamli 2020).

2.2 Related Works

Artificial Intelligence (AI), Machine Learning (ML), and Data Analytics (DA) have been extensively studied for their roles in healthcare insurance fraud detection (Amponsah et al., 2022a; Kaafarani et al., 2023; Gohil et al., 2022). Kapadiya et al. (2022) emphasized the use of AI in detecting fraud through behavioral profiling and various learning techniques. AI models are praised for their accuracy and efficiency in identifying fraudulent activities. However, they are heavily dependent on high-quality data and are challenged by imbalanced datasets where fraudulent instances are significantly fewer than non-fraudulent ones. Moreover, the integration of AI systems with existing technologies requires specialized knowledge, and ensuring real-time data access remains difficult. Amponsah et al. (2022) discussed ML techniques such as decision trees, support vector machines, and logistic

regression. ML models automate fraud detection effectively and can handle large datasets, enhancing detection capabilities. However, they face significant concerns regarding data quality, scalability, and their reliance on pre-established fraud scenarios, which limits their ability to detect new types of fraud. Additionally, security and privacy issues arise due to the sensitive nature of the data being processed.

Scholars also highlighted the role of advanced data analytics in processing large healthcare datasets to identify anomalies indicative of fraud. DA's strength lies in its ability to manage the volume, variety, velocity, and variability of big data, which are crucial for effective fraud detection. The analytics approach offers comprehensive insights into fraudulent behavior patterns, enhancing detection accuracy. However, managing such complex data presents significant challenges, and the limited evaluation of improvement strategies due to small dataset sizes hampers the effectiveness of these analytics methods. Despite these constraints, integrating ML with DA can provide a more robust understanding of fraud patterns and improve the accuracy of detection systems. Together, AI, ML, and DA offer a multifaceted approach to enhancing fraud detection, each contributing unique strengths while facing specific challenges related to data quality, scalability, and integration (Amponsah et al., 2022a; Kaafarani et al., 2023; Gohil et al., 2022; Herland, 2019).

Blockchain technology, a peer-to-peer network, ensures secure transactions by maintaining a shared ledger with immutability and an append-only nature. This technology preserves data integrity by preventing alterations and simplifying tracking, thereby enhancing transparency and trust. Ncube et al. (2022), Mackey et al. (2020), Kapri & Venkatesh (2023), Saldamli (2020), and Elda Hiererra et al. (2022) advocate for blockchain technology due to its decentralized structure, which eliminates single points of failure and makes it resilient to attacks. Predefined rules in smart contracts can automate validation and verification processes, flag fraudulent claims, reduce fraud risks, and ensure regulatory compliance. These features significantly enhance the efficiency and robustness of fraud detection systems.

In conclusion, while AI, ML, and Data Analytics each offer significant advancements in healthcare insurance fraud detection, they also face substantial challenges related to data quality, scalability, and integration. Blockchain technology addresses many of these issues by ensuring data integrity, security, and transparency through its decentralized nature and the use of smart contracts. Adopting blockchain in the healthcare insurance industry can develop more robust, efficient, and trustworthy fraud detection systems, ultimately enhancing the overall integrity and reliability of the insurance ecosystem.

2.3 Research Gaps

This study identified a critical research gap in healthcare insurance fraud detection. Current technologies, including machine learning (ML), artificial intelligence (AI), and data analytics (DA), rely on high-quality data, but face significant issues related to data quality, ambiguity, and scalability, impacting their ability to detect fraud accurately (Ali, 2019). Amponsah et al. (2022) highlighted that traditional methods, such as manual audits and rule-based systems, are inadequate for detecting sophisticated and complex fraud schemes, necessitating more advanced approaches.

The existing literature (Ncube et al., 2022; Mackey et al., 2020; Kapri & Venkatesh, 2023; Saldamli, 2020; Elda Hiererra et al., 2022) underscores the potential of blockchain technology, but its application in healthcare insurance fraud detection remains underexplored. Developing a comprehensive fraud detection system that incorporates blockchain technology could address the limitations of current methods, offering a more secure, efficient, and trustworthy solution. Further research is essential to fully leverage blockchain's capabilities and create more robust and reliable fraud detection mechanisms.

Blockchain technology offers a promising solution to these challenges by enhancing transparency, accountability, traceability, security, and immutability (Ali, 2019). Its decentralized, tamper-proof ledger ensures data integrity and automates validation processes, reducing human error and ensuring regulatory compliance (Kapri & Venkatesh, 2023). Integrating blockchain can significantly increase the efficiency and effectiveness of fraud detection systems in healthcare insurance.

3. Research Methodology

The methodologies employed Design science as the research methodology and Personal Extreme Programming as the software development approach to create a complete blockchain-based fraud detection system. The software development methodology utilized is known as Personal Extreme Programming (PXP). PXP improves software quality and empowers independent developers by integrating modified XP with Personal Software Process (PSP) methodologies (Iyawa, 2020). PXP prioritizes high-importance skills in each iteration to ensure

customer satisfaction and continuing progress. We divided requirements into functional and non-functional categories using the PXP technique, focusing on claims submission, authentication, verification, analysis, and reporting. Periodic reviews ensure alignment with user demands. Key functional and nonfunctional requirements include**:** The research uses Visual Studio Code as the primary IDE, the Ethereum blockchain platform for smart contract creation, and React for front-end development. For UI prototype, smart contract creation, and local testing, tools such as Hardahat, Remix, and Figma are utilized, in that sequence

4. System Activity Diagram

Activity diagrams are intended to show the activities that make up a system process and the flow of control from one activity to another (Sommerville, 2011). They show how different workflows in the system are constructed, how they start, and the possible decision paths that can be taken from start to finish. Activity diagrams are comprised of activities, states, and transitions between them. Figure 1 below shows the activity diagram for the system

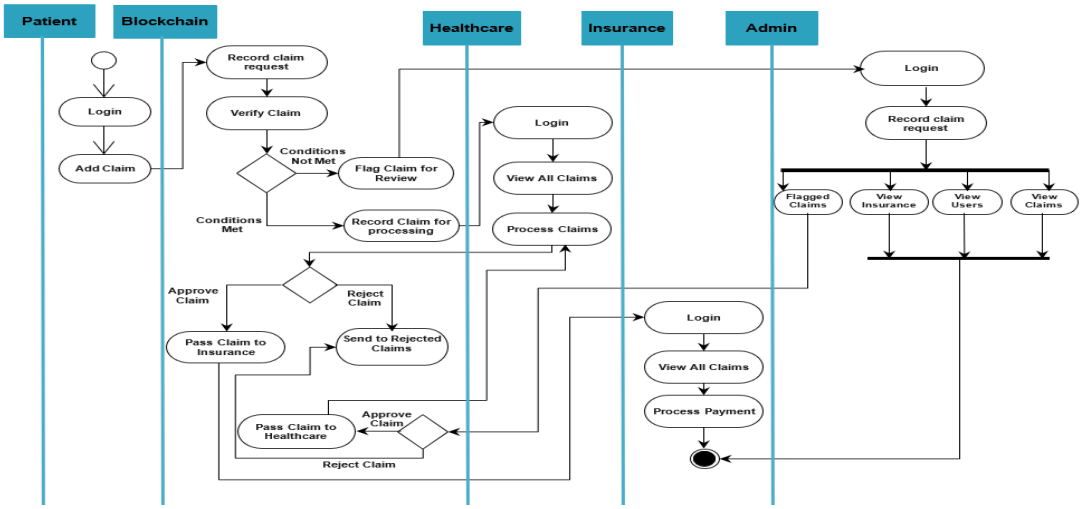


Figure 1: Activity Diagram

The process of initiating a claim begins with a patient submitting a claim request through a web browser, providing details about the medical service received and the cost. This information is then encrypted and sent to a blockchain network for verification and processing. The blockchain verifies the patient's eligibility and the healthcare provider's legitimacy, as well as checks the claim details against per-defined rules encoded in smart contracts. If the verification is successful, the claim is approved, updating the status on the blockchain and potentially initiating a payout to the provider. If the claim does not meet the verification criteria, it may be flagged as potential fraud and passed for further review or rejected. There is also a scenario that allows Admin to view all claims, adding, and listing insurance providers and users.

5. Results and Discussions

The blockchain-based fraud detection system in healthcare insurance demonstrated efficient capabilities through seamless integration of the fronted user interface, backed, and Ethereum blockchain. This system offers transparency, security, and real-time data access, enhancing fraud prevention and detection processes. The results highlight the potential of blockchain based solutions to revolutionize fraud detection in healthcare insurance, providing a reliable platform for mitigating fraudulent activities and ensuring insurance claim integrity. The system consists of interfaces through which patients, healthcare providers, administrators, and insurance professionals interact. These interfaces play a crucial role in facilitating communication, data exchange, and fraud detection within the healthcare insurance ecosystem.

Login

The login screen prompts the user to enter their credentials and gives feedback if the credentials are incorrect. Figure 2 shown below is the visual view of a user logging on to the system.

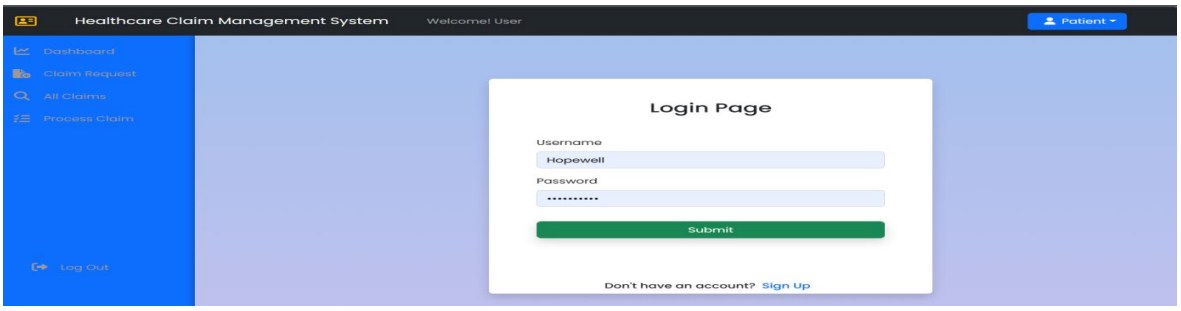


Figure 2: Login Screen

Admin Screen

Administrators utilize an interface to manage user-related tasks, including adding new users such as healthcare providers, patients, and insurance representatives. This interface collects essential personal details and assigns user roles accordingly. Administrators can also add insurance providers to the system. Furthermore, they review and approve user role requests to ensure appropriate role assignments based on user responsibilities. Additionally, administrators have access to tools within the interface to review flagged fraudulent claims, facilitating the investigation and necessary actions such as rejection or further inquiry this is shown in Figure 3.

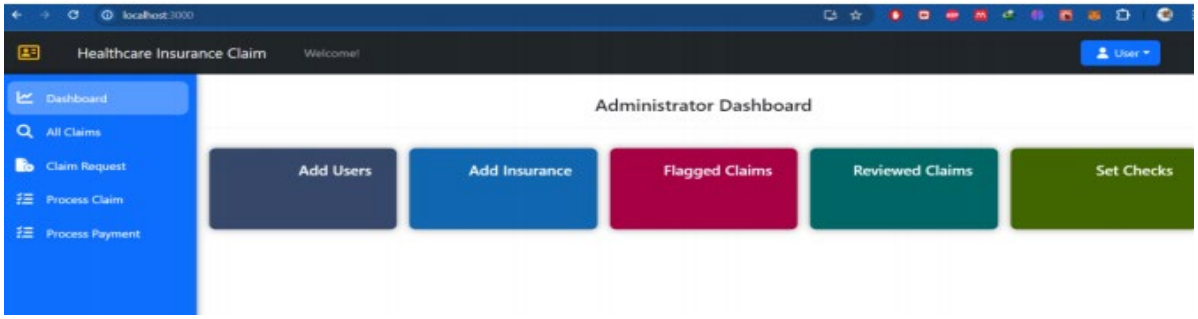


Figure 3: Admin Screen

User Registration Screen

Figure 4 simulates the registration process for a new user in the system by inputting new user information, including name, email, and password, into the registration form. The expected outcome is that upon successful registration, the system creates a new user account and provides confirmation to the user, ensuring a seamless and efficient registration process for new users.

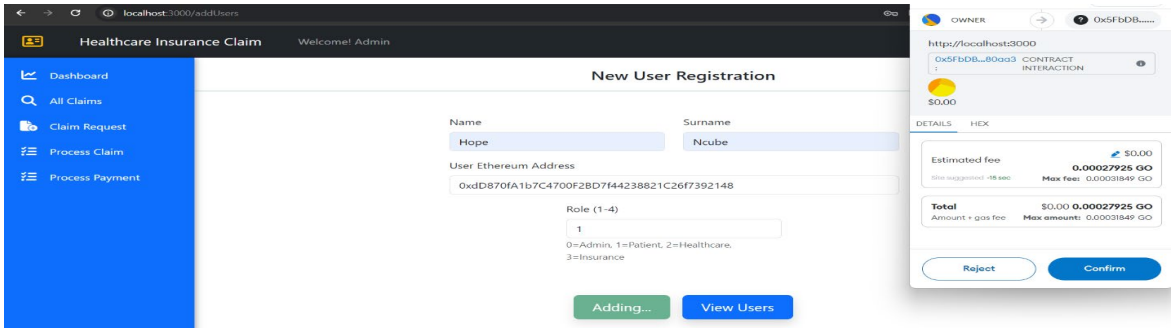


Figure 4: User Registration Screen

Patient Screen

Figure 5 simulates a Patient initiating a claim request for healthcare services received, providing details such as the patient details, healthcare provider information, and treatment received. They can track the status of their submitted claims, including updates on claim processing, approval, or rejection, ensuring transparency and keeping them informed about reimbursement progress.

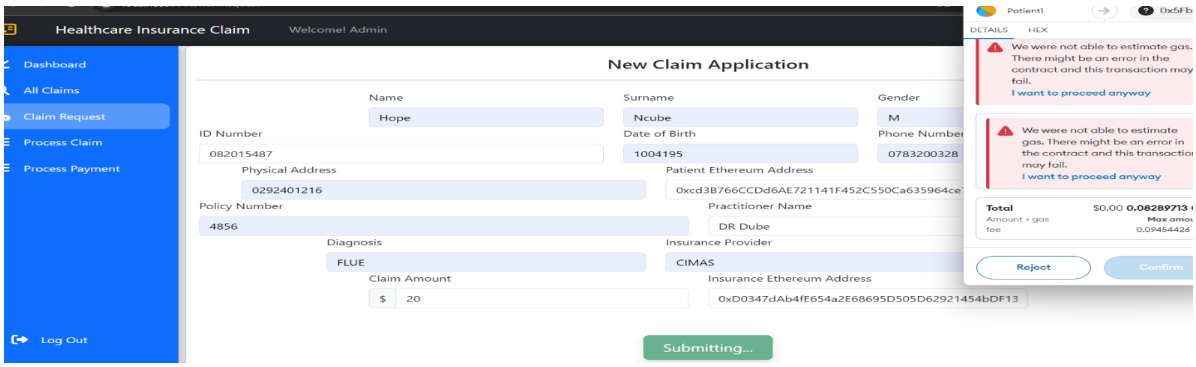


Figure 5: Patient Screen

Healthcare Screen

Healthcare providers review, assess validity, and process claim applications submitted by patients. They access a dashboard displaying all submitted claims, including pending, approved, and rejected claims, enabling them to track claim statuses and take necessary actions accordingly. Figure 6 shows the page for the process of viewing all claims

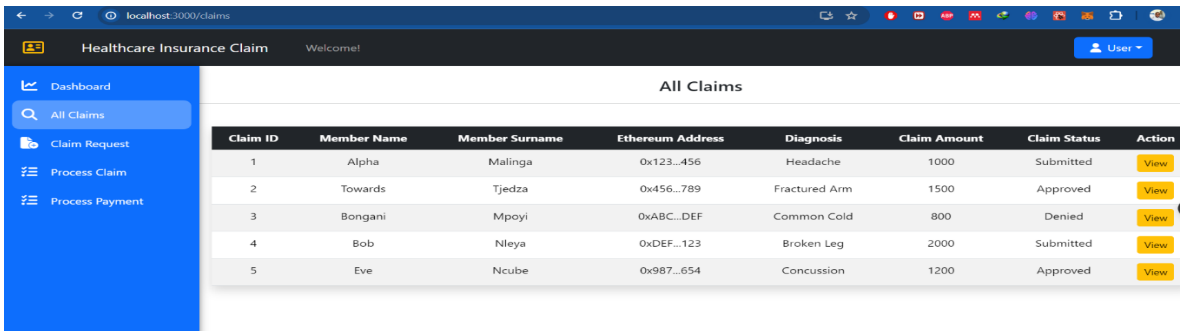


Figure 6: Healthcare Screen

When viewing a single claim, the user interacts with the Claims component, which displays a table of all claims. Each entry has a "View" button. Clicking this button redirects the user to a dedicated page via a dynamic route with the claim's unique ID. The component then fetches and displays the full details of the selected claim in a receipt-like format. This allows users to easily access detailed information about specific claims from the list view. The full Individual claim application made by a user is shown in Figure 7 below.

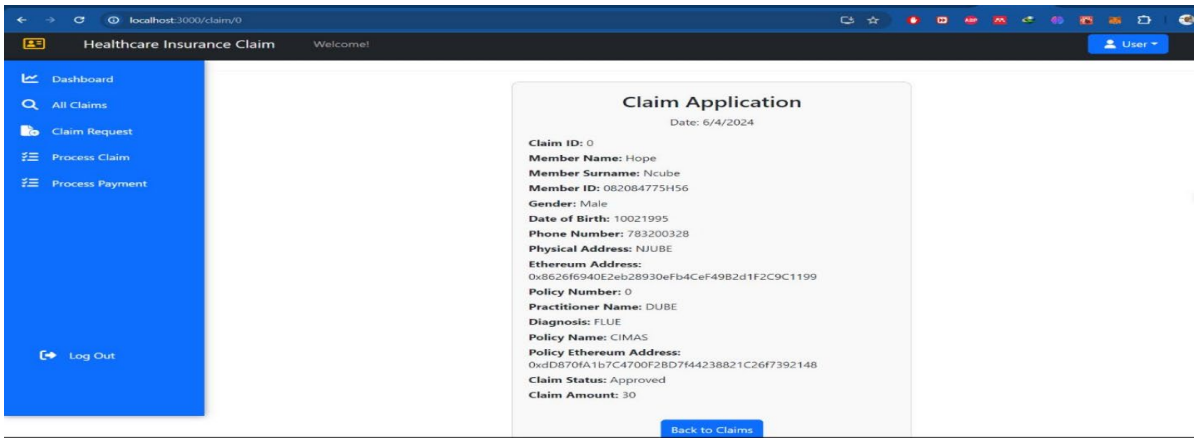


Figure 7: Viewing Full Individual Claim

In the Process Claim interface, the user sees the full details of the claim and is provided with buttons to either approve or deny the claim, along with fields to input any necessary notes or reasons for the decision. This interface is designed to streamline the decision-making process, ensuring that all relevant information is easily accessible, and actions can be taken efficiently. Figure 8 shows the process claim screen

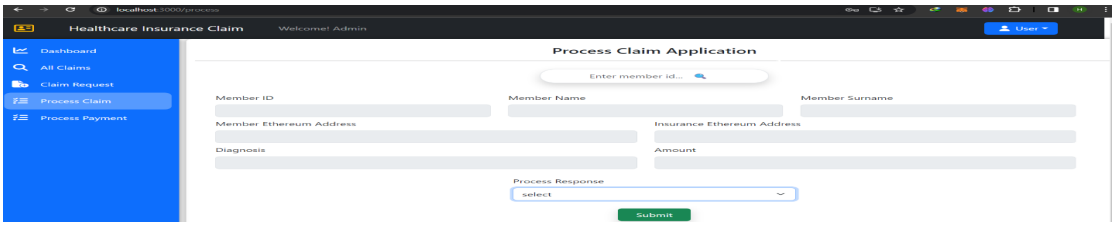


Figure 8: Processing Individual Claim

When a claim with suspicious or irregular details that may indicate fraudulent activity the system detects and flags the claim for further investigation by administrators or designated authorities and displays it alongside other flagged claims this is shown in Figure 9 below

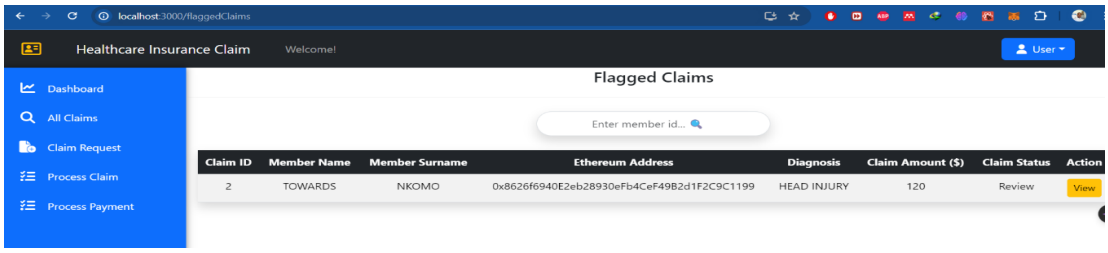


Figure 9: Flagged Claims

Figure 10 below simulated viewing a flagged claim with suspicious or irregular details that may indicate fraudulent activity. The system generates a report of the claim and displays a reason why it was flagged for further investigation by administrators or designated authorities.

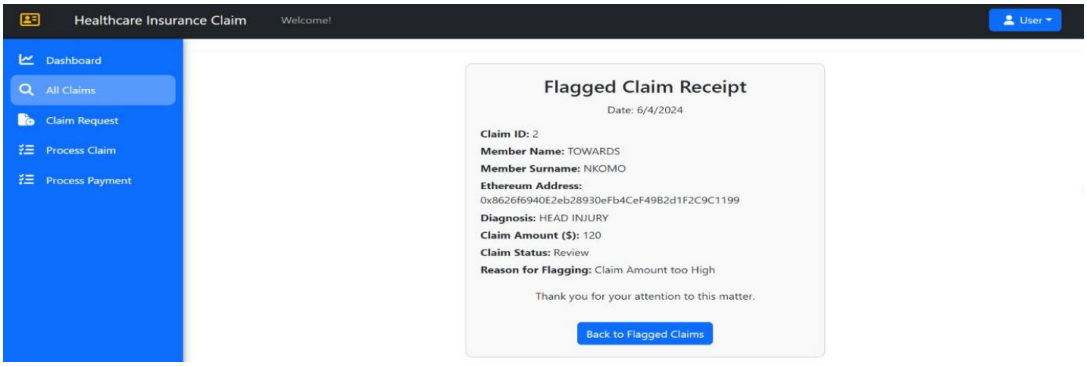


Figure 10: View Flagged Claim Report

Blockchain Claim Application Snippet

Figure 11 simulates the addClaim function which is pivotal in the smart contract, managing the addition of new claims. It requires various parameters detailing the patient, practitioner, diagnosis, insurance policy, and claim amount. These parameters undergo rigorous checks to ensure the validity of the claims.

```
function addClaim(    undefined gas
    User memory patient,
    string memory _practitionerName,
    string memory _diagnosis,
    string memory _policyName,
    address _policyEthAddress,
    uint256 _amount
) public onlyPatient {
    require(insuranceProvider[_policyEthAddress], "Insurance provider not registered");

    // Check if the amount exceeds the max claim amount
    require(_amount <= maxClaimAmount, "Claim amount exceeds the maximum allowed amount");

    // Check the number of claims the patient has made this month
    require(patientClaimCount[patient.ethAddress] < maxClaimsPerMonth, "Patient has exceeded the maximum number of c

    Practitioner memory practitioner = Practitioner(_practitionerName, _diagnosis);
    patient.policyNumber = allPatients[_policyEthAddress].policyNumber; // Assign policy number to patient

    // Create a new claim
    Claim memory newClaim = Claim(patient, practitioner, _policyName, _policyEthAddress, ClaimStatus.Submitted, _amo
```

Figure 11: Blockchain Claim Application Snippet

6. Proposed Improvements

Future improvements for the blockchain based fraud detection system could involve seamless integration with Electronic Health Records (EHR) and the development of a mobile application. By integrating with EHR systems, the fraud detection system can access comprehensive patient data, enabling more accurate fraud detection and

prevention. Additionally, the development of a mobile app can enhance user accessibility and convenience, allowing stakeholders to monitor and interact with the system on the go. Future enhancements may also include advanced machine learning algorithms for predictive fraud detection, real-time monitoring features, and enhanced security measures to safeguard sensitive healthcare data. Furthermore, continuous updates and refinements based on user feedback and emerging technologies can ensure the system remains at the forefront of fraud detection in healthcare insurance.

7. Conclusion

In conclusion, the automated fraud detection system utilizing blockchain technology offers a proactive solution for combating healthcare fraud in insurance claims. By harnessing blockchain's security and transparency, the system enhances the accuracy of fraud detection in healthcare insurance claims. Integration with Ethereum's blockchain platform and smart contracts ensures transaction integrity and reduces the risk of alterations. The decentralized nature of blockchain streamlines claims processing by eliminating intermediaries and reducing administrative costs. The strategy strives to protect the interests of patients in healthcare insurance, while also reducing financial losses through extensive testing and validation. Subsequent editions will focus on improving functionality and optimizing algorithms to combat evolving deceitful methods in the healthcare sector.

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Academic Entrepreneurship Overview: New Program Development Using Entrepreneurship Principles

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Abstract: This paper examines human dimensions of innovation within the context of complex problem solving and solution generation. We review theories and methodologies used in entrepreneurship, identifying similarities and implications. In an illustrative case study, we describe process used to launch a new academic program in a university. Program faculty used frameworks, perspectives, and analysis that are fundamental to entrepreneurship with the goal of launching an academic program in response to local industry requests. We conclude with a discussion of implications for research and practice.

Keywords: Academic entrepreneurship, Design thinking, Effectuation, Innovation, Entrepreneurship

1. Introduction

Entrepreneurship instructors provide students with an assortment of concepts, frameworks, and analytical methodologies, or a toolbox of sorts, to understand the field of entrepreneurship and, perhaps, start a business. In considering entrepreneurship theories, the perspectives range from deterministic and causal to dynamic and emergent. From a learning perspective, the instructor may want to offer a concise set of materials that describe theoretical aspects of the topic being shared with the audience. However, in offering overviews of theoretical frameworks, there may be some perceived ambiguity or misunderstandings by the audience in reconciling the variety. Instructors may also include stories from life as illustrations of success or failure to convey the nuances of entrepreneurial decisions and actions. The audience may struggle to reconcile theory with practice.

We address these aspects of this conundrum; how to reconcile theoretical differences and how to reconcile theory with practice. This paper reviews foundation theories in entrepreneurship and offers suggestions for distinguishing nuance between the perspectives. Using a case study, we address discuss how theoretical perspectives align with practice. We conclude with thoughts on theory, practice and instruction.

2. Literature Review

Universities are crucibles of innovation that occurs on various levels. Their focus involves open innovation, or innovation that involves the managed inflows and outflows of knowledge across organization boundaries in accord with organization goals, and at various organizational levels (Chesbrough & Bogers, 2014). Within this context, we focus on innovation that addresses problems that are complex, ill-structured, open to various perspectives, and require creativity combined with diverse knowledge in order to develop viable solutions (Beck, et al, 2022). Entrepreneurship literature that puts an emphasis on various frameworks and tools for identifying, and creating and assessing entrepreneurial “opportunities” (e.g., DeTienne and Chandler, 2004) and teaching a design thinking methodology provides a framework to innovate in academic business programs (Glen, Suciu, and Baughn, 2014).

We discuss models of entrepreneurial innovation practices that offer counterpoints to traditional business practices (of extensive planning and forecasting within static markets) for developing and innovating new products, programs, services, or processes. These models involve exploration, experimentation and iteration. Design thinking applies to these processes broadly, incorporating ethnographic methods to understand potential users, ideation to generate new ideas, prototyping to gather user reactions, and visualization throughout the entire iterative process (Lietka & Ogilve, 2011; Brown 2009). This process helps to ensure that ideas for new products, services, programs and processes are anchored in actual needs, even when potential users cannot articulate those needs.

Work in effectuation specifically challenges the logic of planning and extensive goal development in the area of entrepreneurship. Effectuation and the lean startup approach to entrepreneurship reduce the cost and risk of innovation through continuous testing and feedback at early stages of the venture so failures occur at lower levels of investment, and that the firm can move to a plan that works before running out of funds. Each of these innovation models is grounded in deep understanding of the needs of potential customers.

While design thinking provides guidance in developing initial ideas for innovation, the work on business model generation and lean startups helps to address additional issues that arise in the development of the business itself (Mueller & Thoring, 2012). Design thinking is particularly useful in addressing the underlying value proposition component in the business model canvas, developed by Osterwalder and Pigneur (2012), and incorporated in lean models and addresses the customer segments and customer relationships elements of the canvas, but can be extended more broadly. At the same time, the lean methods provide quantitative testing and feedback to assess opportunity in the market. In contrast to descriptive and explanatory sciences, design sciences focus on the process of making choices on what is possible and useful for the creation of possible futures, rather than on what currently prevails (Hevner et al. 2004; Romme 2003).

2.1 Design Thinking Methodology

Design thinking draws from such fields as architecture, urban planning, and product design (Cross, 1982; Lawson, 1979; Kimball, 2011; Rowe, 1987). The problems faced in such fields are often ill-defined and ill-structured, calling for the need to undertake a process of exploration with users in jointly developing an understanding problem formulation, design specifications, and alternatives. The process is highly explorative and iterative, with a strong emphasis on visual representation of concepts and prototypes (Buchanan, 1992; Ferguson, 1997; 1992). Herbert Simon (1969) and Richard Buchanan's (1992) assertion that the difference between science and design is that "design thinking deals primarily with what *does not yet exist*," while science "seeks to explain *what is*." Science discovers, design invents.

Business firms typically collect customer information through focus groups and surveys, and may segment markets based on readily-measurable demographic characteristics. Design thinking, on the other hand, invests in extensive observation and in-depth interviews with users (as well as non-users and extreme users) to develop empathy and insights relating to both expressed and unexpressed needs (Liedtka and Ogilve, 2011; Fraser, 2007, Brown, 2008).

While a traditional business approach attempts to avoid failure and manage risk through extensive and expensive analysis and planning before committing resources to action, design thinking reduces risk by engaging in relatively inexpensive means of gathering information from potential users through interaction based on quick, low-fidelity prototypes (Liedtka and Ogilve, 2011). This is reflected in common design thinking refrains, such as "fail often to succeed sooner" (Kelly, 2001, p. 232) and "fail early to succeed sooner" (Brown, 2009, p. 17). Design thinking provides an opportunity to gather feedback and uncover problems as strategy unfolds, rather than waiting until it is formally locked down and rolled out into the market (Fraser, 2007).

2.2 Business Model Methodology

Business models are being incorporated into innovative projects (Blank and Dorf, 2012; Osterwalder and Pigneur, 2010; and Ries, 2011). The rationale is that many of the business assumptions will probably be incorrect, so the business model itself should be prototyped and developed using design principles. Variations of this idea include Osterwalder and Pigneur's (2010) widely used visual "canvas" that includes nine business building blocks to expedite business model prototyping. Using the business model canvas approach, Blank and Dorf (2012) detail the steps for building a business startup. The model includes assumption testing and emphasizes going "outside the building" for observation and ideas.

In the process of moving from developing a product/service concept to launching business, one faces new sets of issues. Osterwalder and Pigneur's (2010) approach to business model generation addresses nine essential elements used in providing a rationale of how the firm creates, delivers, and captures value. These nine building blocks are: customer segments, value propositions, channels, customer relationships, revenue streams, key resources, key activities, key partnerships, and cost structure. Osterwalder and Pigneur (2010) developed a business model canvas to provide a visual platform and shared language to serve as the basis for understanding, developing, describing, and challenging elements of the proposed business.

Business model generation is customer-centric, research informed understanding of customers' environments, daily routines, concerns and aspirations is used to access and understand unreached segments. Addressing unreached segments is facilitated by extending considerations beyond existing customers. Osterwalder and Pigneur's (2010) approach builds strongly on design thinking principles. Nearly 70 pages of their *Business Model Generation* are devoted specifically to design methods and tools used not only in developing a sound understanding of customer needs, but also in communicating, developing, challenging, and testing the various elements of the business model.

2.3 Lean Start Methodology

Startups involve the creation of new products or services under conditions of extreme uncertainty. Who is the customer and what the product should be is often not yet known. It is critical to design experiments to test and validate early assumptions so that the entrepreneur can learn a sufficient amount about what works before running out of cash (Ries, 2011; Blank & Dorf, 2012; Maurya, 2012). Approaches facilitating this process of learning were drawn from lean principles of manufacturing developed by Toyota, as well that from the "customer development" process developed by Blank (2006). Customer development entails getting out of the building to gain deep, personal firsthand understanding of potential customers' needs (Blank & Dorf, 2012; Maurya, 2012).

Lean approaches replace a fixed business plan with a flexible business model that mitigates risk through early testing to get the product right, and by validating all components of the business plan in building a path to customers. This involves repeated "build-measure-learn" feedback loops in the development and testing of hypotheses relating the product or strategy to all phases of the business model canvas (Reis, 2011, p. 75; Blank & Dorf 2012; Maurya 2012). The lean approach builds on continuous iterations and "pivots", using structured course corrections designed to test a new fundamental hypothesis about the product or strategy (Ries, 2011, p. 149). The process involves the development of prototypes, including a minimally viable product (MVP), for evaluation by, and possible sale to, customers. The experimental nature of this approach is supported by actionable metrics to provide feedback to understand the people behind the numbers (Maurya, 2012). These include split-tests, for example, which offer different versions of products to customers at the same time, and cohort analyses to assess the effect of a design decision over time.

2.4 Effectuation Methodology

Effectuation, articulated by Sarasvathy (2001, 2003), describes processes adopted by entrepreneurs in the area of new business creation, where planning and forecasting is particularly problematic. Simon noted in *Science of the Artificial*, "if there is any way to design without forecasts, we should seize on it" (1996, p. 147). Sarasvathy (2001) found that entrepreneurs succeeded though exploitation of contingencies rather than through well-specified goals and extensive analytic projections.

Entrepreneurs begin with who they are, what they know, and whom they know, and proceed to construct opportunities through experimental and iterative learning. By bringing on board key stakeholders, including customers and strategic partners, the entrepreneur does not need to waste resources on prediction as they continually listen to customers, building an ever-increasing network of customers and partners. The structure of what the venture is, including the market and goals for the firm itself, is flexible and dependent on the particular commitments made by customers and other stakeholders (Sarasvathy, 2001; 2003). This process addresses the constraints that uncertainty places on information processing and the use of planning in entrepreneurship (Grégoire, et al, 2011). Also, effectuation focuses on affordable loss rather than expected returns. As with design thinking, risk is reduced by allowing failures to occur at earlier stages and at lower levels of investment. At the same time, the effectuation process promotes capitalizing on successes that arise, which shape subsequent investments (Sarasvathy, 2003).

Effectuation proposes several other guiding principles (Read, et al, 2011). In a review of the development of effectuation literature, Zhang & Van Burg (2020) identified the following effectuation design principles (Sarasvathy 2001; Wiltbank et al. 2009):

- Principle 1, Bird in hand: Start with your means, who you are, what you know, and whom you know.
- Principle 2, Affordable loss: Decide on the basis of what you can afford to lose instead of expected returns.
- Principle 3, Crazy quilt: Form and obtain pre-commitments from partnerships.
- Principle 4, Lemonade: Leverage both uncertainties and contingencies.
- Principle 5, Pilot-in-the-plane: Rely on human agency to maneuver rather than on exogenous factors, such as technological trajectories.

The above principles are prescribed as heuristics for developing solutions to difficult problems in complex situations under uncertainty. They share the aspiration of exploiting locality and contingency in the evolution of an artifact rather than predicting the best artifact in advance (Sarasvathy 2003). These principles also are not passive deployments and redeployments of resources purely in response to simple signals (cf. Augier and Teece 2009); rather, they are purposeful and intentional actions (Matthews 2009; Zhang & Van Burg, 2020;).

3. Methodology

A qualitative case study was selected for the illustrative purposes of this study. A qualitative approach was deemed appropriate given the purpose of this study is to understand and communicate the how various processes are used in practice. For this project, interviews with the founders, reviews of journal notebooks, and reviews of related program documents were the primary sources of data collection, with in-depth interviews as the primary data collection method. Interviews were carried out over several months to explore the decision-making process and learning outcomes. Journal notebooks were kept by faculty team members throughout and used to provide a record of relevant events. Interviews were conducted both face-to-face.

3.1 Objectives, Including Need and Relevance

The objectives of the paper are to present theoretical perspectives and methodologies to discuss the similarities and differences between them, and to illustrate how these methodologies are implemented by managers. Understanding and distinguishing the basis of the methodologies and similarities is important for researchers and faculty working in the topic area in order support research and training.

3.2 Case study: New Program Development

In this section, we describe the decisions, actions, and learnings experienced by the new program development team charged with launching a hospitality management program.

3.2.1 The program mandate

The impetus for the team's program development effort was a mandate by the university president made in response to a request for a training program by a major employer in one of the state's largest industries. Following a meeting in 2021 with the management team of one of the state's largest ski resorts, the university president said, "We will launch a hospitality program and I want it ready by next year." With that simple statement, the team had their outcome and completion time goals identified.

In 2020, the world was in turmoil as it tried to survive the Covid-19 pandemic. Industries that depended on service employees were substantially short staffed but at the same time the general public's demand for food and entertainment services increased. In Idaho, demand for outdoor recreation in both winter and summer seasons surpassed the capacity available to serve customers. By midyear 2021, tourism had returned to pre-pandemic levels and continued to grow. In 2024, Idaho's $3.7 billion tourism industry employed more than 45,800 people and generated US$475 million in local, state and federal tax revenues (commerce.idaho.gov), making it Idaho's third largest industry behind agriculture and technology. Also, with a large land size and relatively small population, much of the state's tourism and recreation locations are located in rural areas which meant that reaching potential students would be a challenge.

3.2.2 Launching a program

The team likened the launch of the hospitality program to a venture startup. The team was composed of two faculty and one staff member used to working in an academic environment. With backgrounds in entrepreneurship, they used the concepts, frameworks, and processes that they taught in their courses to help guidance their efforts.

The goal of launching a new hospitality program was clear enough but the time frame in which to do it was a constraint. Developing new programs in universities often take several years, not one year. The team's challenge was how to create a new program in a very short amount of time. Also, they had no dedicated funds available to support faculty, staff, course development, or marketing. These conditions were additional resource constraints.

3.2.3 Start with the customer

A first step of the project was identifying the customer. Since ski resorts had initiated the call, they seemed an obvious customer group. But students were also customers as they would be taking the courses in the program.

Before diving into the program development, the team needed to learn more about their intended customer groups. Talking with and understanding user's needs and wants is fundamental for design thinking and the business model canvas approach. Both emphasize the critical importance of first talking with the user to understand their current problems and desired aspects of any future solution or benefit. The goal was to develop a solution that was desirable, feasible and viable.

The team began by talking and engaging with expected customers. As the program request came from a ski resort, the team first met with the resort. In the first discussions, the resort management team brought in their current open jobs list. While the list contained the expected jobs of customer service representatives, chair lift operators, and snow groomers, many of the vacancies were for business roles such as accountants, marketing, supervisors and first line managers. The team learned that during the pandemic, many of the older and more experienced staff had left or retired, while most newly hired staff were younger and less experienced, creating a skill gap in leadership roles. Further conversations revealed it was these opening that were of the biggest concern to the resort. This need for staff with business management skills was reinforced with customer discovery conversations with other ski resorts.

The team turned next to their other customer group, the potential students, identified as people currently employed in the industry or interested in working in the industry. In talking with people were currently working in the industry, the team found that many had started in the industry with summer jobs or as temporary work but stayed because they enjoyed the work, atmosphere, culture, service orientation, and/or camaraderie of the job. They also learned from interviews that many felt additional training or skill development was needed to build a career or be recognized for promotions.

3.2.4 Customer discovery: Pains, gains, and benefits

In the course of interviewing ski resorts and their employees, the team discovered that while the state had 19 ski resorts in operation, only five were large enough to have a sufficient number of interested employees to support program enrollments. With this realization, the team broadened their scope of industry to include resort hotels, urban hotel groups, and restaurant groups. Subsequent conversations with this expanded customer group reinforced many of the earlier customer characteristics, needs, and wants: business management and leadership emphasis, flexible class schedules, online delivery, and career focus. At this point, the team felt they had a good enough understanding of both customer groups to begin working on a solution prototype, or minimum viable product, that they could discuss with users.

3.2.5 Bird in hand principle

To shape their program development efforts, the team followed the effectuation principle, “bird in hand”, to start with what they had available. The team recognized their existing online Bachelors of Business Administration (OBBA) as a platform foundation on which to build. Within five years, the online program had become nationally ranked in the top 25 of online business programs. Primarily a general business management degree program, it could offer areas of emphasis and provided core business management courses. As a “degree completion program,” it was designed to complement two-year associate degree programs. Also, as an online program, it was not geographically constrained by a physical campus, allowing a hospitality focused program to reach students anywhere in the state and beyond, and offering growth potential as the program developed.

The team also recognized that being a business management program, it allowed them to distinguish the program from the many two-year associate degree technical programs which focused on applied job skills such as culinary arts, restaurant, hotel and hospitality operations, and ski lift operations. Focusing on the business management aspect of these industry sectors allowed the team to create a complementary and distinct program that filled a career skill gap for supervisors, first line managers, and those with hospitality management career aspirations. This repositioning of the program and its components was, in essence, an example of the effectuation principle of “transformation”.

3.2.6 Crazy quilt and lemonade principles

Taking this transformation one step further, the team had determined through customer discovery conversations with employers and current employees that many working in hospitality and outdoor recreation industries were unable to stop working in order to attend classes full time. To accommodate this constraint, the team needed to develop an option that allowed a part-time or flexible course schedule. Also requested was a program shorter in duration. Certificate programs could require only six courses completed with less time and cost. Coincidently about this time, the state expanded support of certificate programs for workforce training.

Two related events helped bootstrap the program. First, the state expanded its financial support for certificate programs to include academic programs. Under the Workforce Development program, student participants were eligible for grant award funding up to 80% of program tuition or US$5,000, whichever was less. There were eligibility and residency requirements, but the support would cover most of the certificate tuition cost (idaholaunch.com). Second, the team successfully applied for a program development grant to support the costs

associated with launching a certificate program, receiving program funding support for three years. This was a fortunate transformation and financial bootstrapping achievement.

3.2.7 Program progress

One year later, January 2023, the program offered its first classes with six students enrolled. By January 2024, over 40 students were enrolled. Through customer engagement, the team discovered that the interest in and need for the program was stronger in the urban hotel and restaurant industry segments and pivoted to be responsive to their program input. The team engaged with hospitality and tourism associations, positioning the program as a training partner in enhancing the level of workforce service quality in the local markets, thereby strengthening their venture identity message, which was also supported by social media. Through the team's continued customer engagement, ski resorts began to enroll students in the certificate program, seeing the potential benefits for management development.

3.3 Observations and Discussion

Among the observations derived from the case study research were that the team members were flexible in their search for solutions and ways to progress toward their goal. Faced with a definite purpose, i.e. launch a new program, and a clear timeframe, i.e. in one year, they utilized aspects of all the process models in a flexible mix-and-match manner, applying process options to situations as best fit the situations. They did not perceive themselves bound to a particular approach. Instead, reaching the goal of program launch was the important driver and they utilized whatever methodologies supported progress toward that goal.

In discussing various theories of entrepreneurship innovation methodologies, we may be inclined to present each as distinct and stand alone. However, when discussing implementation, we need to recognize that entrepreneurs often are flexible and not held to strict theoretical boundaries. Instead, they use permeable boundaries between models as a way to match solutions to problems, aligning with Chesbrough and Bogers (2014).

4. Entrepreneurship Thoughts: Theory and Practice

We focused on theories that consider the human aspects of innovation as humans, individually or in groups, perform the innovation (Majchrzak, et.al., 2023). We discussed theories and methodologies regarding creativity and innovation within the context of solving complex ill-structured business problems. In all of these considerations, an important feature stood out: the role, or interpretations and actions, of humans, usually as individuals or organization members, engaging with one or several user groups, to gather and assess wants and needs in order to develop viable solutions (Beck, et al, 2022; Chesbrough & Bogers, 2014; Osterwalder & Pigneur, 2010; Kelley, 2001). How the problem, challenge, or situation was evaluated for potential pains, gains or benefits, and the solution proposed were greatly influenced by the perceptions of the team members and how they interpreted the information gathered from their users or customer groups. This area warrants future research as the findings can be extremely insightful for academics and practitioners.

Another aspect to consider is whether or to what extent do solutions to complex ill-structured problems vary by the individual or group personalities of the problem solvers, especially in whether they take a structured approach to problem solving or a flexible, more open approach. The outcomes could vary on whether teams are strict rule followers or more independent in their thinking and how their perceptions affect the views of other team members involved in solution generation. Future research can examine how the roles of docility and disruption orientation affect problem solving, solution generation, and team dynamics.

This paper described one team's experience in launching a new academic program. Within the perspective advocated by Chesbrough and Bogers (2014) we should consider organizations as having permeable boundaries in regards to information and knowledge flow. Individuals acting within the university may receive knowledge and information from outside the university and use it to shape decisions internally that have external implications. In the team's hospitality program development efforts, their perceptions of opportunities and constraints were very much shaped by their individual perceptions and interpretations of information and how they collectively assessed opportunities, challenges, and their path forward.

5. Conclusion

For university administrators and individual faculty, it is important to utilize the knowledge we share with our students. In this paper, we discussed used processes and methodologies that consider human aspects of innovation that include Design Thinking, Business Models, Lean Start, and Effectuation. In the case study, the

team followed processes and methodology that are the foundations of most design thinking and entrepreneurship courses. However, we may not fully realize the power the offer. Recognizing that these frameworks and methods can apply to a range of problems and solutions can yield effective outcomes if we are ready to see opportunities.

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Promoting Consumers' Adoption of Buy-Now-Pay-Later Feature While Using E-wallet Application: The Case of Gen Z in Vietnam

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Abstract: The Buy-Now-Pay-Later (BNPL) feature has emerged as a popular payment innovation, offering users convenience and flexibility in their purchasing behavior. However, consumers' adoption of BNPL is often limited due to the trust issue usually associated with electronic payment. Previous studies have highlighted personal traits that affect consumers' trust in adopting BNPL, such as risky indebtedness behaviour or privacy concern. Adopting the Stimulus-Organism-Response framework, this study investigates environmental factors influencing consumers' attitudes and perceptions of privacy risks and trust. The main objective of this study is to identify these factors, which can be valuable to practitioners in promoting consumers' intention to adopt BNPL. The model was tested based on data collected from 430 young Vietnamese consumers. Data analysis is conducted using SmartPLS 4.0. The study's findings, which are significant in consumer behavior, confirm that behavior intention to use BNPL results from attitude, trust, and perceived risk, which were influenced by perceived ease of use and subjective norms. These findings provide actionable insights for practitioners in the field, equipping them with the knowledge to promote BNPL adoption effectively. One notable result of the research is that perceived ease of use has a negative impact on privacy risk. This finding implies that users' primary apprehension in using the E-wallet BNPL feature pertains to the risk of losing their privacy. It strongly recommends that developers create a more user-friendly and transparent BNPL experience to alleviate privacy concerns and enhance user trust, thereby promoting the adoption of BNPL.

Keywords: Buy-Now-Pay-Later, Stimuli-Organism-Response, E-wallet, Vietnam

1. Introduction

In the context of digital payment method advancement and innovative financial services contributing to reshaping financial transactions, the widespread adoption of e-wallets has dramatically influenced consumer payment behaviors. In recent years, the proliferation of the Buy-Now-Pay-Later (BNPL) payment method, especially among youngsters, has become a payment alternative offering users the flexibility to buy products/services and make later payments. It highlights the economic impact of this payment method. With the explosion of e-wallets facilitating transparent transactions, integrating BNPL into these platforms presents a significant opportunity for consumers and businesses. Understanding the factors affecting intention to use this is crucial for companies to utilize the potential opportunities effectively.

While significant contributions of prior research, we identify two gaps. Firstly, existing studies have focused on the intention to use BNPL in the context of credit cards/visas, but they have yet to explore the impact of factors when using this function in e-wallets. Secondly, the previous research has neglected the impact of perceived ease of use on privacy risk and its subsequent effect on intention to use BNPL. This is a salient gap as it has been explored in e-service that ease of use is a potential privacy risk reduction factor (Featherman *et al.,* 2010). Investigating the relationship between perceived ease of use, privacy risks, and BNPL adoptions can assist developers in enhancing their strategies and positively affect the intention to use BNPL on e-wallets.

Our research has two significant contributions. Firstly, it delves into the multifaceted factors that influence individuals' intention to use BNPL integrated on e-wallets, considering the context of the Vietnamese socio-economy specified in the GenZ cohort. Secondly, In this study, we further develop the aspect of "Perceived ease of use" in the context of technology through BNPL payment, exploring the negative impact of this factor on privacy risk. This is a significant contribution as it proves that enhancing the ease of use can reduce privacy risks when using BNPL on an e-wallet.

2. Literature Review and Hypothesis Development

2.1 The S-O-R Framework

The S-O-R (Stimulus-Organism-Response) theoretical framework can help us better understand the aspects that influence consumer acceptance and behavior for Buy Now, Pay Later (BNPL) services. This paradigm systematically investigates the external cues, internal processes, and subsequent responses associated with BNPL adoption.

In the context of BNPL, the "Stimulus" component might refer to different marketing and environmental variables that customers are exposed to. These stimuli may include BNPL providers' promotional efforts and advertising and the availability and visibility of BNPL alternatives during the online purchase process. Furthermore, the perceived ease, flexibility, and financial benefits of BNPL might operate as external triggers to influence customer attention and interest. The "Organism" component describes the internal processes in the consumer's mind in reaction to these inputs. This comprises cognitive processes such as weighing the possible advantages and hazards of utilizing BNPL, analyzing one's financial status, and deciding whether to use BNPL. Affective processes such as emotions, attitudes, and perceptions toward BNPL providers and the perceived trustworthiness of these services can all impact the consumer's internal state. The "Response" component of the S-O-R paradigm refers to the observable behaviors or activities that consumers engage in due to the internal processes activated by stimuli. In the case of BNPL, these answers might include embracing or rejecting BNPL services, utilizing BNPL for purchases regularly, handling BNPL money responsibly, or making word-of-mouth recommendations or criticisms of BNPL.

Understanding the relationships between these components enables BNPL providers and retailers to create effective marketing strategies and environmental cues (S) that positively influence consumers' internal processes (O), resulting in favorable responses (R), such as increased adoption, responsible usage, and positive word-of-mouth. Furthermore, researchers may utilize the S-O-R framework to investigate the variables contributing to BNPL's rising popularity and indicate potential risks or concerns that may influence customer behavior toward these services. The S-O-R theoretical framework is valuable for understanding the intricate interplay of external stimuli, internal processes, and consumer behavior in the context of the growing BNPL business.

2.2 The Intention to use BNPL

Previous studies have found a number of characteristics that influence customer acceptance of BNPL services. One of the critical factors driving BNPL adoption is its ease of use and versatility (Mikael et al., 2022). BNPL enables customers to make purchases without paying the whole amount up front, instead spreading payments over time, frequently in interest-free installments (Bhatia and Golaka, 2022). This flexibility attracts customers who may not have immediate funds accessible or desire to manage their cash flow more efficiently. Financial limitations and restricted access to standard loan options have also contributed significantly to BNPL's intention to use. Many customers, particularly younger generations, experience financial difficulties and struggle with credit card debt or lack a strong credit history (Rau *et al.,* 2021). BNPL services offer a more accessible payment method than traditional credit choices, as they frequently have less severe credit checks and approval processes (Lodewijkx *et al.,* 2023). This makes BNPL an appropriate option for those who may not be eligible for regular credit cards or loans. Effective marketing and promotional tactics by BNPL providers have also contributed significantly to uptake. BNPL firms have created alliances with merchants, used influencer marketing, and provided appealing incentives like discounts or cashback awards (Kearney and Saren, 2021). These techniques have helped to raise knowledge and exposure for BNPL services, making them more desirable and accessible to customers. Furthermore, some customers see BNPL as a form of budgeting that provides greater control over their expenditures. By splitting down payments into smaller installments, BNPL may assist clients in better managing their money and avoiding overspending. The apparent benefit of better planning and spending management has prompted consumer adoption of BNPL.

Consumers' decision to use BNPL services can also be influenced by their trust in the providers and the perceived dangers of these services, such as late fees or credit repercussions (Rau *et al.,* 2021). Consumers may be more willing to use BNPL if they believe the providers are trustworthy and the related risks are controllable or small. Furthermore, the COVID-19 pandemic can increase BNPL adoption as customers confront financial uncertainty and seek other payment choices (Hultman *et al.,* 2022). The pandemic also caused a spike in internet purchasing, where BNPL choices are more clearly displayed, exposing customers to these services. While BNPL provides convenience and flexibility, it also includes significant risks, such as the temptation to overspend, the

accumulation of debt, and the threat of late penalties or bad credit consequences if payments are missed (Lodewijkx *et al.,* 2023). Users must use BNPL services responsibly and understand their terms and conditions to avoid financial troubles. However, the influence of privacy concerns and trust on customer sentiments about BNPL remains uncertain. Because of the frequent hacking and leakage of customers' personal data, privacy issues and trust have continually been raised in the online environment (Roh *et al.,* 2022; Wang *et al.,* 2020).

2.3 Hypothesis Development

2.3.1 The effects of perceived ease of use and subjective norms

Subjective norms are defined as the social pressure or influences people have to go through when deciding to use or not to use a product or a service (Raj *et al.,* 2023). People tend to rely on reviews and opinions from others who are significant to them when they don't understand a system and accordingly gain trust toward that system (Li *et al.,* 2008). Subjective norms can strengthen a potential customer's trust regarding guidance from friends, peers, and superiors and affect their feelings about a product or service (Yang *et al.,* 2017). Considering the circumstances of emerging nations, we anticipate that as the penetration rate of BNPL increases, individuals will progressively accept this technique while continuing to trust the conventional (i.e., cash on delivery). Because societies in these nations have a substantial influence on consumers' adoption of new goods and services (Dholakia and Talukdar, 2004; Kaman, 2008; Parashar et al., 2008; Shukla, 2011; Souiden et al., 2011b), we anticipate that SN will have a direct beneficial impact on customer trust. Users' trust in BNPL services can also be positively influenced by their friends, family, or peers' approval. Hence, we hypothesize:

H1: Subjective norms are positively associated with Trust

Privacy risk is "the possibility that personal information about individuals will be used in ways that are harmful or objectionable to them" (Solove & Schwartz, 2014, p. 36). Social validation within an individual's social circle can affect views of BNPL services since social norms and attitudes determine one's faith in this payment method. Positive reviews and peer recommendations might strengthen trust in BNPL providers, lowering perceived privacy concerns about providing personal and financial information. In short, if an individual's social circle views BNPL as a convenient and trustworthy payment alternative, it may lessen the perceived privacy concerns associated with exchanging personal and financial information with BNPL providers (Rau *et al.,* 2021). Conversely, adverse subjective norms or doubt from one's social group could compound the perceived privacy risk associated with BNPL adoption (Lodewijkx *et al.,* 2023). Therefore, we developed the following hypothesis:

H2: Subjective norms are negatively associated with the perceived privacy risk of BNPL services

Ajzen and Fishbein (1980) found that subjective norms are essential in molding people's attitudes about certain services. Furthermore, empirical studies in consumer behavior, such as those conducted by Kim and Johnson (2016), consistently found a positive relationship between subjective norms and attitudes toward various financial services, implying that perceptions of social approval or disapproval influence attitudes toward BNPL services. As a result, subjective norms have a beneficial influence on attitudes regarding BNPL services because people are more likely to adopt positive views when they sense social acceptability within their social circles. In contrast, unfavorable subjective norms or skepticism from one's social group may contribute to adverse views regarding BNPL adoption (Bhatia & Golaka, 2022). As a result, we estimate that higher levels of subjective norms will lead to more positive sentiments regarding BNPL adoption. Hence, we hypothesize that:

H3: Subjective norms are positively associated with attitude towards BNPL services

Perceived ease of use influences consumer attitudes since it can promote favorable views. A system's perceived ease of use refers to the extent to which a user believes that using it will require no effort. Usage volume and user-system interaction can also indicate ease of use. The criteria below can be used to assess perceived ease of use: simplicity of use, ease of learning, ease of operation, and skill development. Customers will be more favorable to technology if they feel it is straightforward to use, understand, and operate (Sularso, 2012). The perceived ease of use of an application might impact approval or rejection feelings. Customers will accept or exhibit a good attitude toward a newly launched application if they believe it to be user-friendly (Rifa'i, 2019). As a result, we put forth a hypothesis:

H4: Perceived ease of use is positively associated with attitudes

Perceived ease of use (PEOU), a fundamental element in the technological adoption framework, is an individual's belief that utilizing a particular technology requires minimal cognitive effort (Davis, 1989). During pre-purchase assessments, an e-service that seems simple to learn, comprehend, and use should reduce customer uncertainty

and total risk. Although preliminary evidence for this broad risk-reduction impact has been identified in the context of e-services (Featherman *et al.,* 2006), it is still being determined whether PEOU serves to lower estimated levels of privacy risk in particular. An equivalent line of study indicates that a well-explained and easy-to-understand website (i.e., one likely to receive a high PEOU rating) boosts consumer trust in an e-commerce business (Gefen *et al.,* 2003). Because subsequent research has shown that trust and risk (as well as trust and security/reliability concerns) are inversely related (Pavlou, 2003; Pavlou and Gefen, 2004), this line of research suggests that, in addition to increasing consumer trust, PEOU also reduces consumer perceived risk levels, as well as security and reliability concerns. Thus:

H5: Perceived Ease of Use is negatively associated with Privacy Risk

H6: Perceived Ease of Use negatively associated with Trust

2.3.2 The effects of attitude, privacy risks and trust on the intention to adopt BNPL

Ajzen (1980) defines attitude as a person's favorable or unfavorable judgment of specific conduct, which is impacted by ideas about a product or service (Hamid *et al.,* 2023). Attitude can impact intention (Raj *et al.,* 2022; Roh *et al.,* 2022; Singh *et al.,* 2021; Wang *et al.,* 2020) and the motivation behind the customer's decision to attend any activities (Ajzen, 1980). Moreover, a happy attitude appreciates customers' intentions (Wang *et al.,* 2020). When users suppose BNPL is a useful tool for affordable purchasing, it will lead to a favorable attitude and increase their willingness to use it. Therefore we propose:

H7: Consumer attitude is positively associated with intention to use BNPL.

Trust includes customer assurance, dependence, and belief and is an essential element between customers and firms (Roh *et al.,* 2023). Customers tend to trust providers who act in their best interest, fulfill commitment and offer high-quality goods or services (Wang *et al.,* 2020). According to Zhou (2011), initial trust will motivate the intention to use, while it is also mentioned that trusting someone will result in a positive intention toward that person (Aydin and Ozer, 2009). Customers are allowed to see the value of mobile banking and the intention to use it if they have trust in a bank (Gu *et al.,* 2009). Moreover, trust positively impacts attitude, which leads to intention being influenced by reducing the fear of opportunistic behavior (Pavlo, 2003). Hence, we state the hypothesis:

H8: Consumer trust is positively associated with intention to use BNPL.

Privacy risk is the uncertainty that can lead to negative results in using a particular service or product and is associated with the probability of losses from leaking personal information (Zhou, 2012). Moreover, users fear that their personal information might be shared with other third parties without their awareness, which decreases their intention to use the service. According to Gupta et al. (2010), privacy risks may have a negative impact on the intention to continue using the service as consumers are becoming more self-reliant about protecting their personal information from third parties. People tend to stop using a platform and implement proactive information protection methods when doubting a company’s information security. Therefore, we propose the hypothesis:

H9: Privacy risk is negatively associated with intention to use BNPL.

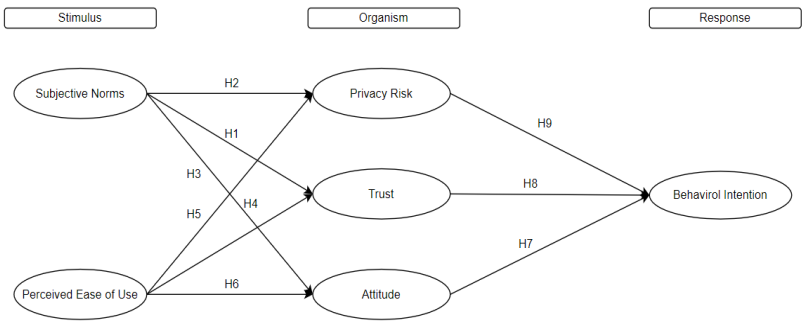


Figure 1: The proposed model

3. Methodology

3.1 Sampling and Data Collection

As the research aims to explain young consumers' behavior, we target undergraduate and postgraduate students in Vietnam. Scales from previous studies were adopted for the research. Three items adopted by Cheng et al. (2006) measured perceived ease of use. The subjective norm was measured by three items from Wu and Chen (2005). Privacy risk was measured by the scale of Aldas-Manzano *et al. (2009) with four items. Trust was measured with four items using the scale developed by Hsu et al.* (2014). Finally, "Attitude" and "Behavior Intention" were measured by adopting the scale of Cheng *et al.* (2006) with 4 and 3 items, respectively. All items were measured using the 5-point Likert scale, with 1 indicating "strongly disagree" and 5 indicating "strongly agree".

Before surveying, our team conducted a pilot test to test the wording and the reliability of the scales. After finalizing the questionnaires, it was made into Google forms and sent out through social media and school websites from 30th January 2024 to 30th February 2024. To make sure that the participants have an understanding of the BNPL feature in e-wallet, a filter question (Do you know about BNPL features in e-wallet apps such as Momo, Shopeepay, etc.) was asked at the beginning of the questionnaires. A BNPL description is also mentioned in the introduction to ensure participants have enough knowledge to complete the questionnaires. Participants who chose " I don't know about BNPL in e-wallet" or the e-wallet app that does not have a BNPL feature were excluded from the survey. Participants who know about BNPL will be asked questions about factors affecting their intention to use BNPL.

There were 435 answers in total, with 5 invalid ones. Table 1 below shows the detailed descriptive statistics of the sample population.

Table 1: Descriptive Statistics

		Frequency	Percent
Gender	Male	233	54.19%
	Female	197	45.81%
Age	Under 20	177	41.16%
	20 - 29	204	47.44%
	30 - 39	39	9.07%
	40 - 49	10	2.33%
	50 - 59	0	0%
	Above 60	0	0%
Education Level	High School or below	0	0%
	College	370	86.05%
	Master or above	60	13.95%

3.2 Analysis

"Partial least squares path modeling" (PLS-PM) technique was used in this study since the collected data was not normally distributed, and it's a suitable method for investigating non-normal data (Hair *et al.,* 2019). SmartPLS 4 was used to conduct the PLS-PM and "Statistical Package for Social Sciences" (SPSS) for descriptive statistical analysis.

The measurement model is evaluated based on reliability and validity. Reliability is assessed through specific measures such as Cronbach's alpha reliability and composite reliability (CR). In contrast, validity (including convergent and discriminant validity) is assessed through the average variance extracted (AVE) and the heterotrait-monotrait (HTMT) ratio.

Table 2: Reliability measures: Cronbach's Alpha, CR, AVE

	Cronbach's Alpha	rho_A	Composite Reliability	AVE
SN	0.702	0.726	0.798	0.579
PEOU	0.863	0.874	0.916	0.785
PR	0.853	0.926	0.903	0.707
A	0.907	0.915	0.935	0.783
T	0.746	0.900	0.802	0.533
BI	0.916	0.917	0.947	0.857

The analysis results from Table 2 show that the square root of the AVE for each concept is greater than the correlation coefficients between latent variables. Therefore, the concepts achieve discriminant validity.

Table 3: Results of the HTMT ratio test for the measurement model

	A	BI	PEOU	PR	SN	T
A						
BI	0.686					
PEOU	0.791	0.761				
PR	0.671	0.640	0.723			
SN	0.391	0.721	0.422	0.335		
T	0.689	0.594	0.646	0.579	0.299	

It also examined the HTMT ratio (Table 3), which shows that all concepts have HTMT ratios below 0.9. This indicates that the concepts achieve discriminant validity.

4. Results and Discussion

4.1 Results

To verify the empirical nature of the theoretical model, we used the bootstrapping technique in SmartPLS for t-statistics tests to clarify the relevance of the path coefficient. Before this, the collinearity statistic was performed to check the model's collinearity problem. The result demonstrates that the VIF value ranges from 1.176 to 2.245, all lower than 3.3. Therefore, it indicates that the multicollinearity phenomenon among the independent variables does not affect the hypothesis testing or cause bias or flip regression coefficients (Kock *et al.,* 2012).

Table 4: Collinearity statistics (inner VIF)

	A	BI	PEOU	PR	SN	T
A		2.245				
BI						
PEOU	1.176			1.176		1.176
PR		1.671				
SN	1.176			1.176		1.176
T		2.081				

The result of the bootstrapping test confirmed that there is a positive relationship between Subjective norms and Attitude (β = 0.145; p = 0.001), between Perceived Ease of Use and Attitude (β = 0.654; p = 0.000), between Attitude and Intention to use (β = 0.267; p = 0.000), between Trust and Intention to use (β = 0.267; p = 0.000). These results show that hypotheses H3, H4, H7, and H8 are all supported. Meanwhile, there is a negative relationship between Subjective norms and Perceived privacy risk (β =-0.110; p = 0.007), between Perceived Ease of Use and Perceived privacy risk (β = -0.608; p = 0.000), between Perceived Ease of Use and Trust (β = -0.608; p = 0.000), between Perceived privacy risk and Intention to use (β = -0.269; p = 0.000). Thus, the result confirmed that H2, H5, H6, H9 is accepted. However, the result rejected H1, meaning that Subjective norms are not positively associated with Trust (β = -0.269; p = 0.000).

Table 5: SEM results and hypothesis testing

	Original Sample (O)	Sample Mean (M)	Standard Deviation (STDEV)	T Statistics (|O/STDEV|)	P Values	Conclusion
A -> BI	0.267	0.269	0.057	4.698	0.000	Accept
PEOU -> A	0.654	0.652	0.041	16.025	0.000	Accept
PEOU -> PR	-0.608	-0.605	0.036	16.963	0.000	Accept
PEOU -> T	0.659	0.656	0.039	16.740	0.000	Accept
PR -> BI	-0.269	-0.267	0.048	5.591	0.000	Accept
SN -> A	0.145	0.147	0.042	3.486	0.001	Accept
SN -> PR	-0.110	-0.115	0.041	2.692	0.007	Accept
SN -> T	0.028	0.035	0.045	0.613	0.540	Reject
T -> BI	0.284	0.285	0.050	5.639	0.000	Accept

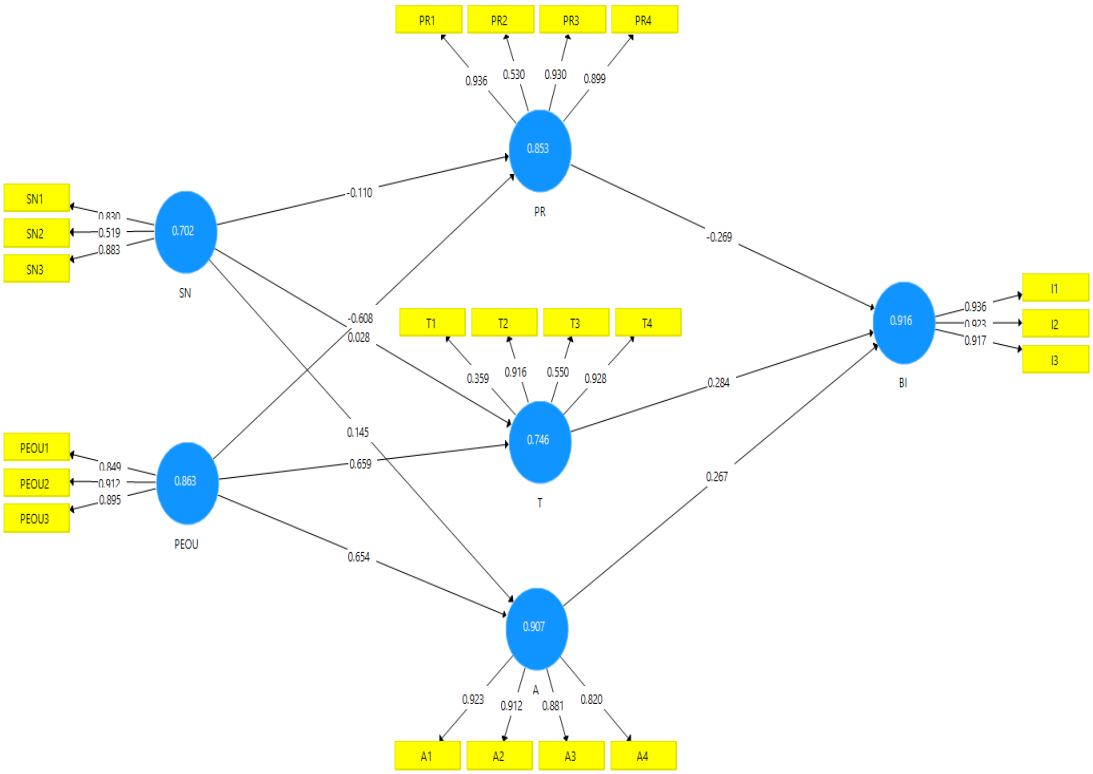


Figure 2: Structural Model

4.2 Discussion

In previous studies, several factors have been proposed to have a significant impact on consumers' intention to use online services, including trust (Wang *et al*., 2020), perceived risk (Penney *et al*., 2021), attitude (Relja *et al*., 2023), and privacy concerns (Raj *et al*., 2023). Therefore, we applied SOR (Stimulus-Organism-Response) as a base model to investigate the influence of attitude, trust, and privacy risk on consumers' behavioral intention in adopting the BNPL feature on e-wallet applications.

This study contributes to the literature by exploring the factors influencing Generation Z's intention to use BNPL integrated within e-wallets. The results indicate a positive impact of perceived ease of use on attitude and trust, suggesting that consumers will be more likely to adopt BNPL when they perceive that using BNPL services is easy, straightforward, and requires minimal effort. This finding is consistent with the conclusion reached by other studies in another context, including online payment (Yang *et al*., 2015), mobile banking (Makanyeza, 2017), and mobile money (Penney *et al*., 2021). Similarly, the positive impact of subjective norms on attitude and trust points to an essential role of social influence in shaping consumer perceptions and their intention towards the BNPL feature. In that case, consumers might believe their friends, family, or peers would approve of their decision to use BNPL services because they trust the provider's credibility (Raj *et al*., 2023).

The results also revealed that perceived ease of use has a negative impact on privacy risk. This means that while consumers find BNPL easy to use, they associate it with higher privacy risks. Alongside the convenience of BNPL, consumers may have concerns about the potential risks of losing their personal and financial information within the digital ecosystem. Exploring the negative impact of perceived ease of use on privacy risk is a significant contribution, demonstrating that enhancing ease of use can reduce privacy risk when using BNPL on e-wallets. Furthermore, this finding indicates that privacy risk hurts the behavioral intention to use the BNPL feature. This emphasizes the importance of privacy issues as a result of hacking and the unauthorized disclosure of consumers' data (Wang *et al*., 2020) and implies that if consumers believe the BNPL feature is associated with privacy risk, their behavioral intention to adopt it is weakened.

5. Conclusion

The study investigates significant factors affecting BNPL adoption within e-wallet applications through the SOR theoretical framework. According to our research, perceived ease of use and subjective norms enhance attitudes

and trust toward BNPL features, while privacy risk discourages the formation of consumers' behavioral using intentions. Therefore, to encourage widespread adoption of BNPL features in e-wallet applications, e-wallet providers should prioritize improving ease of use, leveraging social influence, and mitigating privacy risks.

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Evaluating the Entrepreneurship Pedagogy and Support Landscape in Secondary Schools In Nigeria

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Abstract: The study examines the entrepreneurship pedagogy and support landscape in secondary schools in Kaduna metropolis. Through the application of qualitative and quantitative methodologies, critical stakeholders including teachers, quality directors, school principals and proprietors were interviewed to determine the state of entrepreneurship education/training in Nigeria, using Kaduna metropolis as case study. Findings reveal poor articulation of national entrepreneurship curriculum, inadequate facilities and resources in the schools visited. Subsequently, some far-reaching suggestions and recommendations were offered to improve entrepreneurship pedagogy in Nigeria in general.

Keywords: Entrepreneurship education, Secondary school, Nigeria, Kaduna, Curriculum

1. Introduction

The impact of entrepreneurial activities and the creation of new businesses on the economic growth of a country and the generation of jobs are recognised worldwide (Sánchez, 2012). Some studies (e.g., Olokundun et al., 2014; Ojo, 2021) have surmised that entrepreneurship competence is relevant for all areas of working and business life, in both new and established activities and enterprises. It is expected that job creation will increase when young people (e.g., secondary school students) are given sound entrepreneurship education and training, for it is today's pupils and students that will create the values and workplaces of the future. It is due to its importance that governments all over the world are paying attention to entrepreneurship education and ensuring its inclusion into schools and colleges curriculum. The key concepts of entrepreneurship can be taught at any time in a person's life, but the values and attitudes that produce a successful entrepreneur are more likely to develop if they are explored and nurtured at a tender age. Teaching children (and young people) about entrepreneurship offers a career path, but more importantly, students learn of the economic and social benefits that entrepreneurs provide to their families, to their communities and their country (Appalachian Regional Commission, 2004).

Nigeria is experiencing a youth bulge (UNDP, 2018) such that the country is regarded as a 'country of the young' with almost half the entire population (46%) currently under the age of 15 (UNICEF, 2019). A sizeable percentage of these young people are especially vulnerable and live in extreme poverty (Ojo, 2019). According to Virk et al. (2024), Nigerian youth face multiple challenges, including poverty, unemployment, and underemployment, limited educational opportunities, and health challenges. The challenges facing Nigeria today is to make education meaningful and more inclusive to this set of young people around the country. Education is widely accepted as one of the most critical means of overcoming the challenges of development, poverty, and inequality. But, from every available study and statistics youth (and general) unemployment is endemic in Nigeria. For example, 55.4% of young people aged 15% to 35% are without work in Nigeria (Al Jazeera, 2019). The number of out of school children and unemployed youth/teenagers in the country is alarming. For instance, there are 727,000 out-of-school children in Kaduna State alone (Alhassan, 2019). The facts on the ground (e.g., high youth unemployment figures, business failures, extreme poverty, etc.) could indicate weak uptake of entrepreneurship among the youth. Subsequently, it could be inferred that the effectiveness of entrepreneurship education in Nigeria's institutions of learning are far from being satisfactory; such that the current quality of education in the country leaves much to be desired.

Studies (e.g., Ajagbe et al., 2016; Ojo, 2021) suggest that the development level of entrepreneurship education and training in many centres of learning in Nigeria may not be mature enough to meet the needs of entrepreneurial practice. Therefore, the perfection of the entrepreneurship education and training system is essential to raise the level of entrepreneurship education and training for the promotion of the entrepreneurial qualities and abilities of students and learners. Invariably, effective entrepreneurship education and training will be particularly useful in a state like Kaduna, which is battling with the challenges of the social menace posed by unemployed youths (Akhaine, 2016). Thus, the key question on focus is: What is the state of entrepreneurship education in Kaduna secondary schools? But the specific question is: Do the current entrepreneurship education

methods and implementation effective in secondary schools in Kaduna? The paper is organised into five sections: (a) conceptual framework - entrepreneurship education, and training (b) contextual interrogation - challenges of entrepreneurship education in Nigeria (c) methodology (d) findings and analysis (e) summary, implications, recommendations, and conclusion.

2. Conceptual Matters - Entrepreneurship Education and Training

Nowadays, entrepreneurship educators view entrepreneurship as a valid concept in all human activities, not just in business (Kirby, 2004). Accordingly, entrepreneurship is defined broadly, including enterprising behaviors, even outside the business context. But the key question remains - can entrepreneurship be taught? According to some authors (e.g., Low, 2001; Woollard et al., 2007), entrepreneurship can indeed be taught and learned though its success depends on internal (individual) and external (contextual) factors (Davidsson, 2003), and should also be related to the development of entrepreneurial behaviour (Fayolle & Gailly, 2013). In this sense, an enterprising person may not necessarily be an entrepreneur and his/her skills and characteristics may be exercised in different contexts (e.g., in a social context as a family or local community) instead of in the market. The academic training aspect of entrepreneurship is important to expose students to new ideas and trends in management and business in the process of obtaining a formal education. In the fast-changing competitive environment, it is no longer enough to know how to perform a specific activity. The ability to create new knowledge is also vital. Entrepreneurship education and training enhance an entrepreneur's absorptive capacity, thereby also influencing his/her capability to acquire and create new knowledge and enabling him/her to better articulate and structure the knowledge-transfer process. The theoretical knowledge in entrepreneurship education/training should emphasise skills like critical thinking, creativity, communication, user orientation, and teamwork as well as using domain-specific and linguistic knowledge. Hitherto, a positive impact of entrepreneurship education on entrepreneurial outcome measures has been reported in many studies. For instance, in a review of literature, Mwasalwiba (2010: 35) found that most studies agreed that "entrepreneurship education has some positive impact on students." Similarly, scholars such as Martin et al. (2012) found a significant relationship between entrepreneurship education and entrepreneurship skills, intentions, and outcomes, although there were potential pitfalls in methodologies in most of the studies (Lorz et al., 2013).

Nevertheless, there are several approaches to teaching entrepreneurship as various researchers proposed assorted methods in delivering entrepreneurial knowledge and skills to students (Fiet, 2000a; Fiet, 2000b). Some of these approaches extended from conventional methods such as textbooks (Fiet, 2002), examinations (McMullan & Cahoon, 1979) to unconventional methods like a business plan (Audet, 2000), life histories of working entrepreneurs (McKenzie, 2004); guest lectures (Klandt & Volkmann, 2006), and field study or visits to business organisations (Cooper et al., 2004). Notwithstanding the differences in curriculum and delivery approaches, the ultimate aim of entrepreneurial programs is to stimulate entrepreneurship awareness among students to increase their interest in entrepreneurship. Taken together, the debate has moved beyond whether entrepreneurship can or should be taught to focus on how to constantly improve entrepreneurship content and delivery to meet the needs of students (e.g., Gendron, 2004).

3. Contextual Interrogation - Challenges of Entrepreneurship Education in Nigeria

Ojo (2021) contends that education in general, and secondary education in particular, seems not to have been properly structured in Nigeria. For instance, the philosophy of self-reliance such as creating a new cultural and productive environment that will provide occupational orientation, technology acquisition, job creation and work discipline is lacking. The failure of secondary education to inculcate these ideas in students has led to wastages in terms of both human and natural resources. This is because youths are not sufficiently equipped with the skills to utilise the natural resources around them (Ojo, 2021). Likewise, Genty et al. (2014) argue that, though there exist several entrepreneurial training institutions in Nigeria, there is no sustainable entrepreneurship system in place. This is because most entrepreneurial training institutions adopt the traditional model of entrepreneurship training. The traditional model of training is either theoretically orientated or geared towards practical skills development. Hence, students and trainees do not acquire creativity and innovation skills and lack risk-taking aptitude. As such, entrepreneurship students and trainees are not proactive in nature and their ability to identify business opportunities is inadequate (Genty et al., 2014). Olokundun et al. (2014) also suggest that the problem of entrepreneurship education in Nigeria seems to be inappropriate structuring. For instance, the philosophy of self-reliance such as creating a new cultural and productive environment that will provide occupational orientation, technology acquisition, job creation and

work discipline seems to be lacking. The failure of entrepreneurship education to inculcate these ideas in students has led to wastage in terms of both human and natural resources.

Moreover, in many institutions and training centres in Nigeria, there seems to be little understanding of what entrepreneurship education and training is or should be. For instance, many academics and trainers equate entrepreneurship with vocational training, and as such, artisans are engaged to teach/coach students/learners vocational trades like carpentry, mechanics, bakery, catering, photography, etc. Likewise, most academics do not perceive themselves as entrepreneurs and they tend to be uni-disciplinary and entrench themselves firmly within their 'academic tribes'. The inadequacy of entrepreneurship education and training in Nigerian schools has been mentioned in the literature. For example, previous studies (e.g., Mohammed, 2015; Olokundun et al., 2014) have found that some schools in Nigeria offer entrepreneurship education that was not effective at motivating students to start their businesses. This is largely because the method of teaching was not practical oriented and lacked real-life experience.

4. Methodology

Both quantitative and qualitative approaches were used in a two-phase mixed methodology in this study. The adoption of a quantitative research design, in which a questionnaire was used as a research instrument, allows data collection that permits anonymity and precludes possible interviewer biases. This research design also allows a respondent sufficient time to consider answers before answering and encourage more respondents to participate in the study (Kumar, 2014). The use of many respondents/participants in a study permits generalisation and data provided by questionnaires are easy to analyse and interpret compared to data obtained from qualitative data (Kumar, 2014). Besides, the anonymity around the application of the questionnaire tends to elicit information that may not be obtained through other methods. Thus, in phase 1 of the fieldwork, a quantitative approach was applied.

On the other hand, the qualitative design was applied in Phase 2 since it aligns largely with the aims and objectives of the study, which principally focussed on examining the dynamic qualities of entrepreneurship education in secondary schools in the Kaduna metropolis. Informants were purposively selected from Kaduna State Ministry of Education's three Zonal Quality Assurance Divisions, namely, Sabon Tasha zone, Rigachukun zone, and Abakpa zone to ensure adequate representation.

Phase 1

The main questionnaire is broken up into two sections. Section 1 focuses on personal questions, which are effectively 'qualifying' questions concerning teaching entrepreneurship. The section also relates to the geographic (location), demographics, the experience, and qualifications of the teachers. Section 2 deals with the actual, 'where', 'what', and 'how' the teachers teach entrepreneurship in the classroom. The section also has questions on the curriculum, teachers' interpretation thereof, and the extent to which teachers deviate from the theoretical curriculum and introduce a 'practical' element. To ensure the validity of the instrument used three experts in the subject area were approached for their comments. They were asked to examine the instrument with regard to its relevance to the study, technicality and clarity of the items in describing issues of entrepreneurship education/training in secondary schools in Nigeria. The researchers amended the instrument in line with their comments. To maximize the reliability of the instrument, the researchers ensured that questions were unambiguously framed to enhance clarity of apprehension and meaning.

Phase 2

The second stage of the methodology is the face-to-face interview sessions with fifty (50) selected respondents from the three categories of interest; zonal education quality directors (2), school principals (14), and entrepreneurship teachers (34). The questions were open-ended to facilitate much deeper interrogation. The qualitative approach largely helps to deeply examine the dynamic qualities of entrepreneurship education in secondary schools in Kaduna. The follow-up interviews were conducted to assess the qualitative data received in the survey.

4.1 Data Collection Process

Participants' responses were collected, collated, and analysed. The researchers referred back to the respondents if reasons are not clear or a reason has emerged that the researchers were unaware of its existence (Saunders et al., 2012). A convenient sample of sixteen (16) schools was selected from the three zonal quality assurance divisions in the Kaduna metropolitan area as described above. Five schools were randomly selected from each zone; however, Queen Amina College (Sabon Tasha zone) was added because it is a girls' boarding secondary

school and one of the best and oldest (established in 1940) secondary schools in Northern Nigeria (Opera News, 2021). Next, eight (8) private secondary schools were selected through referrals, and four (4) secondary schools owned by the military were also added to add depth to the samples. A total of twenty-eight (28) secondary schools were in the sample list.

Questionnaires were administered to teachers of entrepreneurship in all the selected twenty-eight secondary schools. The schools were grouped under three rubrics: Public, private, and military-owned schools. There are sixteen (16) schools from the public category, four (4) from the military-owned schools, and eight (8) from the private category. The schools were selected based on certain considerations, the first is the security consideration. Due to the high level of insecurity in Kaduna in general and around schools in particular (Gabriel, 2021), only schools within the Kaduna metropolis were chosen. The second criterion is the schools must have both junior secondary school (JSS) and senior secondary school (SSS) levels as some schools only have the JSS level. Schools under the public category are clustered into three zonal quality assurance divisions: Rigachukun zone, Sabon Tasha zone, and Abakpa zone.

Our respondents/participants were 84 entrepreneurship teachers, 28 school principals, 3 zonal quality assurance directors, and three private schools' proprietors in the Kaduna metropolis. All the 84 teacher-respondents were given a survey questionnaire to fill, and the researchers carried out 50 face-to-face interviews comprising 34 teachers, 14 principals and 2 zonal quality assurance directors. Each interview lasted between 30 to 45 minutes. The researchers paid due attention to ethical issues. All the respondents/participants gave informed consent approval and were assured of confidentiality and anonymity. For the sake of convenience, a standardised, open-ended questionnaire was used to gather data (Cohen et al., 2011). The questionnaire was given to the informants after approval was received from the Zonal Quality Assurances Divisions and individual School Principals. The teachers filled in the responses and returned to the researchers the same day or at a later day. In this way, they were able to respond to the questions at a time most convenient to them (Greeff, 2011). This data collection method had its advantages and drawbacks. The questions were close-ended and prevented detailed prodding; however, this drawback was ameliorated in phase 2's face-to-face interviews.

Content analysis of the national entrepreneurship subjects' curricula was also conducted to identify the structure and challenges they contain in providing useful guidelines for teaching entrepreneurship in secondary schools. This helped to enhance methodological crystallisation (Strydom & Delport, 2011). Respondents/participants' responses were collected, collated, and analysed. However, it must be mentioned that the quantitative data collected were analysed and converted into meaningful and acceptable information by the use of simple percentages scores.

5. Results and Discussions of Findings

Following the completion of the fieldwork, scores were collated from the questionnaire forms and field notes from interviews with the respondents of the schools visited, into a dataset. Three main themes were distilled from the data, these are dysfunctional entrepreneurship curriculum calibration, the landscape of entrepreneurship education in Kaduna secondary schools, and resources and state of resources in Kaduna secondary schools.

5.1 Dysfunctional Entrepreneurship Curriculum

Findings reveal that the current national curriculum and methods of teaching in many schools in Kaduna metropolis are defective and not fit for purpose. First, there is no uniformity in the structure or organisation of entrepreneurship elements of the various 'entrepreneurship subjects' listed in the national curriculum. For instance, the themes for the subjects are not uniform; while some emphasise classroom pedagogy (e.g., Radio, Television and Electronic), a few others highlight practical actions (e.g., Haircare and Hair Products). In some modules, students' activities include a visit to business premises. Yet, students' activities for some hands-on modules/subjects do not mention visits to existing businesses. For example, practical-oriented modules/subjects such as Plumbing and Pipefitting listed actions such as (a) participate in grouping to show the differences between the organisation of the business units (b) attempt solving problems on record keeping and books of entries in small scale business transactions. There is no mention of visits or invitations of experts as guest lecturers.

Furthermore, the contents of some entrepreneurship modules/subjects do not align with the listed students' activities. For example, there is a disparity between the contents of Entrepreneurship in Salesmanship module mentioned in the curriculum, such as (1) Documents of trade (2) Terms of trade (3) Balance of payment; and students' activities listed for the module, which includes: (1) defines entrepreneurs and entrepreneurship (2)

Lists difference between the two concepts (3) List the problems associated with entrepreneurship (4) Explain how a salesman can be a successful entrepreneur.

Aside from the incongruity of the curriculum, researchers also noticed that entrepreneurship teachers and school managements in many of the schools visited do not align their teachings to the curriculum. Some of the reasons adduced include inadequate finance, especially in carrying out practical aspects of the module/subject (e.g., Agriculture – fishery, catering and craft practice). In addition, a lack of qualified entrepreneurship teachers was mentioned.

5.2 The Landscape of Entrepreneurship Education in Kaduna Secondary Schools

In Nigeria, three distinct groups are involved in the development and promotion of entrepreneurship education programs in secondary schools. These are the governments (Federal and State), Non-governmental agencies (NGOs), and private institutions/organisations (mostly private schools). Secondary entrepreneurship education programs and curriculum, thus, differ both in consistency and form. Some secondary schools in the State may have a state-wide curriculum, while others rely on resources available at a particular school. In the latter case, an experienced or particularly interested teacher/instructor might offer an entrepreneurship course in one school that is not available elsewhere in the State.

Generally, the teaching approach in most of the schools visited relies heavily on classroom lectures (i.e., theorising), only a handful of the schools engaged students in practical aspects of entrepreneurship education. Such practical aspects include applied tutoring, visits to real-life businesses, training excursions, and workshop/studio activities. These events and activities, which will help students to gain practical experience, have basis in learning theories such as action learning (Revans, 2011), problem-based learning (Barrows & Tramblyn, 1980), and experiential learning (Kolb, 1984). Invariably, the introduction of these learning theories in entrepreneurship education (e.g., Scott et al., 2016) has amplified focus on the role of experience in the learning process (Mandel & Noyes, 2016). It was Freire (1996: 68-69) who argued that "learning comprises both an active side and a passive side, where mere action only leads to activism and mere reflection leads to verbalism".

Consequently, students that are largely meant to imbibe the character and attitudinal disposition of entrepreneurs through hands-on entrepreneurial training events end up with only classroom entrepreneurship theorising. Thus, the main goal behind the national entrepreneurship education program appears to be defeated. This main goal aspires to develop students morally, mentally, and physically and to imbue them with the highest ideals of self-sufficiency, and self-efficacy to produce youths who are independent-minded and have the potential to develop an entrepreneurial mind-set to generate jobs for themselves and others.

5.3 Resources and State of Resources in Kaduna Secondary Schools

Resources available for the delivery of quality entrepreneurship education in Kaduna secondary schools as observed and evaluated during the fieldwork are revealed in this section. Resources are classified under two widely used templates – tangible and intangible. The tangible resources include physical structures such as classrooms, teaching facilities (e.g., interactive board, projectors), finance, and entrepreneurship teachers. Intangible resources include such things as teachers' experience (teaching and entrepreneurship), motivation, and capability. These items are discussed below.

5.4 Tangible Resources: Physical Structure and Condition of Schools and Teaching Facilities

The physical conditions of many of the schools, especially the government-owned schools, visited are not in good shape. Some schools' buildings have no roof (or leaking roofs) and students are at the mercy of the weather elements. Facilities such as classrooms, workshops, teaching aids and tools (e.g., interactive boards) are either not available or in deplorable conditions, particularly in many government-owned schools. Insufficient equipment necessary for entrepreneurship education coupled with non-optimisation of the few available ones is noted in many of the schools visited. Inadequate facilities are not limited to government-owned schools but cut across all categories of schools visited. Most schools (i.e., government schools) have over-crowded students and the number of entrepreneurship teachers in most schools (all categories of schools) is not adequate.

5.5 Intangible Resources: Relationship, Experience, and Capability of resource Personnel

There is a general lack of motivation amongst entrepreneurship teachers in government schools compared to teachers in private or military schools. For example, entrepreneurship teachers in government schools are not enthused to go the extra length to inspire or encourage students' entrepreneurial spirit. Most are unwilling to

organise students' visits to local businesses or invite role models to give lectures or engage students in entrepreneurial activities outside the school hours (compared to teachers in some private schools). For instance, none of the government-owned schools took the researchers' offer to give free entrepreneurship lectures to students as a goodwill gesture. Yet, this offer was enthusiastically accepted by all the private schools and most of the military-owned schools visited. In addition, some entrepreneurship teachers in the private schools do organise informal entrepreneurship training and encourage skills acquisition activities for students outside the class hours/period.

A major finding during this research is the realisation of the little or no understanding of the concept of entrepreneurship among almost all the respondents (teachers, administrators, principals, and owners). The general understanding of entrepreneurship among the respondents does not extend beyond business ownership or business start-up. It took the researchers considerable effort to explain the key principles and relatable characteristics of entrepreneurs and entrepreneurship (e.g., innovativeness, hard work, discipline, and entrepreneurial mind-set) that are required to be emphasised in entrepreneurship education/training to the students. It is this mind-set and innovativeness that distinguish entrepreneurs from others (e.g., business owners and managers) and are present in people (e.g., intrapreneurs) who do not own or set up their businesses but exhibit entrepreneurial tendencies that bring value to organisations' activities. Quality entrepreneurship education and skills training can only be achieved, according to Jusoh et al. (2011), through creativity and innovation.

6. Summary, Recommendations and Conclusions

6.1 Summary

This study seeks to understand key issues related to entrepreneurship education in secondary schools in Kaduna metropolis, within the context of entrepreneurial learning, entrepreneurial pedagogy, and entrepreneurial skills acquisition. Towards this end, the study first synthesises the current national curriculum on entrepreneurship and anchors it in the context of entrepreneurship education and training for attaining a quality pedagogical template for students. Studies have shown that secondary schools are an important force influencing innovation systems and entrepreneurship (Fagerberg & Shrolec, 2009). It is assumed that students who are exposed to entrepreneurship education/training at the secondary school level will have basic entrepreneurial knowledge, skills, and attitudes for starting economic, social, or cultural activities for their benefit as well as that of society.

Several issues that render entrepreneurship education and training inadequate in Kaduna State were identified (e.g., weak curriculum, inadequate funding, and inexperienced instructors). It is the case that entrepreneurship education and training ecosystems vary greatly in secondary schools but generally include key building blocks and scaffolds such as the national curriculum on entrepreneurship in Nigerian secondary schools. Given the context of the globalised knowledge economy we live in, it is logical to enrich entrepreneurship education and training field of action for the benefit of all. The attitude we take towards entrepreneurship education and training will have a large impact on economic growth in Nigeria, especially as entrepreneurship promotes individual creativity and economic dynamism. The creation of new enterprises, the commercialisation of new ideas and innovation are essential for the economy. Consequently, education for potential entrepreneurs needs to be robust and coordinated with educational, advice giving, and support programs that help enterprise leadership individuals (e.g., teachers and instructors) or teams understand what it takes to successfully impart knowledge to individuals to be able to manage successful entrepreneurial enterprises. A robust and broader approach will facilitate the efficiency of the investments that individuals, academic institutions, entrepreneurial and small business support organisations and governments make in entrepreneurship education and training events.

7. Recommendations

Flowing from the data and data analysis, this study offers a series of recommendations that can help policymakers leverage the full potential of entrepreneurship education to advance Nigeria's development agenda. Thus, the following abridged recommendations are put forward to enhance entrepreneurship education, particularly in Kaduna State and generally in Nigeria.

- Build a Robust Entrepreneurship Education Ecosystem
- Revamp the National Entrepreneurship Curriculum
- Institute Effective Personal Development Plan Programs
- Create a System of Monitoring and Evaluation

- Facilitate and Encourage Entrepreneurial Activities

8. Conclusions

The Nigerian government has indicated a growing interest in interventions that foster entrepreneurship among the citizenry, making significant investments in entrepreneurship education and training. Positive relationships between entrepreneurial activity and innovation, and between entrepreneurship and job creation have been registered in several research studies. Effective entrepreneurship education offers potential rewards for individuals in both the formal and the informal sectors of the economy as it signifies self-efficacy, potentially more stable income flows, increased profits, and more secure employment. However, the question remains whether entrepreneurship can be taught and, if so, what is the best way to teach it. Several studies have reached mixed conclusions across a variety of outcomes related to entrepreneurship education and training courses. Findings are further complicated by the fact that training and education programs are delivered in diverse socio-cultural and educational contexts.

Nevertheless, the findings of this present study draw on both national and state-specific research, as well as on the experience of teachers/administrators of entrepreneurship education and students of entrepreneurship, using Kaduna as an exemplar. These findings and the others in this study should be very useful in filling some of the critical knowledge gaps that have made it difficult to know what is being taught, how is it taught, and with what general effect. The findings also point to specific gaps in the national entrepreneurship curriculum at the secondary school level. Finally, the study's findings can inform entrepreneurship education policy and program discourse at multiple levels, guide the investment decisions that government institutions and policymakers must make concerning entrepreneurship education at the secondary school level, and more clearly indicate in which direction further research in the entrepreneurship education field is most needed.

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Brand Communication Management of Startups in Portugal

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Abstract: In this article we briefly present the outlines of a research project on the challenges of managing communication among startups in Portugal. The exploratory study was based on the combination of quantitative and qualitative methodologies and sought to analyze how crucial it is for startups to invest in branding and activate their brands through a planned communication strategy. It is universally recognized that the brand represents the most valuable intangible asset for the organization (Aaker, 1996; Kotler et al, 2012; Huseynli, 2022), currently having all the potential of technology to discover patterns of behavior and communication, but without ever compromising the humanization of the brand, despite the fascination with the digital lifestyle (Kotler et al., 2021). In 2014 a brand management methodology for agile companies emerges, Lean Branding (Busche, 2014) that teaches 21st century entrepreneurs the "way to create, communicate and sell a brand, constantly measuring its performance" (Busche, 2014). This methodology cannot be neglected by startups. The big challenge is precisely the crossing of this business area, which is in affirmation, between the branding, since the literature review has shown that we are facing a little explored theme. Also, understanding how Portuguese entrepreneurs deal with the challenges of brand communication in such a competitive ecosystem, even with more modest budgets, and bringing more knowledge about branding applied to Startups, are the major contributions of this study.

Keywords: Brand management, Brand communication, Startups, Lean branding

1. Introduction

The brand is the most valuable asset for any company, because it represents the business. Company financiers were the first to draw the attention of marketers, strategists and managers to the importance of one of the pillars of brand management; brand equity “brand capital” and “brand value” (Kapferer, 2003), but from a more economic perspective, alerting them to the relevance of a company’s most important intangible asset: the brand.

Markets are dynamic and very volatile, competition is intense and customers are demanding and aware of the decision-making power they have. Given this scenario, it is easy to understand that the path for companies is to focus on branding as a differentiating factor (Aaker, 2011) to achieve longevity in the market.

The brand only exists when it is activated through communication (Kapferer, 1991), which is a “central element in the brand construction and management processes, as it corresponds to the occasion in which it meets its target audiences” (Arriscado et al., 2015, p.3) and, therefore, making brands closer to stakeholders, transforming them into an integral part of consumers' lives, is one of the objectives of brand communication (Aaker, 2010/2011).

The communication strategy must be planned and not according to the needs of the moment, so that the positioning and identity defined by the company reflects the desired image. A brand's identity must be the result of a deliberate and strategically developed effort by organizations and not be the result of chance (Ruão, 2006), which requires systematic, proactive management and an anticipatory perspective (Aaker, 2010; Kapferer , 2003).

For Kotler et al. (2017), in an increasingly digital and interconnected world, customers do not have as much time to devote attention to the brand and are surrounded by alternatives at every step of the way. It is necessary to be present, get their attention and transmit the message they want to hear, companies have seen the need to create stronger bonds with their customers, focusing on the relationship with them, so communication takes on both a strategic and as tactical and operational in this new reality. It becomes crucial to humanize the brand, because the relationship between brands and consumers is horizontal (Kotler et al., 2017).

People no longer just consume products/services, they buy/consume values, image, which means they need to build an emotional relationship with the brand. Consumers in the digital age “make decisions based not only on the characteristics of products, services and prices, but also on what brands say, what they do, who they are and what causes they stand for” (Kotler & Sarkar, 2018, p .20). Regarding communication, Castells (2017) is emphatic with the concept of changing the power relationship in society as he understands that this is defined by values,

in the form of discourse, that motivate social actors (individual, collective, institutional, etc.) to influence the decision of other actors so that they do their will (Castells, 2017). People influence others, transforming cultures and values with the potential of communication networks.

Over the years, companies have grown and evolved in the market. In this sense, technology began to integrate all sectors of companies, using automated systems (Puntoni et al., 2021). Based on this evolution, companies changed their strategies with the aim of investing more in the use of new technologies, applying Artificial Intelligence (AI) (Du, & Xie, 2021). AI has the potential to increase interaction between brand and consumer, in the same way that companies use AI in digital marketing to help consumers learn more about their products and services, and help them navigate through the abundance of offers they have available in a more effective and efficient way, these same AI tools help companies understand consumers and how to approach them with their product and service offerings (Van Esch, P., & Stewart Black, J. , 2021).

This reality paved the way for marketing 5.0 – Technology for Humanity, Kotler et al. (2021) explain how marketers can use technology, in particular artificial intelligence, to satisfy customer needs and make a difference in the world. Marketing 5.0 is data-centric agile marketing, and marketing will continue to be strategic but highly scientific. And it is within this new reality that Startups are born and assert themselves, due to their agility, flexibility and ability to interact with consumers.

2. The Lean Branding Methodology

There are differences between Startups and a conventional company and it is imperative to make the correct distinction, (Blank, 2014). A Startup at the beginning of its activity is necessarily a small or micro company, and needs innovation to not be considered a traditional model company (Sebrae, 2020), however, not all small or micro companies are a Startup. The pace at which traditional small businesses grow is slower.

Startups are not necessarily internet companies, although this modality represents the majority, digital businesses become promising and increasingly attract the attention of large investors (Sebrae, 2020). These arise from ideas from entrepreneurs in a creative and innovative context, aiming to solve a problem (Toledo, 2011). The main characteristics of these businesses are the nature of a temporary organization with the potential for rapid growth, they operate in an environment of extreme uncertainty, in the incessant search for a business model that can become repeatable and scalable. A company established in the market, on the contrary, was designed to execute a business model that could be repeatable and scalable (Blank & Dorf, 2014).

Startups are directly related to the Lean methodology. This methodology is a management philosophy inspired by practices and results that began with Toyota in the 40s. Talking about Lean methodology and Startups takes us to the Lean Startup concept by Eric Ries (2011), who introduced this new concept in the world of Startups.

The Lean Startup methodology, according to Blank (2013), has revealed that it is possible to make the process of creating a company and innovating less risky. For the author, this methodology recommends experimentation instead of detailed planning, the customer's opinion instead of intuition, the interactive path instead of the traditional conception of a finished product from the beginning and presented to the market finished. Although it is only a few years old, concepts such as Minimum Viable Product (MVP) and testing hypotheses acquire meaning in the world of entrepreneurship. The MVP should be a very simple version of the product and include whatever is necessary to convey to the customer as realistic a vision as possible of how the product will work. Only what is necessary to get feedback (Ries, 2011). So, just like building a product, you can also build a brand as the company grows and refine it to find the solution that meets customer preferences. In view of the above, and according to Fresneau (2020), we are faced with a term that is very familiar and increasingly used by entrepreneurs and founders: Minimum Viable Brand (MVB). Being “lean” means understanding that it is not a problem not to have a perfect product upon launch, and this situation is considered the most sensible. The brand will not and should not be perfect when starting the business (Busche, 2014). In this regard, Ries (2012) states in the preface to the book Lean Branding, “just as products are never truly finished, brands must also be committed to adaptation and evolution. Managers must build chameleon brands that adapt to consumers' ever-changing needs and desires, putting hypotheses to the test and using what they learn from repetition and adaptation”, Eric Ries in Lean Branding (Busche, 2014, p.vii)

The Lean Startup methodology presents itself as a recent and very pertinent topic and therefore, it is imperative to study it since the Lean Branding methodology was inspired by this method. Although Lean Startup is focused on product development and business management, its principles can also be applied to brands. The Lean Startup Build-Measure-Learn cycle is completely valid and easy to apply to the Lean Branding methodology. This

is what the authors Busche demonstrated in the book Lean Branding (2014), and Gardner and Cooper, in the book The Lean Brand (2014).

Building a brand in companies that operate in volatile markets, "where barriers to entry are low, competition fierce, people's attention increasingly divided, search more sophisticated and easy access to information, it is quickly realized that building a brand disruptive and dynamic, in a context like the one described, is precisely the path for startups" (Busche, 2014, p. 4). For all of this, the author argues that the time has come when branding must be accessible to Startups.

A lean brand is a brand in which an organization and audience achieve a symbiotic relationship around a common value without creating any brand waste. Brands are currently more relevant and effective if managers, entrepreneurs and professionals in the areas of marketing and communication understand the changes that occur, especially in an increasingly globalized and connected world, and learn from them. "Lean brands have conversations, not monologues" (Busche, 2014, p. 218). For Gardner and Cooper (2014), brand means a relationship, and thousands of Startups, entrepreneurs, managers and entrepreneurs fight to, based on these conversations, build passionate relationships with the public (Gardner & Cooper, 2014). Wheeler (2019), in this regard, wrote that "people fall in love with brands, trust them and believe in their superiority" (Wheeler, 2019, p.2).

In Lean Branding, we talk about brand innovation. An optimized methodology for creating a disruptive brand centered around experimentation, iteration and elimination of brand waste. This methodology provides a scalable structure for continuous cycles of development and improvement of branding through validated learning and the development of real customers (Gardner & Cooper, 2014).

A world of opportunities has opened up for Startups to be in contact with the customer in the same way as a large company. It is necessary to demystify the idea that marketing and branding are only within the reach of companies with large structures. The Lean Branding methodology (Laura Busche, 2014) is proof of this. For all this, we believe it is interesting to study the reality of Portuguese Startups, in their relationship with brands and adoption of Lean branding principles.

3. Building Connections: The Importance of Communication in Brand Consolidation

The function of a brand, nowadays, is not just to identify and differentiate. As highlighted above, the brand currently assumes vital importance for companies, it is universally recognized that the brand represents the most valuable intangible asset for the organization (Aaker, 1996; Kotler et al, 2012; Huseynli, 2022), because it allows managing value that goes beyond your products and services. It is an asset of the organization and, therefore, management should not be restricted to the marketing department, but rather be transversal to the company's structure. The company must provide the brand, first of all, with the content that defines it and gives it identity (reason for being). The brand must have values that allow it to differentiate itself in a market that is increasingly competitive and unstable. When talking about brands, it refers to important associations and memories for consumers, linking an increasingly emotional and symbolic relationship (Aaker, 2010).

The role of branding in the context of business marketing is of paramount importance, as it plays a fundamental role in building an emotional connection with consumers and distinguishing the company from its competitors. As highlighted by Girão, M., & Knupfer, A. M. (2020), a brand truly exists when it is installed in the minds of consumers.

For the brand to "come to life" in the market, it needs to communicate, it is important that the consumer knows it. Kapferer (1991) states that "the brand is a being of discourse. It only exists through communication. Given that the brand states the products or services, it must necessarily take the floor" (Kapferer, 1991, p. 55), so that it can be known and recognized. However, given the high number of messages that reach target audiences, it is increasingly difficult to communicate, get noticed, persuade and influence. More than persuading, now the task is to get noticed. And getting noticed means gaining relevance for what you communicate (Arriscado et al., 2015). And to be relevant in communication, the company must have a pertinent and expressive brand that asserts itself by offering a unique and referential value proposition, differentiated by innovation, capable of distinguishing itself from competitors, gaining customer loyalty and winning the market (Aaker, 2011).

Consistent communication of the brand's values, benefits and differentiators is essential to establish a positive and distinctive image in the minds of consumers compared to the competition, and ensuring a good online experience with the brand will result in a greater chance of interaction with the brand, which will reinforce customer satisfaction (Ho, S. P. S., & Chow, M. Y. C., 2023).

According to Kunch (2018), the complexity of current times, due to globalization, the information technology revolution and the digital era, forces organizations to adopt a new stance and strategically planned communication. Only in this way will they be able to survive in increasingly complex markets and serve increasingly demanding audiences. “Strategic organizational communication plays an important role in the social and organizational context. Faced with the transformations that have been occurring, in the face of the great global uncertainties present in contemporary times, there is no longer space for merely instrumental, technical and tactical communication” (Kunch, 2018, p. 20), because the world we live in is VUCA (Lawrence , 2013), an acronym for volatile, uncertain, complex and ambiguous.

We are based on the line of reasoning of the authors Zerfass et al. (2018), who state that the “term “strategic communication” operates as a replacement for “integrated communication,” which is an umbrella term for all types of goal-oriented communication initiated by organizations to address any kind of stakeholders and audiences” (Zerfass et al, 2018, p.488). For an organization to communicate strategically, it has to work online and offline communication in an integrated way. A holistic approach, which brings together the various areas of communication previously considered in isolation. It is, therefore, about encompassing a set of communication actions designed, structured, planned and integrated to achieve the objectives of an organization and fulfill its mission (Zerfass et al., 2018).

We live in the age of information, communication, technology, big data, computational algorithms, so companies have to follow this evolution to impact internal and external audiences. This is a prominent and valid reality for large companies, small and micro companies, where Startups are naturally inserted.

4. Methodology

With regard to the methodological procedures adopted, we chose to use method triangulation, considering it to be the most appropriate approach to achieving the objectives established for the research. Methodological triangulation involves the collaboration of a team with diverse disciplinary skills, working cooperatively at all stages of the research, integrating different methods and disciplines to bring quantitative and qualitative approaches closer together. In this approach, the methodological specificities of each discipline are not diluted, but rather maintained, allowing an inter or transdisciplinary perspective of research (Minayo, 2014).

As for data collection instruments, in-depth interviews with content analysis and questionnaires with statistical analysis (SPSS) were used. The questionnaire consisted of 21 questions, using a Likert scale from 1 to 6 points. It was applied to a sample of 259 Portuguese entrepreneurs, covering the north, center and south of Portugal, including the islands, and took place over approximately 5 months.

Interviews, one of the most common techniques in scientific work, allow obtaining a large amount of information in an active and informative way. For this exploratory research, 13 interviews were carried out divided into two segments. In segment 1 - Entrepreneurs, we included 6 entrepreneurs from Startups and 2 from Scaleups. We chose to interview Scaleup entrepreneurs to understand whether, during the business transition phase, concerns about branding are the same as in the initial starting up phase. In segment 2 - Specialists - 3 experts in entrepreneurship and 2 in branding participated. The entrepreneurship experts interviewed were: João Borga, former Director of Startup Portugal; Rafael Rocha, professional with 20 years of experience in entrepreneurship and former director of entrepreneurship at ANJE (National Association of Young Entrepreneurs); and Inês Santos Silva, Executive Director of Aliados Consulting. The branding professionals who participated in the study were: Laura Busche, author of the Lean Branding methodology; and Paulo de Lencastre, University Professor and author of several books in the area.

We chose the Delphi method because it is a rich approach that “enables the gathering of a set of opinions from experts and professionals, who work in different areas and who are geographically dispersed, with the goal of understanding and seeking consensus on complex topics, controversial and comprehensive” (Marques & Freitas, 2018, p.411).

5. Results Discussion Analysis

The journey of a Startup is a topic of discussion among entrepreneurship experts in Portugal. While some suggest a life cycle of 1 to 5 years, data from European Startup Monitor indicates that, in general, these companies are less than 10 years old. By combining information from the literature, data from the European Startup Monitor and expert opinions, it is possible to propose a more precise conceptual definition for the term Startup.

We can understand a Startup as a nascent company destined for growth, with a life cycle generally no longer than 10 years and divided into 2 distinct phases. In the first three years, it faces an unstable and challenging period, characterized by a lack of financial and human resources. During this time, conditions of risk and uncertainty are exacerbated as the company relentlessly searches for a replicable and scalable business model. After this initial stage, known as the "Valley of Death", when the Startup reaches the financial break-even point, reality changes, allowing greater autonomy and different priorities. After the fifth year, the company enters a phase of maturity, going through several stages of growth before consolidating itself as an SME or large company. In this process, it relies on professionals, generally led by the founder or a team of up to 30 employees, and works with digital and technological tools, where innovation and disruption are fundamental.

According to the quantitative study, during the first years, brand management may not be a priority for entrepreneurs, who focus on areas such as product/service development, internal management and business model dynamization, due to resource limitations, as shown in table 1.

Table 1: Startup Development Factors

Startup development factors	Average	Standard deviation
Product/Service	5.54	.617
Internal management	5.40	.699
Streamlining the business model	5.10	.818
Brand communication	5.01	.894
Attracting investment	4.34	1.367

Table 1 - Prepared by the authors

However, they recognize the importance of brand management to stand out in a competitive market, where differentiation becomes crucial. To achieve this, it is essential that entrepreneurs invest in creating a strong brand identity and positioning it in the market with a unique value proposition. Lencastre states, "the essence of Startup is differentiation", referring to the intimate connection between entrepreneurship and the idea of standing out from the competition.

Branding essentially encompasses the management of a company's brand strategies. This implies careful planning, structuring and management of the brand Aaker (2010). As Ruão (2006) states, brand identity should not be left to chance, but rather deliberately worked on and managed.

Paulo de Lencastre emphasizes the importance of finding a differentiating concept that resonates with the community. With the advent of the virtual world, new opportunities arise for even small businesses to develop their brands, thanks to innovative methods and tools that do not require large investments. The Lean Branding methodology, for example, aims to demystify the idea that branding is a time-consuming and expensive process. Busche, author of this methodology, in her work provides tools that enable the creation of agile and consistent brands, with a focus on conversion.

Portuguese entrepreneurs recognize the importance of brand management and have a clear understanding of what constitutes a brand. They associate the brand with different dimensions, such as identity, image, logo, company, value system and relationship. However, there is a tendency for some entrepreneurs to associate the brand only with its visual identity. It is crucial to intervene to clarify this concept and emphasize that visual decisions must be aligned with a clear strategy, defined mission and a consistent brand story. Lean Branding focuses on this reality, highlighting the importance of the brand's strategy, history and symbols, and how these elements must be monitored over time to ensure effective communication. This methodology emphasizes agility and the importance of continually measuring performance, especially in a digital market where conversion is crucial. Although Portuguese Startups deal with limited resources and teams with few employees, the collaborative mentality is present, as organizations tend to be more horizontal and less hierarchical. However, they face a series of challenges.

Laura Busche highlights that the biggest challenge when developing a brand is the difficulty in creating a story that goes beyond functional attributes and benefits. It is essential to connect the product with the symbolic and psychological benefits, maintaining a balance to generate a mix of enchantment and rationality in the consumer, leading them to make a conscious and impulse purchase. The Colombian author provides five pieces of advice to Portuguese entrepreneurs: 1) they must develop strategies to highlight their businesses in an agile market,

impacting audiences, especially early adopters, who are more informed and demanding. Many entrepreneurs face difficulties in strategic planning, and it is important to understand that success usually comes after several trials and errors; 2) in saturated markets, they compete with established companies and other emerging startups. The path will be to develop a unique value proposition and communicate it in a clear and convincing way to stand out from the competition; 3) entrepreneurs, especially those at the beginning of their activity, must share lessons learned, knowledge and tools used; 4) it is crucial that Startups invest in internal research for decision-making, reducing dependence on data from secondary sources. Primary investigations, conducted internally, allow for quick and proactive decisions. The formation of an internal department to conduct in-depth interviews, structured questionnaires and other forms of research is recommended; 5) when a brand enters the global market, entrepreneurs compete on a global, not local, level. It is essential to adjust the brand narrative to the global market, adapting it to different social and cultural conditions and customer expectations. Lean brands must be flexible and adaptable, maintaining two-way communication with consumers rather than monologues. The brand has to be "chameleon-like in this sense and adapt. Lean brands have conversations, not monologues" (Busche, 2014, p.7).

In the view of entrepreneurs and experts, the future of branding in the digital era is shaped by the rapid evolution of the business environment, driven by the speed of change and the increasing complexity of the modern world, characterized by the acronym VUCA (Volatility, Uncertainty, Complexity and Ambiguity), as discussed by Lawrence (2013). In this context, companies need to adapt to ongoing transformations, especially in the face of a consumer who plays an increasingly active and creative role in communication.

Changes in brand management suggest that the most agile companies, especially smaller ones, may be best able to transform their brands at the speed required by the constantly changing market. The connectivity provided by digital technology has replaced the traditional model of unilateral communication with a constant dialogue between companies and customers. This has strengthened relations between both parties, placing them side by side in the communication and interaction process. The horizontalization of the communication process brings consumers closer to companies (Kotler et. al, 2017), creating new opportunities for interaction and influence. New consumer profiles emerge, such as "prosumers" and "adprosumers", created by technological developments. The internet allows brands to get closer to these audiences, enabling the co-creation of products and content, which facilitates the dissemination of the brand's image.

With easier access to international markets and more controlled investments, competition increases, but more growth opportunities for companies also emerge. It is essential that companies monitor the performance of their brands and measure results so they can reposition, readjust and redesign communication strategies as necessary. The rapid evolution of the market requires companies to be present in new channels and emerging social networks. This requires professionals with up-to-date skills and qualifications, such as community managers. The branding strategy must be developed quickly, otherwise companies risk losing valuable opportunities.

In the context of Lean Branding, a metaphor used by author Laura Busche (2014) is that of the chameleon and the dinosaur. Companies that maintain cumbersome organizational structures and time-consuming processes are less equipped to succeed, while those that are agile and adaptable are more likely to thrive.

According to Lencastre (an expert in brand semiotics who participated in the study), the future of branding in the digital era will be less centered on brand owners, making room for more open and democratic management. Stakeholders will have a more active role in product design, communication and pricing policy, making brand management more multifaceted and participatory.

Based on the information collected through interviews and questionnaires carried out in this investigation, it was found that entrepreneurs tend to develop a communication strategy for their brands in the most advanced phase of the business, generally after the first three years of operation. In the initial stages, Startups' main concerns revolve around overcoming financial and human resource limitations. This finding confirms that Portuguese Startups approach the communication management of their brands in a planned manner. It has been proven that brand communication plays a crucial role in leveraging business, demonstrating the importance that the topic assumes.

Risky (2015) argues that nowadays it is not enough to have a quality product or a differentiated service, it is essential to publicize and value it through communication. The digital medium emerges as the communication platform par excellence for these businesses, allowing them to win new customers and encourage interaction with the public, which paves the way for co-creation. Startups demonstrate a special affinity with social

networks, as they offer visibility at almost zero cost and make it possible to connect with the world in a matter of seconds, without demanding anything in return, just quality content and maintaining a solid relationship with the clients.

As highlighted by Aaker (2011), the internet provides almost everyone with the opportunity to serve consumers directly and transform the relationship with them into a powerful brand-building tool. This digital environment makes it easier to build a strong presence in the market, strengthening relationships with customers and effectively expanding the brand's reach.

Entrepreneurs, driven by the context of digital natives, adopt a strategic approach from the beginning of their businesses when selecting and planning their presence on digital social networks. These platforms play a fundamental role as the first contact with the market, allowing consumers to assess interest in the products/services offered or in ongoing promotional campaigns. Among the most used networks are Instagram, Facebook, LinkedIn, Twitter and YouTube, with different strategies being used, such as content marketing, storytelling, videos, attractive images, concise messages, contests, stories and collaborative partnerships, for example with influencers including nano influencers. Getting the right message across to your target audience is critical, but it can be difficult with limited resources. Using digital platforms and social networks in a creative and strategic way to reach and engage the target audience effectively, leveraging the power of visual and narrative content, could be the way forward.

Faced with a wide range of digital marketing strategies, contact points, tools and services available, it is observed that Portuguese entrepreneurs tend to adopt the best known, and still little explored, for example, the potential of chatbots. This evolution has completely transformed the way companies manage their businesses, as the fast pace allows managers to monitor brand behavior in real time, thanks to constant feedback from the public.

Based on these reflections, it becomes clear that Startup professionals need to closely monitor emerging trends, identify market requests and develop strategies to discover customer needs, with branding as a primary concern from the beginning of the process.

6. Conclusions

After completing this study, which contributed to both business and academic circles, we highlight the main insights, although there is still a vast area of study on branding applied to Startups to investigate. The insights extracted from this research have a relevant impact on the academic field, namely: presentation of a proposal for a conceptual definition of Startup; a deeper understanding of how Portuguese entrepreneurs involved in the Startup universe define and manage their brands, in addition to understanding the importance they attribute to it; the dissemination of branding trends in the digital era, in which consumers are increasingly connected; the application of the principles of the Lean Branding methodology enables brand management work even with modest budgets, demystifying the idea that this practice is exclusive to large companies.

From this study, some contributions emerge aimed at entrepreneurs, aiming to assist them in brand management in an extremely competitive, volatile and aggressive market: the importance of integrating brand management is recognized from the moment the business idea arises, and not only after overcoming the initial challenges; It is highlighted that the brand has a crucial impact on the Startup's success, going beyond the creation of visual elements; introduction of the concept of Minimum Viable Brand (MVB - Minimum Viable Brand), which, when strategically applied according to the Lean Branding methodology, provides significant benefits to Startups, and finally shares the advice of the author of the Lean Branding methodology on brand management, based in her vast experience as a mentor to several Startups over the years.

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The Social Economy and Contemporary Challenges: Innovation and Sustainability

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Abstract: This article explores the relevance of the social economy in addressing contemporary challenges through innovative and sustainable practices, supported by public policies. The research investigates the management models that social and solidarity economy organizations (SSEOs) employ to respond to the challenges of innovation and sustainability. The study includes an in-depth analysis of diverse operational models and accomplishments across various cases, presenting evidence on how the sector adopts innovative and sustainable practices. The article scrutinizes essential characteristics of SSEOs, such as democratic governance, reinvestment of surpluses in social businesses based on innovation and entrepreneurship, and a strong community orientation. These characteristics are examined for their relevance in addressing issues like social inequalities, digital transformation, and climate change. Additionally, the research includes an examination of four diverse cases of SSEOs established in mainland Portugal. It reveals the wide range of activities and significant interactions that these organizations have with various stakeholders in different economic and social contexts, contributing to regional social innovation ecosystems. The empirical study, based on a descriptive case study methodology applied to multiple and heterogeneous cases (in terms of fields of intervention and scale of resources), demonstrates that sustainability has become a driver in the social economy, within a framework of democratic governance and community involvement. Moreover, the research fills a gap in empirical literature by providing strong evidence through real cases of collaborative social innovation, the integration of environmental, social, and governance practices, as well as financial and regulatory support from the state for the resilience of SSEOs. The social value of the research lies in its empirical contribution to demonstrating how social business is a crucial element for communities to address global challenges, promoting economic growth and employment, social justice, including the fight against poverty, and environmental sustainability.

Keywords: Social economy, Sustainability, Digitalization, Social innovation, Social entrepreneurship, Social innovation ecosystem

1. Introduction

The social economy is a vibrant and dynamic sector that is crucial in promoting sustainable development and addressing complex societal challenges. The European Economic and Social Committee (EESC) defines the social economy as "*the set of organisations that do not belong to the public sector, operate democratically with the members having equal rights and duties, and practise a particular regime of ownership and distribution of profits, employing the surpluses to expand the organisation and improve its services to its members and to society*." (EESC, 2012; p.14). Distinguished by its social objectives and democratic governance practices, the social (and solidarity) economy encompasses a diversity of organizations, including cooperatives, mutual societies, associations, and foundations. These organizations operate based on principles of solidarity, the primacy of people over capital, and the reinvestment of surpluses to achieve social goals (Defourny & Nyssens, 2010; Moulaert & Ailenei, 2005). While diverse in its forms and practices, the social economy shares a common goal of meeting social needs and promoting community well-being. It emerges as a key player, through social innovation, social business models, and the inclusive digital transition, to respond to contemporary challenges, such as social inequalities, population aging, technological unemployment, the dehumanization of interpersonal relationships, and environmental crises (World Economic Forum & Schwab Foundation, 2022).

In the current global context, marked by rapid technological and economic changes, the social economy offers innovative and sustainable solutions that reconcile economic development with social justice and environmental protection (Birchall, 2011; European Commission, 2021). According to the Council of the European Union (2023), the social economy has been instrumental in promoting sustainable development practices. Previously, the United Nations (2014) highlighted that the social economy plays a key role in accelerating progress on the Sustainable Development Goals.

This paper will investigate the relevance of the social economy (also including the solidarity economy) in addressing contemporary challenges through innovative and sustainable practices supported by public policies. Thus, the research issue is what governance models social and solidarity economy organizations employ to respond to the challenges of innovation and sustainability. Based on a literature review including scientific articles published very recently in journals indexed to Scopus and Web of Science, as well as documentation

available on e-portals of relevant international organizations, and on original case studies, we present evidence on how such sector contributes to social cohesion, economic development and environmental sustainability.

The structure of the article is as follows. In section 2 a characterization of the social economy is carried out, with emphasis on the distinctive principles of this sector to the private sector. Section 3 explains the distinction between social innovation and social entrepreneurship and their interconnection through the so-called social innovation ecosystem concept. Section 4 presents the case study including the explanation of research methodology, followed by characterization of the analysed cases of social and solidarity economy organizations. Section 5 provides evidence of cases' common practices and challenges regarding models of governance, communication with stakeholders, financial stability measures, social innovation projects, and environmental sustainability projects. Conclusions are presented in Section 6.

2. Characteristics of Social Economy Organizations

As stated by prominent authors (Defourny & Nyssens, 2017 and 2010; Defourny & Develtere, 1999) social and solidarity economy organizations (SSEOs) operate on principles that prioritize community well-being, social justice, and environmental sustainability. The main characteristics that define this sector include the primacy of social objectives; democratic governance; reinvestment of surpluses; autonomy and independence; solidarity and mutuality; and community orientation. By analysing shortly each of these characteristics, through theoretical insights, we will address the statement that SSEOs prioritize the creation of social value over financial profits, addressing issues such as poverty, unemployment, and social exclusion. This feature is key to differentiating the SSE from the business sector.

2.1 Primacy of Social Objectives

The social economy stands out for its emphasis on social objectives, contrasting with traditional economic models which primarily focus on financial profits (Defourny & Nyssens, 2010 and 2017; Utting, 2023; Utting et al., 2015). As mentioned in the Introduction, the main concerns are the reduction of social inequalities, population aging, technological unemployment, the dehumanization of interpersonal relationships, and environmental crises (World Economic Forum & Schwab Foundation, 2022), amongst others.

2.2 Democratic Governance

Democratic governance is a central feature of SSEOs, and they are managed through participatory decision-making processes that guarantee the voice of all members (Yi et al., 2023). Cooperatives, for example, operate on the principle of "one member, one vote," regardless of the amount of capital invested. This democratic framework promotes inclusivity, accountability, and shared ownership, strengthening a sense of community and collective responsibility (Birchall, 2011). Recent studies also highlight the importance of democratic governance for innovation in emerging technologies, such as artificial intelligence, which can be used to optimize internal processes and increase member participation in decision-making (Gonzales, 2023). Junior (2023) explored the importance of democratic governance and stakeholder participation, concluding that inclusive governance structures make SSEOs more resilient and able to respond quickly to crises, promoting sustainable practices effectively.

2.3 Reinvestment of Surpluses

Any surplus generated by SSEOs is reinvested in the organization itself or used to achieve social objectives, rather than being distributed as dividends to shareholders (Defourny & Nyssens, 2010 and 2017; Utting et al., 2015). This reinvestment supports the sustainability and growth of the organization by increasing its ability to deliver social benefits. Borzaga & Becchetti (2010) state that the reinvestment of surpluses is an essential practice that allows social enterprises (part of SSEOs, as shown further) to constantly adapt and innovate, ensuring their continued relevance and impact. The reinvestment of surpluses is vital for the implementation of sustainable practices and the promotion of green initiatives within SSEOs, contributing to the mitigation of the effects of climate change and other threats associated with globalization (Katajamäki, 2023; Giagnocavo, 2023).

2.4 Autonomy and Independence

Although SSEOs often work in partnership with public authorities and private entities, they maintain a high degree of autonomy and independence. This independence is crucial to preserve its social mission and avoid undue external influences. Autonomy allows these organizations to innovate and respond effectively to the needs of their communities (Defourny & Develtere, 1999). Scholz (2016) also highlights the importance of independence for social innovation, especially in contexts where social needs are rapidly changing. Recent research emphasizes that organizational independence facilitates the adoption of emerging technologies, such

as artificial intelligence (AI), which can be used to improve operational efficiency (Gonzales, 2023) and broaden the reach of social initiatives namely in the education sector (Clamp & Tapley, 2023).

2.5 Solidarity and Mutuality

Solidarity and mutuality are core values of the SSEOs. These operate on the principles of mutual support and cooperation, both among its members and with the wider community (Yi et al, 2023). Examples include mutual aid societies and cooperatives that provide support to members in times of need, fostering a culture of reciprocity and collective well-being. Moulaert & Ailenei (2005) emphasize that solidarity is not only a core value but also a practice that strengthens the resilience of communities in the face of economic and social crises. Recent studies suggest that solidarity and mutuality within SSEOs are crucial to addressing global challenges such as the COVID-19 pandemic, helping communities to recover faster and more equitably (Mullings & Otuomagie, 2023).

2.6 Community Orientation

A strong orientation towards community development is another defining feature of the social economy. SSEOs often emerge in response to local needs and priorities, and their activities are rooted in the context of the communities they serve. This local insertion allows SSE to effectively address specific social challenges and contribute to the resilience and vitality of communities (Monzón & Chaves, 2008). Quiroz-Niño and Murga-Menoyo (2017) discuss how the social economy contributes to sustainable development and the strengthening of local communities. These authors highlight that the community orientation of SSEOs is essential for building more cohesive and resilient societies, especially in times of crisis.

The main characteristics of the SSE are as follows: teamwork, cooperation, self-management, inclusion, democracy, the connection of production to a specific geographical area, the creation of conditions for improving quality of life, and the sustainable local development of people and communities.

2.7 Sustainability

Recent literature adds new key themes suggesting promising paths for the evolution and continuous impact of SSEOs, contributing decisively to the change of the economic paradigm based on social innovation, social entrepreneurship, and the digital transition. For instance, Utting et al. (2015) explored how the SSE is emerging as a new economic paradigm that challenges the traditional rules of the market economy under the capitalist economic system. The authors argue that SSEOs are key to promoting social justice and environmental sustainability, especially in contexts of economic crises and climate change. In their view, the integration of these two principles into the operations of such organizations contributes significantly to Sustainable Development Goals. Siddique et al. (2023) found that ethical banks often adopt cooperative organizational structures and participatory governance models that promote principles like democratic control, participation, and collaboration. These features enable ethical banks to develop innovative financial products and services that address emerging societal needs sustainably.

2.8 Digitalization

A remarkable new type of SSEO is the platform cooperative which has emerged side by side with the digitalization of markets and social businesses, especially since the occurrence COVID-19 pandemic. Scholz (2016) examined the role of platform cooperatives in the digital economy. This author argues that these new forms of cooperatives can democratize the digital economy, offering an alternative to the traditional corporate model that dominates the sector. The author highlights that autonomy and democratic governance are essential for the success of platform cooperatives, allowing them to respond flexibly and effectively to the needs of their members.

By econometrically analysing the theoretically positive correlation between technological innovation and economic growth, in the light of neoclassical and endogenous economic growth models, Gonzales (2023) finds evidence in favour of using AI as a proxy for technological innovation. The author's interpretation is that AI helps in production, marketing, and customer acquisition for companies (and organizations, *in latu sensu*), increasing their productivity and consumer reach. In addition, other effects of AI include improved quality of services, increased accuracy and efficiency in work, and increased customer satisfaction.

3. Social Innovation and Social Entrepreneurship

Social innovation and social entrepreneurship are two distinct yet interconnected concepts that aim to address complex social problems and promote sustainable development. Social innovation involves creating new ideas,

products, services, or models that are effective in improving living conditions and promoting social well-being (Coronel-Pango et al., 2023; Adro & Fernandes, 2021). Social entrepreneurship, on the other hand, utilizes entrepreneurial methods to solve social problems by combining a social mission with business strategies (Sottini et al., 2024).

3.1 Similarities and Differences

Both social innovation and social entrepreneurship recognize the importance of stakeholder collaboration and participation in achieving meaningful and sustainable results (Coronel-Pango et al., 2023; Adro & Fernandes, 2021; Crupi et al., 2023). However, social innovation is a broader concept that encompasses various activities and actors, while social entrepreneurship is more specific, focusing on applying business strategies to solve social problems (Sottini et al., 2024; Adro & Fernandes, 2021). Another significant difference lies in the approach to finance and sustainability. Social innovation initiatives can be funded through various sources, such as grants, government funding, crowdfunding, and social investment, with their sustainability often depending on their ability to generate continuous social impact (Global Innovation Fund, 2024). Social entrepreneurs, on the other hand, seek financially sustainable business models that generate revenue to reinvest in their social mission and expand their impact (Sottini et al., 2024).

Social innovation and entrepreneurship emerge as central themes in sustainable development and solving complex social problems. These concepts often intertwine, providing new approaches to social and economic challenges, and promoting social cohesion and community development. In recent years, the intersection between these fields has gained prominence in academic literature and regional development policies (European Parliament, 2021). This reflects a growing awareness of the need for integrated strategies that promote economic growth and respond effectively to social needs (Sottini et al., 2024). These strategies involve co-creation aiming to invest in evidence-based, accessible, affordable, and scalable new solutions (NESTA, 2015).

3.2 Social Innovation Ecosystem

Collaboration between different sectors – public, private, and SSEOs – is essential for the success of initiatives mentioned in the previous section, fostering a robust and resilient social innovation ecosystem (Abdi et al., 2024). This is characterized by the participation of diverse actors, including non-profit organizations, social enterprises, governments, and local communities aiming at innovation in different dimensions, such as environmental sustainability, social inclusion, and economic justice (OECD, 2021).

Another important aspect is the role of public policies and funding in supporting social innovation. Financing programs, tax incentives, and public-private partnerships are some of the strategies used to foster the development of financially sustainable business models, using revenues generated by their activities to reinvest in the social mission and expand their impact (Sottini et al., 2024). The successful implementation of these policies can significantly accelerate the uptake and impact of social innovation and social entrepreneurship, fertilizing and densifying regional social innovation ecosystems and thus contributing to building fairer and more equitable societies.

4. Case Study

4.1 Research Methodology

The present research used a descriptive case study methodology (Yin, 2018; Stake, 1995) to explore and describe in depth the characteristics and contexts of specific SSEOs. This methodology involves detailed collection and analysis of data from multiple sources, providing a holistic view of the phenomena under analysis.

Semi-structured interviews were carried out between April and May 2024 having been selected as interviewed people playing strategic roles within the organizations investigated, accumulating extensive experience at the top and mid-levels of management. Besides the interviews, the data collection process also involved consultation of available reports and accounts, and direct observation, including visits to the respective infrastructures. This approach ensured rich and contextualized data collection, which is essential for in-depth analysis of heterogeneous cases of SSEOs.

4.2 Sample Data Collection

This section presents collected data on a small sample of prominent Social and Solidarity Economy Organizations (SSEOs) dedicated to various social causes and located across different regions of Portugal. The coverage spans the entire country, from the northern to the southern regions, as well as from coastal areas to the interior.

Organization 1 is a non-governmental and private institution of social solidarity located in the NUTS3 region of Metropolitan Area of Lisboa, with approximately 60 years of existence. With about 160 employees, its mission is to support and care for children and young people in vulnerable situations, promoting a family environment that fosters their development and autonomy. Its values include solidarity, respect, and dignity. The organization operates through self-sufficient communities known as "villages," where children are cared for by dedicated ladies. It maintains close relationships with donors, volunteers, and the local community. The funding sources include state subsidies (33%), donations from individuals and companies (53%), and property and financial revenues (14%), with a total revenue of approximately €6,147,000 and a net profit of around €572,000. The challenges faced include efficient communication, maintaining operational quality and credibility, and ensuring continuous funding. In terms of social impact, the organization supported over 400 children and young people in 2023, and its awareness campaigns reached more than 10,000 people. However, it does not have any environmental sustainability projects.

Organization 2 is a non-profit social solidarity association located in the NUTS3 region of Baixo Alentejo, with approximately 25 years of existence. It has about 70 employees and aims to intervene in therapy with at-risk adolescents, promoting their social reintegration. Its values include empathy, change, and trust. The organization operates therapeutic centers offering psychology, occupational therapy, and social support services, in collaboration with schools, health services, and community organizations. Its funding sources include the Portuguese Ministry of Health, user contributions, and Social Security support. The challenges include overcoming the social stigma associated with addictions, securing public funding, and ensuring service continuity with limited resources. In terms of social impact, the organization served over 300 at-risk adolescents in 2023, with a 70% success rate in school reintegration and improved mental health indicators. It does not have any environmental sustainability projects.

Organization 3 is a civic non-profit association, a private institution of social solidarity, and a non-governmental development organization (NGDO) located in the NUTS3 region of Metropolitan Area of Lisbon, with approximately 20 years of existence. With about 40 employees, the organization promotes human dignity and social innovation, focusing on education and sustainable community development. It operates programs spanning education, social inclusion, and sustainable development. Its funding sources include European funds, local authorities, foundations, and private donations, with a total income of approximately €3,168,000 and a net profit of around €475,000. The challenges include ensuring long-term financial sustainability and balancing employee workload. In terms of social impact, the organization implemented over 20 community projects in 2023, impacting around 5,000 people. It promotes sustainability through the *Ubuntu in the Neighborhood* Project.

Organization 4 is a private institution of social solidarity located in the NUTS3 region of Ave, with approximately 45 years of existence. With about 90 employees, its mission is to promote social inclusion through art and culture. Its values include creativity, community participation, and cultural innovation. The organization operates programs including theatrical performances, workshops, and educational activities, in collaboration with schools, senior universities, cultural organizations, municipalities, and the local community. Its funding sources include public funds, private sponsorships, ticket sales, and partnerships. The challenges include securing continuous funding, managing limited human resources, and adapting programs to community needs. In terms of social impact, the organization had a positive impact on the development of educational, social, and artistic skills for all ages and developed various community programs, including elderly care and temporary reception centers. It promotes sustainable practices through the Eco-Schools project.

5. Results

The research reveals several common practices and challenges among the analysed Social and Solidarity Economy Organizations (SSEOs): active participation of members and partners in governance is a core practice, fostering transparency and accountability. Organizations demonstrate a strong alignment between their day-to-day activities and founding values, with empathy, change, trust, courage, commitment, and responsibility guiding internal practices and policies.

Clear and regular communication with stakeholders using traditional and digital channels is essential to maintain trust and support. Organizations monitor public opinion and provide whistleblowing channels and complaints books to promote customer, employee, and supplier satisfaction.

Diversification of funding sources is a common concern to ensure financial stability and continuity of missions, reducing over-dependence on public subsidies. Organizations seek financing through sales, service provision,

and state support for social innovation and entrepreneurship projects. The centrality of values and mission in governance is evident, with organizations facing challenges such as social stigma, public disinvestment, and the need to maintain service quality with limited resources. Organizational resilience is strengthened through collaborative innovation practices. The analysed organizations have a significant social impact, benefiting thousands of individuals and communities through effective management practices, democratic governance, autonomy, and innovative approaches to address contemporary social challenges.

As a summary result the research fills a gap in empirical literature by showing strong evidence through real cases of collaborative social innovation, the integration of environmental, social, and governance practices, as well as financial and regulatory support from the state for the resilience of SSEOs. The social value of the research lies in the empirical contribution of social business as a crucial element for communities to address global challenges, promoting economic growth and employment, social justice, including the fight against poverty, and environmental sustainability.

6. Conclusions

The research shows that democratic governance, diverse funding, and effective communication are essential for the effectiveness and sustainability of the Social Economy. Public policies are crucial in supporting and promoting social economy activities, directly influencing the sector's sustainability and impact. SSEOs rely heavily on government subsidies and programs to run and expand their operations, which are essential for their maintenance and growth.

The resilience of the social economy sector is strengthened by financial and regulatory support from the government, as seen during the COVID-19 pandemic. Public policies also promote social innovation, enabling impactful projects on social inclusion and community development. Intersectoral collaboration facilitated by public policies is essential for the success of the social economy sector, as these policies promote partnerships and support networks, allowing the sector to innovate, grow, and adapt to contemporary challenges.

The combination of innovative and sustainable practices supported by public policies is key to addressing global challenges such as social inequalities, digital transformation, and climate change, promoting economic growth, social justice, and environmental sustainability.

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Towards a Socially Conscious Start-up Brand: EDI in Entrepreneurial Branding

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Abstract: Successful start-ups are those capable of evoking customer loyalty. To achieve this, a well-crafted brand with a clear brand message that resonates with the target audience is needed. The pandemic, and its aftermath, has led to heightened scrutiny of brands by audiences, with consumers spending more time and money online. Purchase decisions and brand loyalty are increasingly influenced by what brands stand for, with a preference for those that believably prioritise people over profits. Nearly two-thirds of UK consumers expect brands to address societal issues. This trend is particularly pronounced among Generation Z, the fastest-growing demographic in the UK and other advanced economies in terms of spending power. This age cohort differs in several respects from preceding generations, showing a distinct hunger for social causes relating to equity, diversity and inclusion (EDI). This paper presents findings from an investigation into Generation Z's perception of EDI as part of entrepreneurial market communications. Our research aims to explore the target audience's awareness and attitude toward the inclusion of EDI elements in start-up brands and to ideate tangible recommendations for entrepreneurs in terms of embracing EDI as part of their brand's activities. Guided by Design Thinking, a total of 35 semi-structured interviews were conducted with young adults in Greater London, UK. Through inductive Thematic Analysis, four key themes emerged: (i) There is currently limited visibility and awareness of start-ups with EDI branding; (ii) there is a desire for authenticity alongside distrust of brands delivering on this; (iii) there is an expectation of intersectional diversity; and (iv) there is a limited risk of 'cancel culture' for start-ups. Based on these insights, four tangible recommendations were formulated for crafting socially conscious start-up brands: (i) embrace intersectional diversity internally and externally; (ii) cultivate a community to co-create EDI initiatives; (iii) utilising/collaborate with existing EDI associations; and (iv) prioritise EDI efforts in branded communications.

Keywords: Equity, Diversity and inclusion (EDI), Branding, Start-up, Entrepreneurial marketing, Design thinking

1. Introduction

The rise of start-ups and their impact on the global economy is well established, but so is their high failure rate. According to Chaudhri, Pridmore and Mauck (2022), the latter is largely due to many start-ups not focusing enough on building a strong brand. It might sound obvious, almost too basic even, but in order to build a business that survives in the market, a start-up needs customers. This, however, poses a real challenge for many entrepreneurs. Research by CB Insight (2021) indicates that not understanding customer wants and needs, and thus not connecting with consumers, is one of the most common reasons that lead to start-ups failing. Knowing the market, and one's target audience, is key to building a successful business.

A long-standing mantra in the business world is the Pareto principle, according to which 80% of sales are generated by 20% of customers (Lavinsky, 2014). Successful start-ups are, therefore, those that can evoke customer loyalty. To achieve this, a well-crafted brand with a clear brand message that resonates with the target audience is needed. According to Lam and colleagues (2010), establishing a robust and healthy brand is essential for achieving a sustainable competitive advantage.

The pandemic, and its aftermath, has led to heightened scrutiny of brands by target audiences, with consumers spending additional time and money online. Purchase decisions, and decisions to stay with a company, are increasingly influenced by what brands stand for, favouring those that put people before profits (Edelman Trust, 2020). Almost two-thirds of UK customers expect brands to focus on values that address societal 'we' issues (Edelman Trust, 2021). This is particularly true among Generation Z, those born loosely between 1995 and 2010; Generation Z is currently the fastest growing demographic in the UK and other advanced economies in terms of spending power (Brodzik et al., 2022). This age group differs in several respects from preceding generations, with a distinct hunger for social causes relating to equity, diversity and inclusion (EDI). No previous generation has 'championed diversity and inclusion quite like Gen Z' (Germano, 2020, para 2).

Because of this valuable audience's focus, it is essential that start-ups targeting this consumer group embrace authentic models for EDI, and incorporate these into their entrepreneurial market communications in order to relate to their audiences (Naylor, Lamberton and West, 2012). Realising any form of authenticity in branding

requires the full involvement of stakeholders, whose perception and expectations need to be matched and/or adjusted (Stengel, 2017). According to Jahns (2023), there is a need for more culture-centric approaches, emphasising genuine connections, active participation and (co-brand) partnerships, as well as a meaningful brand purpose. This sense of purpose is tied to brand identity, which can be expressed in various forms such as a name, logo, symbol, packaging design, or certain performances and actions (Belch and Belch, 2009).

Generation Z is often associated with 'woke consumerism' and 'cancel culture'—the former labelling an increasing intolerance of transgressions, particularly in relation to social justice, and the latter referring to the public boycott of brands and people, often fuelled by social media movements. Both have been considered growing threats to existing and emerging brands (Amed et al., 2019; Forbes, 2020). Aligned values between consumers and brands can help overcome these risks and are a key reason why people are drawn to certain brands (Lim, 2019). Aligned values undeniably contribute to 'brand love', the degree of emotional and passionate affection that a satisfied consumer has toward a particular brand. In contrast, brands that do not align with the consumer's mindset and expectations are running the risk of losing them (Forrester, 2022). This appears particularly relevant in the context of EDI, as inclusive policies (e.g., LGBTQ+ or ethnic equity) might help increase the appeal of a brand amongst a variety of audiences and might even help grow a brand's market share (Cunningham and Melton, 2014; Brodzik et al., 2022).

Consumers ascribe a central role to businesses in transforming societies and pursuing social causes. In a recent survey, over two-thirds of UK consumers voiced that 'brands are expected to solve both societal and personal problems' (Edelman Trust, 2020, p.12). For Generation Z, this number is even as high as nine in ten consumers (Amed et al., 2019). Entrepreneurs therefore ought to craft a socially conscious start-up brand that positively resonates with generational concerns, such as those revolving around EDI, which, in turn, should inform their business decisions. Emerging brands need to pay close attention to changes within consumption behaviour. As consumers seek to build their identity through brands and products, not providing adequate means to 'forge feelings of social solidarity' (Arnould and Thompson, 2005, p.873) may lead consumers into the welcoming arms of competitor brands that are more in line with current social attitudes. An authentic approach beyond tokenism is needed to avoid being perceived as and/or criticised for 'piggybacking' off current social movements, such as Black Lives Matter, or chasing the 'pink pound'—a reference to the disposable income of LGBTQ+ consumers (Dhal, 2020).

A recent study on consumers' perceptions of LGBTQ+ brand activism by Tressoldi, Espartel and Rohden (2023), based on eleven in-depth interviews based in Brazil, revealed that outwardly supporting diversity can help brands win over consumers if the activism is perceived positively in terms of the brand's representativeness and social impact. However, inauthentic activism perceived as inconsistent and insincere can significantly harm a brand's image and bottom line, potentially leading to consumer backlash and boycotts. Similarly, a study on co-brand partnerships supporting minority entrepreneurs in the US by Smiths, James, and Griffiths (2023) highlighted that a mismatch between brands and what consumers perceived these brands stand for could result in consumer backlash.

These studies highlight the importance of a considered implementation of social activism when constructing a start-up's brand. However, as Shi and Miles (2020) point out, evidence-based knowledge regarding start-up brand identity construction—as part of entrepreneurial marketing—is still in its infancy and requires more insights before a robust theory can be developed. In other words, there is still a lack of clear guidance to date on how entrepreneurs can effectively build their brand identity. This is where our research comes in.

This paper presents results from an investigation into Generation Z's perception of EDI as part of entrepreneurial branding in the UK. The objectives of this research project are twofold:

- To explore the target audience's awareness of and attitude towards the inclusion of EDI elements in a start-up's brand; and
- to ideate tangible recommendations for entrepreneurs in terms of embracing EDI as part of their brand's activities.

By addressing real-world challenges for brands, this research is applied and practice-oriented, making it particularly valuable in the discourse on brand management, as noted by Baumgarth and colleagues (2020). Additionally, it contributes valuable new data points for the on-going conceptualisation of a theoretical framework on brand identity construction (Shi and Miles, 2020).

2. Study Design: Design Thinking

This project is framed by Design Thinking (figure 1), a research approach that focuses on understanding and addressing complex problems through a human-centred and iterative process (Meinel and Leifer, 2012). Design Thinking lends itself to the investigation and development of branding, due to its emphasis on continuous user feedback which facilitates co-creation. Customer co-creation has been shown to positively impact brand value (Merz, He and Vargo, 2009; France et al., 2020), experiencing increasing popularity amongst brand managers due to the progressive empowerment of stakeholders in digital environments that require changes to the ways in which brands are created and managed (Siano, Vollero and Bertolini, 2020). The results presented in this paper reflect the Design Thinking process up to, and including, prototyping; thus, covering all stages dedicated to *understanding* and *exploring* the topic at hand. According to recent literature, this is a suitable point for sharing research outcomes with broader audiences to further enhance the feedback loop (Micheli et al., 2019).



Figure 1: The Design Thinking process

In addition to a literature review, *N* = 35 semi-structured interviews were conducted with Generation Z consumers based in Greater London, England, as part of the *empathise* stage. A combination of convenience and snowball sampling was employed to recruit suitable participants. The initial convenience sampling was conducted among the student population at the University of West London, with the sole selection criterion being that they were born between 1995 and 2010 and currently lived within Greater London. In the subsequent snowball sampling procedure, the selection criterion of location was added—that is, recommended participants needed to live in a different borough within Greater London. This approach aimed to diversify the socio-cultural and socio-economic makeup of the sample. Each interview lasted between 46 and 71 minutes, and took place in person between November 2022 and February 2023. Participants were aged between 18 and 25 years, and included 20 women, 14 men and one non-binary interviewee from diverse socio-demographic backgrounds.

Stimulus material for the consumer interviews derived from two start-ups that have tailored their brand values and messages around aspects of EDI. The two start-ups, both from the fashion sector, were part of the London School of Film, Media and Design's Creative Entrepreneurship Suite throughout 2020 and 2021. Both crafted their branding around a founder's story, emphasising the aspect of LGBTQ+ and black ownership of their fashion brands, as well as the aspect of giving back to their respective communities. Data collection was concluded once a desired level of understanding and saturation was reached (Fugard and Potts, 2015; Saunders et al., 2018). All interviews were subsequently transcribed and analysed using inductive Thematic Analysis (Kiger and Varpio, 2020) in order to define key consumer problems (Design Thinking: *define* stage). Data analysis was facilitated by

NVivo, which documented and structured key themes. To ensure anonymity, each participant was assigned a number from one to thirty-five (the corresponding participant number, e.g., P1, P2, P3, etc., is indicated after each quotation). Finally, tangible recommendations were *ideated* and *prototyped* for creative start-ups to better embrace EDI as part of their entrepreneurial branding.

3. Empathising: Consumer Insight

The analysis of the consumer interviews resulted in a total of four key themes: theme one addresses a lack of visibility and awareness of start-ups with EDI branding amongst participants; theme two lays out the consumer group's desire for authenticity, paired with distrust of brands delivering on this; theme three looks at the importance of intersectional diversity; and, finally, theme four provides insight on the limited danger of cancel culture for start-ups.

Theme one: (in)visibility

A key theme identified addresses a *lack of visibility and awareness* of start-ups embracing EDI in the UK market amongst participants. This was both the case for black owned start-ups, as well as for those embracing LGBTQ+ as part of their branding. Participants raised concern about a lack of easily accessible information and transparent messaging that would help them identify relevant start-ups. *'Where to begin, where do I start to find these brands?' (P14) 'It's hard to find UK based black owned fashion brands.' (P5)* Suggestions to overcome this included *'bold' (P7)* and more *'transparent' (P1)* brand communication on behalf of the start-up that *'should hit me with what it stands for right when I encounter the brand for the first time' (P20)*.

Theme two: authenticity

Closely connected to this is the second theme of *authenticity and distrust*. Participants expressed a desire to see start-ups adopt an authentic approach to EDI—that is, something rooted in more than just promotional efforts, but that permeates the brand's values and actions. *'Everyone can say they support equality, but that doesn't mean they actually do it.' (P15) 'Actions speak louder than just random promises.' (P18)* It appears that the target audience puts brands under considerable scrutiny and reflects on whether activities might be opportunistic in nature. *'During the BLM [Black Lives Matter] protests, many fashion brands pandered to the trend of supporting diversity. This felt rather fake.' (P29) 'Are you really here for us, or just yourself?' (P2)*

Just like with the previous theme, transparency and clarity appear to be key to overcoming distrust and to back up any authentic approach to EDI. *'As a brand, you've got to make it clear what you're about.' (P11)* Suggestions from participants for start-ups included presenting tangible *'proof' (P9)* as part of their communications, such as, featuring easy-to-find testimonials or examples for any EDI claims on their website and social media. In addition, start-ups should ensure that, if they commence their genuine EDI efforts, these do not coincide with bigger movements or heritage months. *'Just avoid pride month, at least at the beginning.' (P4) 'If all you do is just happening during a themed month, be it black history or pride month, or because there are protests going on, you can just stop doing it right away. No one will believe that you are genuine.' (P13)* Several participants also indicated that their trust in an authentic approach would improve if independent third parties featured and/or backed the brand and their activities.

Theme three: intersectionality

Theme three revolves around the importance of *intersectionality* when it comes to EDI as part of a start-up's branding. Participants showed a distinct awareness that *'just ticking one box' (P13)* with regard to equity, diversity and inclusion was not enough. *'Really, the changes we're talking about making should be the bare minimum anyway.' (P16)* The plurality and intersections of diversity characteristics ought to be kept in mind when crafting brand values and messages, as not meeting the target audience's expectations might negatively impact brand trust. *'It would make me question whether they know what they are doing if they say they are all about diversity and inclusion but then only care about one group. I wouldn't buy from someone who seems clueless.' (P24) 'I'd buy more often from a brand if I could trust that they honestly stand for diverse-diversity, yeah.' (P21)*

Theme four: cancel culture

The final theme challenges the idea of a growing threat of *cancel culture* from this consumer group. Most participants stated that they would not publicly boycott a brand based on controversial EDI business practises, due to the personal efforts associated and the potential danger of ending up helping the brand. *'I don't feed into cancel culture, because it's too exhausting carrying all that fire and anger for brands who use our rage for*

publicity.' (P6) This appears to hold particularly true for start-ups, which appear to enjoy an additional level of goodwill in case of a misstep. *'If it is a small business that just started, I'd give them another chance if they mess up once.' (P19) 'As long as they are honest about it and learn their lesson, I'd not cancel a start-up.' (P4)* Nevertheless, bad EDI practice might still negatively impact brand love, with participants being less attracted to brands with questionable EDI practices. *'I would probably care less about the brand, but if I needed something specific, I'd probably still buy from there.' (P33) 'I might lose some interest in it [the brand], yes. Completely cancel it? No, I wouldn't.' (P21)*

4. Defining the Existing Issues

The apparent lack of public awareness amongst participants regarding start-ups embracing EDI does not come as a surprise. The first half of 2023 saw almost half a million new companies registered every hour in the UK, with an unprecedented number of new brands entering the already saturated fashion market since the start of the pandemic (Chen, 2021; Young, 2022; Miles, 2024). The confusion and lack of direction among participants is an understandable consequence. It is difficult for consumers to keep track of all market players and would require an undue amount of time and consumer effort to research every new start-up brand. A lack of transparent guidance regarding brands embracing EDI more holistically—that is, beyond promotional efforts—impedes easy navigation of the market.

The importance of authenticity in terms of EDI, expressed by participants in this study, is in line with what previous researchers have found to be a crucial component for the success of emerging brands (Jahns, 2019; Mirzaei, Wilkie and Siuki, 2022). Generation Z, more than any previous generation, requires authenticity and truthfulness from brands to be encouraged in their consumption (Francis and Hoefel, 2018). Brand authenticity contributes to the development of brand trust (Portal, Abratt and Bendixen, 2019).

Consequently, actions driven by tokenism can damage this crucial trust, which appears to impact the perception of brands overall and consumers' decision making more specifically, thus supporting what, *inter alia*, Tressoldi, Espartel and Rohden (2023), Smith, James and Griffiths (2023) and Cunningham and Melton (2014) have highlighted for Brazil and the US. In this context, it is also unsurprising to see a heightened expectation for brands to embrace the plurality and intersection of EDI characteristics. As Generation Z have grown up digitally immersed, they have had opportunities to engage regularly with diverse people online, resulting in more than half of Generation Z believing that it is natural to belong to various social groups or communities at any given point in time (Francis and Hoefel, 2018). The expectation of intersectionality as part of branding is thus simply a reflection of this generation's own lived experience and reality.

Although the apparent low willingness of participants to publicly boycott brands that infringe on consumer expectations regarding good EDI practice does not echo the warnings expressed by some authors for other countries (i.a., Amed et al., 2019; Forbes, 2020; Tressoldi, Espartel and Rohden, 2023), the findings are in line with recent research by Forrester (2022, para 2), which states that 'cancel culture impacts personal brands more than company brands'. Whilst on the surface, this appears to be positive news for start-ups, further research is needed as to how this might affect businesses where the lines between personal brand and company brand are blurred; this is often the case in entrepreneurial market communications, with start-ups crafting their brands around origin and founder's stories.

Also, although most participants would not cancel a brand for a lack of EDI, they indicate a decreased engagement with and attraction to these brands. This might result in a strategic disadvantage; research has shown that customers must 'feel' a brand and know what is happening with it to develop love for the brand and to become advocates or influencers for it (Stengel, 2017; Coelho, Bairrada and Peres, 2019).

5. Ideating and Prototyping Recommendations for Start-Ups

Based on the findings within this study, four tangible recommendations for start-ups targeting Generation Z and wanting to embrace EDI were derived:

Recommendation one: Embrace intersectional diversity internally and externally

A focus on one single diversity characteristic should be avoided when crafting a brand. Rather, a brand that embraces the plurality of EDI characteristics is appreciated. On this basis, crafting effective brand storytelling that encompasses the range of diversity within an organisation (be that the founder, team, etc.) would likely demonstrate a good understanding of the matter. Furthermore, demonstrating this externally through

partnerships, such as with contractors, manufacturers, marketing agencies, etc. would highlight practical action on EDI commitments.

Recommendation two: Build and foster a community

Engaging with the target audience beyond selling products/services and attempting to forge genuine communication will give brands greater authenticity in relation to the brand's values and identity. This rapport with the target audience should be utilised to co-create EDI strategies, aiding in transparency from a brand's position. This can strengthen consumer trust and brand love, as well as loyalty, as there is a more meaningful reason to return to the brand.

Recommendation three: Sign up to existing associations working in EDI

Aligning with an organisation that already offers education, training and/or resources may make it easier to form EDI policies based on research and social awareness that already exists. There is also value in being a part of an organisation that has a proven track record in EDI, such as *My Runway Group* (https://www.myrunwaygroup.com/) and/or *Consortium* (https://www.consortium.lgbt/), as well as being recognisable with the target audience. This recognition can be utilised to demonstrate a brand's values, but should not be conducted in isolation to avoid the appearance of opportunism and/or tokenism. Start-ups should only sign up and join organisations that truly align with their own values and mission to ensure an authentic approach to EDI.

Recommendation four: Put EDI efforts front and centre of branded communications

Bold and clear messaging can increase transparency as to what the start-up embraces in terms of EDI, which is appreciated by the target audience. Making it easier for interested audiences to find the information is key. For example, on the brand's website, messages on EDI should be featured in several places—and optimised for search engines—as well as featured in the profile section of social media accounts.

However, brands can take it one step further by producing material that is interesting to the target audience. Creating content that is engaging branded material can also be a vital educational tool. The presence of informative, compelling content means that there is greater chance consumers will engage with a brand; sharing through socials, offline word of mouth, etc. are all ways that consumers become active participants in demonstrating social proof of a brand's strategy.

6. Concluding Remarks

Generation Z has a distinct hunger for brands that authentically embrace social causes relating to EDI. They want to see brands reflect their lived experience and reality in order to identify and connect with these brands. Start-ups that cater to Generation Z might therefore want to consider EDI as a core part of their entrepreneurial branding.

This paper derived four tangible recommendations worth considering when crafting or redesigning their branding, but most importantly, start-ups should think about EDI as part of the customer experience rather than a tick-box exercise. Activities and actions that feel organic and complement the customer journey will likely resonate well with the target audience. The aim should always be to build a community of loyal customers by staying authentic to the brand's identity.

EDI elements as part of entrepreneurial market communications appear to have the potential for gains in terms of, *inter alia*, brand love and brand loyalty. Our research also showed that start-ups that might have been hesitant to broach this topic in the past may not need to be too worried about negative impact. Consumer goodwill appears to lower the risk of business damage caused by missteps. Co-creation with the target audience, and transparent communications, might further mitigate the risk.

Contribution and outlook

This study delved into a critical aspect of contemporary branding—the incorporation of EDI elements to resonate with Generation Z consumers. Our research methodology, guided by Design Thinking, emphasises a human-centred and iterative approach—putting the stakeholders front and centre in the creation of socially conscious start-up branding, thus aligning to calls for stakeholder involvement (*i.a.*, Stengel, 2017; Jahns, 2023). Our exploration of how brands can move beyond tokenism to embrace the plurality and intersectionality of EDI characteristics is crucial for long-term brand sustainability and consumer engagement, and delivers much needed additional insights for the on-going journey towards more robust theories for entrepreneurial branding

(Shi and Miles, 2020). We want to emphasise, however, that there is still a lot that needs to be done. The authors of this paper agree with Chaudhri, Pridmore and Mauck (2022) that entrepreneurial brand building is not a one-size-fits-all process and lacks a linear pathway. Although our prototyped framework does not guarantee success, it suggests a new approach for using strategic communication to develop a socially conscious start-up brand that integrates equity, diversity, and inclusion (EDI) into its branding efforts.

What are the next steps for this project? For the final stages of the Design Thinking process, collaborations with creative start-ups across Greater London are pursued. Guided by the recommendations put forward in this paper, both strategy and creative assets tailored to the participating start-up brands will be developed and tested (A/B testing) with existing Generation Z customers. Results from the testing phase are expected to be available by early 2025, with the final implementation expected to take place later that year.

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Inspiring Entrepreneurship by Spreading New Technologies and Innovative Methods that Popularise Science and Art

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Abstract: In recent years a new term related to *GPT (Generative Pre-trained Transformer)* has become very popular among professional society members who develop and use computing applications. This trend has inspired entrepreneurship in education in the following aspects: *Academic* – in the Computer Science and Management Departments *Non-academic* - studies for high school pupils and for adults who wish to enrich their education. The purpose of these studies is to popularise science, technology, and art using innovative methods to make these subjects attractive. Academic *entrepreneurship* requires students to be innovative, namely, to create a project using their acquired professional skills. The work, called the *final project*, is a part of the students' academic requirements at universities. As a promoter of these projects, I have been giving the students proposals, suggestions, and inspiration for the subjects of their projects. The article mentions and describes a *database* with hundreds of recommendations for subjects for projects as well as projects completed by students who previously finished their *final project.* This project's database is used as a model for the current students. The *database* includes the project's hierarchical classification along with subsections, according to their theme, *innovation level, and* completeness, indicating their practical or theoretical properties. The following projects are a sample demonstrating the variety of the final projects, for example: "*Analysing the voiceless languages*"*, "Double buffer economic boiler",* and *"Creating the most consensual coalition".* The second aspect of the entrepreneurship being developed is a series of lectures "*The Popularisation of the Science and the Art"*. This collection of lectures includes an innovative method for preparing and presenting the lectures, connecting attractively the way in which science and art are popularised together for an audience in a wide spectrum of society. The *Power-Point* presentations contain built-in programs, demonstrating dynamic and user-friendly theoretical issues that are accessible using artistic, visual, and acoustic effects, such as known clips, classical and modern paintings, sculptures, music, and other artistic creations. Some of the subjects in this series of lectures are as follows: "*Cryptology*", "*Illusions*", "*Architecture and Mathematics*", and "*Polarisation index in the society*". The main difference between the two above *entrepreneurships* is that in the first case, the main innovation lies in finding the subject of each final project, whereas in the second case, the innovation relies on its *implementation*, namely, its multi-media and multi-disciplinary presentation.

Keywords: GPT (generative pre-trained transformer), Entrepreneurship, Final project, Database, Science and art popularisation, Implementation

1. Introduction

Encouraging the *entrepreneurship* presented in the article is performed at two levels: (1) the academic level, where students mentor and (2) popularising science and art. Both ways inspire *entrepreneurship* in different populations. Entrepreneurship is technologically a relatively new domain mainly based on computer science and the business sector. There is rich related literature in this area, for example, Wilkinson A. (July 2024) and Dung L. T. and Dung T. T. (2024).

The purpose of this article is, on the one hand, to popularise and integrate the following three domains: science, technology, and art into a wider population and on the other hand, to get computer science students closer to these three domains. The wider population represents the passive side of this concept, whereas students must be active, and as an entrepreneur, to be inventive, to be well informed about what is new, and to improve prospects for humanity.

The article consists of two main parts related to its purposes. Each part describes the different modules according to the type of its user: the consumer, for whom it is dedicated, the students in the academic case, or the wide audience in the non-academic case. In the first case the emphasis is on novelty and usefulness, whereas in the second case the emphasis is on presenting examples of the audio-visual merging of art, science, and technology.

A detailed description of these two ways is given next.

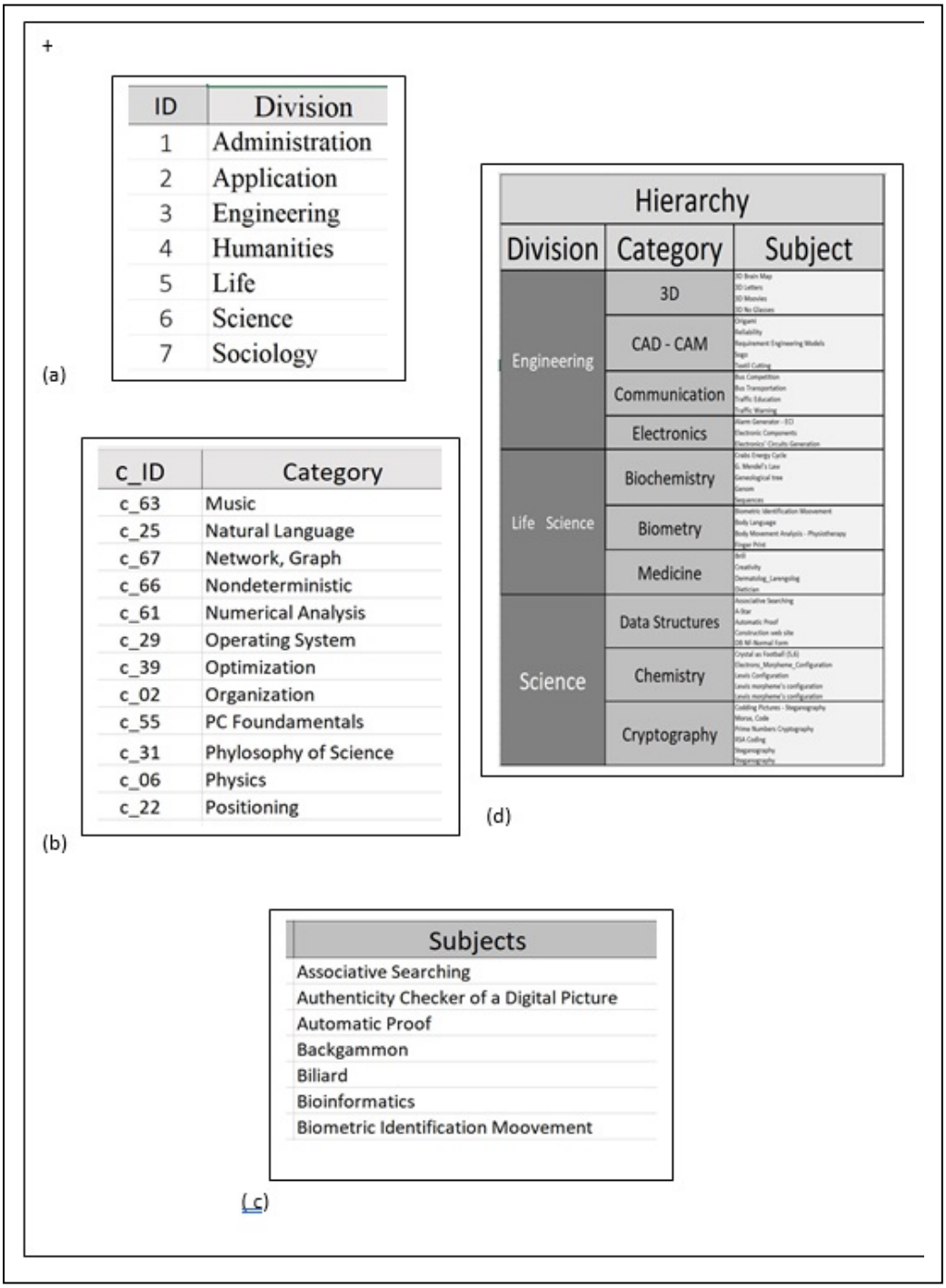
Table 1: Classification of project subjects in the data base by divisions and categories

a. The divisions used in this classification

b. A sample of some categories along with their corresponding ID number

c. A partially reduced list of subjects

d. The hierarchical schematical description of partial data base classifications.



(a)

ID	Division
1	Administration
2	Application
3	Engineering
4	Humanities
5	Life
6	Science
7	Sociology

(b)

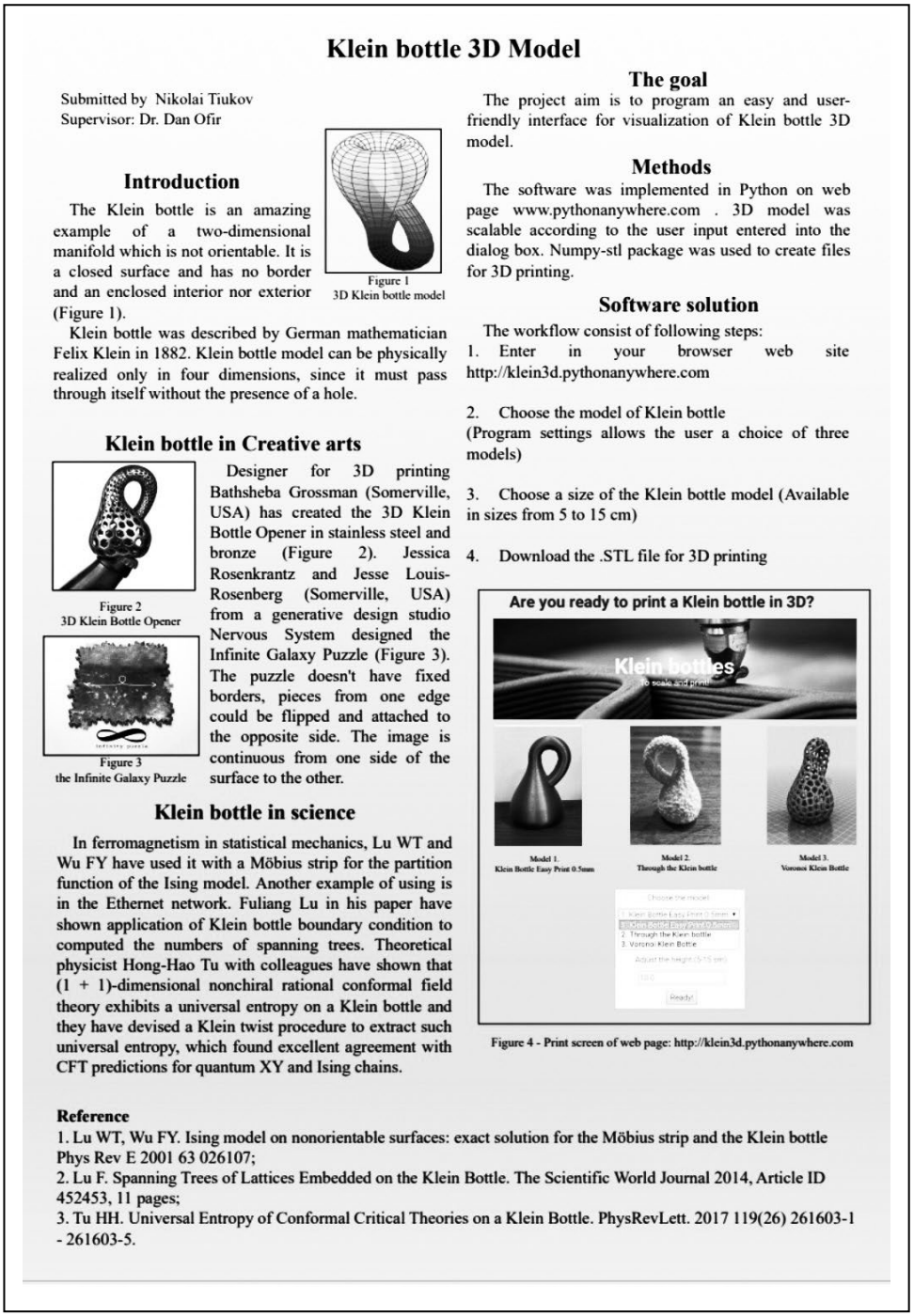
c_ID	Category
c_63	Music
c_25	Natural Language
c_67	Network, Graph
c_66	Nondeterministic
c_61	Numerical Analysis
c_29	Operating System
c_39	Optimization
c_02	Organization
c_55	PC Foundamentals
c_31	Phylosophy of Science
c_06	Physics
c_22	Positioning

(c)

Subjects
Associative Searching
Authenticity Checker of a Digital Picture
Automatic Proof
Backgammon
Biliard
Bioinformatics
Biometric Identification Moovement

(d)

Hierarchy		
Division	Category	Subject
Engineering	3D	
	CAD - CAM	
	Communication	
	Electronics	
Life Science	Biochemistry	
	Biometry	
	Medicine	
Science	Data Structures	
	Chemistry	
	Cryptography	



Klein bottle 3D Model

Submitted by Nikolai Tiukov
Supervisor: Dr. Dan Ofir

Introduction

The Klein bottle is an amazing example of a two-dimensional manifold which is not orientable. It is a closed surface and has no border and an enclosed interior nor exterior (Figure 1).

Figure 1
3D Klein bottle model

Klein bottle was described by German mathematician Felix Klein in 1882. Klein bottle model can be physically realized only in four dimensions, since it must pass through itself without the presence of a hole.

Klein bottle in Creative arts

Figure 2
3D Klein Bottle Opener

Figure 3
the Infinite Galaxy Puzzle

Designer for 3D printing Bathsheba Grossman (Somerville, USA) has created the 3D Klein Bottle Opener in stainless steel and bronze (Figure 2). Jessica Rosenkrantz and Jesse Louis-Rosenberg (Somerville, USA) from a generative design studio Nervous System designed the Infinite Galaxy Puzzle (Figure 3). The puzzle doesn't have fixed borders, pieces from one edge could be flipped and attached to the opposite side. The image is continuous from one side of the surface to the other.

Klein bottle in science

In ferromagnetism in statistical mechanics, Lu WT and Wu FY have used it with a Möbius strip for the partition function of the Ising model. Another example of using is in the Ethernet network. Fuliang Lu in his paper have shown application of Klein bottle boundary condition to computed the numbers of spanning trees. Theoretical physicist Hong-Hao Tu with colleagues have shown that (1 + 1)-dimensional nonchiral rational conformal field theory exhibits a universal entropy on a Klein bottle and they have devised a Klein twist procedure to extract such universal entropy, which found excellent agreement with CFT predictions for quantum XY and Ising chains.

The goal

The project aim is to program an easy and user-friendly interface for visualization of Klein bottle 3D model.

Methods

The software was implemented in Python on web page www.pythonanywhere.com . 3D model was scalable according to the user input entered into the dialog box. Numpy-stl package was used to create files for 3D printing.

Software solution

The workflow consist of following steps:

1. Enter in your browser web site http://klein3d.pythonanywhere.com
2. Choose the model of Klein bottle (Program settings allows the user a choice of three models)
3. Choose a size of the Klein bottle model (Available in sizes from 5 to 15 cm)
4. Download the .STL file for 3D printing

Are you ready to print a Klein bottle in 3D?

Figure 4 - Print screen of web page: http://klein3d.pythonanywhere.com

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Figure 1: An example of a poster prepared by a student, Nikolai Turkov, as one of the requirements of the Final Project, a Klein Bottle. The Klein Bottle is a topological special figure in which the inner and the outer parts are encountered in an astonishing manner. The aim of the project was to construct such a bottle using solid modeling and a 3D Line Printer

There is a time limit for working on the final project. However, this limit does not prevent it from being completed in a reasonable time. The research limitation related to the popularisation of science, technology. and art lies in the difficulty of matching a suitable audience to the type and level of the subject.

2. Academic Level

At this level, mentoring the students in their final project is described. One of the obligations of students in scientific and technological orientations in academic institutions is completing final projects. The students who

completed final projects with me were required to present an original problem, without a known solution, and to solve it by writing code for the algorithm in order to solve the problem. The steps for submitting a dissertation follow:

2.1 Choosing a Topic

The procedure for choosing topics for the final project consists of the following three stages:

- *An Interview*: A short interview with the student about himself: the courses he took, his hobbies, his interests, etc.
- *Suggestions* - My topic suggestions from a selection of open topics and final projects that match the student's background, which may inspire similar topics. The relevant topics offered are organised hierarchically by divisions (see Table 1 (a)), categories (Table 1(b)), and subjects (Table 1(c)) (see a hierarchical classification in a partial data base collection - Table 1 (d)).
- *Decision and Project Proposal* – The third stage is to reach a decision regarding selecting a project. The decision can be immediate, on the spot, or soon afterwards in writing. After the decision, the student writes a detailed project proposal that includes the following sections:
- *Project name*
- *Its purpose*
- *The finished product - its target audience and the way it is used*
- *The development method - tools for its development.*
- *Prerequisites - the background required by the developer.*



Figure 2: Gallery of Zoom participants

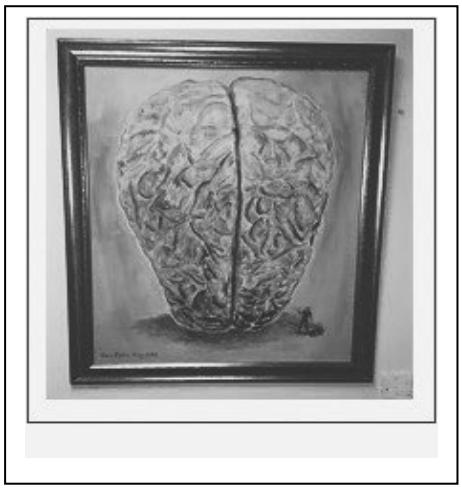


Figure 3: The chosen Logo: "Brain vs. Fear" (Ophir D, (2003) "Brain's Fear")

2.2 Guiding a Project and its Implementation

Meetings are held at times when the student reports on the progress of his work in writing and orally and receives feedback from his supervisor. Repeated feedback includes encouragement for action, advice on dealing with difficulties that appear along the way, and referral to the relevant reference materials and professional literature.

2.2.1 Final project results

Final project results are presented to various forums until the final weighted grade is generated. The final products are as follows:

- Poster - One of the milestones in developing the project is Poster Day. On this day, all students doing final projects in the department present their projects as a poster (see Figure 1) in a concise, visual way to the public: students, lecturers, and faculty members. A team of judges consisting of three moderators give a score on the poster, accompanied by notes.
- Thesis - a student summarises his thesis according to a predetermined format and submits it to his supervisor and the supervisor responsible for managing the students' final projects.
- Project Presentation - the student prepares to present his project and is tested on the project while presenting his project to a panel of judges.

2.2.2 By-products

Some of my projects were used by the instructors as inspiration and as a starting point for an idea presented in articles and presentations at international scientific conferences such as Mesika L. & Ophir D. (2012), Ophir D. & Pomerantz I. (2012), and others. A small part was submitted as a patent at the National Patent Institute.

3. Non-Academic Level

The social media network development tools, such as Facebook and ZOOM, which enable individuals to appeal to a wide audience around the world, motivated the *entrepreneurship* to develop the methodology of popularising science and art. Figure 2 illustrates the ZOOM meeting participants' gallery.

3.1 Modules of the popularisation pattern

3.1.1 Brand

Logo

The logo of the template will run in various media; it should be relevant to the popularisation of science, and attract attention, i.e., catch the eye of a potential user. The logo should have several characteristics to attract attention, be easy to remember, and be relevant to the topic it represents.

The logo we chose meets these requirements (Figure 3). It depicts a huge brain and a small person next to it, which gives the impression of some kind of intimidation: man fears the brain. There is symbolism here; the mind represents reason, knowledge, and science; man, on the one hand, is afraid and on the other, he is curious. A series of popularisation lectures is introduced here, with the aim of combining them.

The anomaly of the logo is expressed in the disproportion in size between the size of the brain and the size of the person; the logo is easy to remember because it represents only two objects: the brain and the person.

Website

A website is used to automatically prepare a list of participants with their preferences, which allows the lecturer to upgrade his contacts with potential participants (see Ophir D. (2021)

There are two types of interactivities:

- Real-time interactivity: During the lecture, the lecturer asks the viewers questions and receives immediate answers, for example, in a lecture on illusions the lecturer gives a test to a reality tester.
- Long-term interactivity: Viewers initiate their contact with the lecturer by asking questions or making comments at the end of the lecture or at a time convenient via email or through a website. This allows the lecturer to interact with the viewers, who send him relevant lecture materials.

3.1.2 Open a Facebook profile

Constructing a Facebook profile requires ensuring a wide exposure. One of the tools that fulfill this requirement is opening the Facebook profile with something suitable so that other users will discover your background.

3.1.3 The lecture outlines

Title

The title of a popularised lecture should be intriguing and should capture the viewer's attention. For that purpose, the title should be exceptional; for example, the title may imply ambiguity, as in the title "*The Illusion of Art or the Art of Illusion*" (see Sekel Al (2006)). The title can allude to elements whose connection is as distant as in the title: "*Architecture, Art, and Mathematics*". At first glance, these concepts are distant, and the viewer may be interested in the connection between the three factors. The title "*Logic, how does it deal with paradoxes?*" (see Baronett S. (2018)) is another type of headline that can entice a potential viewer. Another way to capture potential viewers' attention is to mention useful aspects of the lecture: "*Game Theory and* Their *Contribution in Everyday Decision-Making Process*" (see Neumann J. Von and Morgenstern O., (2020)).

A title that contains a question mark is often a good title because it indicates the lecturer's appreciation of the viewer. Here the lecturer thinks that the viewer will know how to deal with the question at the end of the lecture. A title that hints, e.g., gives tips on easy financial gains, appeals to the audience, as in the headline: "*Understanding Bitchain, and its Impact on Optimal Digital Currency Investments*."

Mystery and secrecy disguised within the headline can add interest to the lecture, as in the headline: "*What are covert encryptions and what damage can they cause*?" Here we encounter another factor that attracts attention in the title, namely, the element of intimidation: if you do not go to the lecture, you will not know how to deal with external threats. Finally, we will present counter examples of a boring title that does not pretend to attract attention, for example, in titles such as "*Game theory*", "Encryption and Identification" (see Burette S. and Paine S., (2001)), "*Bitcoin*", and "*Computer Games*".

Lecture's Abstract

The abstract accompanies the invitation to the lecture. The role of the abstract is to briefly tell the target audience about the content of the lecture. On the one hand, the abstract should attract potential viewers, and on the other hand, it is advisable to leave the factor of surprise to the lecture itself, for example, by presenting a connection between two different areas. As an example, we have shown an association between encryption and genetics (see Piercer B. A., (2016)). The summary also explains how the current lecture fits into the series of lectures as part of the popularisation of science. Thus, it is possible to advertise the entire series.

Opening and closing remarks

The opening contains the following components: (1) thanking the organisers of the lecture series for their contribution to the initiative, the organisation, and for inviting the lecturer to give a lecture; (2) a description of the factors that led the lecturer to develop a series of lectures, and an overview of which lectures have already been given as part of the series; (3) a reference to the audience's responses to lectures given so far; and (4) conclusions to the above

After the opening remarks, it is recommended that the opening slide, which explains the motivation for the lecture, will appear. The slide will contain a direct description of events that were effectively dealt with thanks to the means described in the lecture. For example, the first slide showed World War II videos on the music of Richard Wagner (Cabalgata de las Valkyries) (see Wagner R., (1851)) and explained the crucial function of the enigma cipher in this event. It began with fireworks against the backdrop of Rossini's impressive music of William Tel's opening "Gallop" (see Rossini (1829)).

Concluding remarks to the viewers: thanking them for listening, directing them to a slide containing the contact details of the lecturer, in case there are any questions and comments, along with follow-up lectures in the series; referring viewers to a penultimate slide containing the lecture's punch line, expressed with familiar musical accompaniment, conveying the message of the lecture in a pleasant and relaxed atmosphere, for example, Frank Sinatra's famous song "I do it my way" at the end of the lecture entitled: "Poland-Israel stories

In the context of culture, science, and what connects them""

3.1.4 Table of contents

The table of contents is built hierarchically, as a tree with several levels of detail. Each node in the tree is a link to relevant material in the lecture.

If we look, for example, at a genealogical tree of the lecture topics: "*Time, Space, and Art*" (see Figure 6, Dainton B. F., (2010)), we see a branching tree with five levels of detail. An arbitrary route in the tree was chosen: [World > Space > Cosmos > Space-I].

The following features will help popularise science, preferably through visualisation and sound effects. There is extensive use of videos, animation, graphical interfaces, supported by programming languages integrated into the middle of the presentation. Several examples presented below are contained in presentation lectures popularising science and art given so far in the lecture methodology described here.

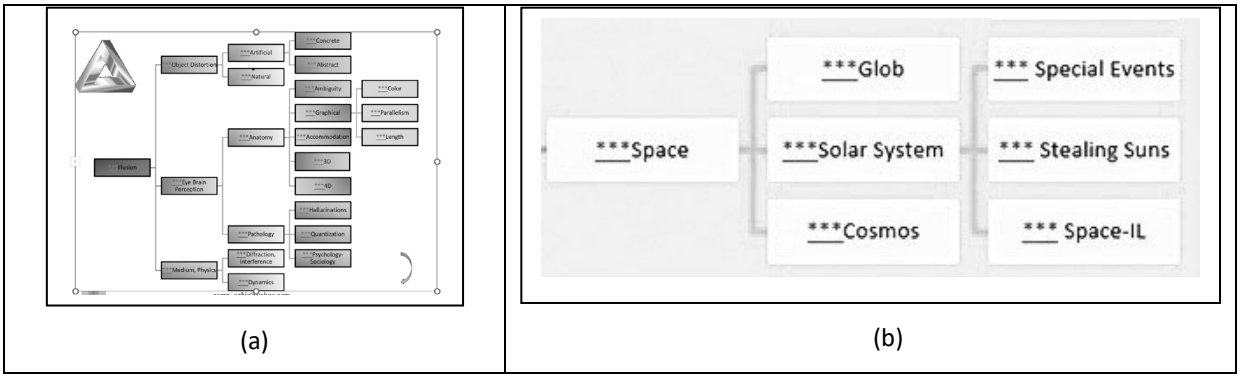


Figure 4: Tree of Contents (a) The whole tree in a miniature size; (b) A partial tree contents



Figure 5: Charlie Chaplin in "*The Gold Rush*" demonstrates hallucinations as a type of illusion in the lecture: "*The Art of Illusions or the Illusions of Art*"

Videos

In a lecture entitled: "*The Art of Illusions or the Illusions of Art*", Charlie Chaplin's video "*The Gold Rush*" was presented, in which the protagonists suffer from exhaustion, accompanied by hallucinations, a kind of illusion. A soundtrack of Chopin's "*Nocturne*" accompanies the video. The video is supposed to evoke in the veteran viewers' feelings of nostalgia, an indulgence in the past - a period in which the film was shown in cinemas (Figure 5, Chaplin C., (1925)).

Sometimes the videos are critical to understand a dynamic phenomenon, as in the case of a description of a folding bridge in a lecture: "*Architecture, Art, and Mathematics*". It is impossible to accurately describe the details of the bridge's folding.

Audio Features

Audio was brought up in a lecture on encryption in the context of the mutual identification of two listeners talking to two telephone line hunters and attempting to identify each other.

Animations

Animations were used in the lecture: "*Space, Time, and Art*" (Figure 6), in a humorous description of the Time Traveler Paradox (see Campbell, J.W. (1935)) the Theory of Special Relativity.

Simulation

Simulations were presented in the lecture: "*Game Theory and Their Contribution in the Decision-Making Process*". The simulation shows the decision tree and the control panel from one node to another node in

another branch, depending on the decision made. Another example of simulation is simulating the Roulette game in the casino in the lecture "*The Art* of *Illusion or the Illusion of the Art*".

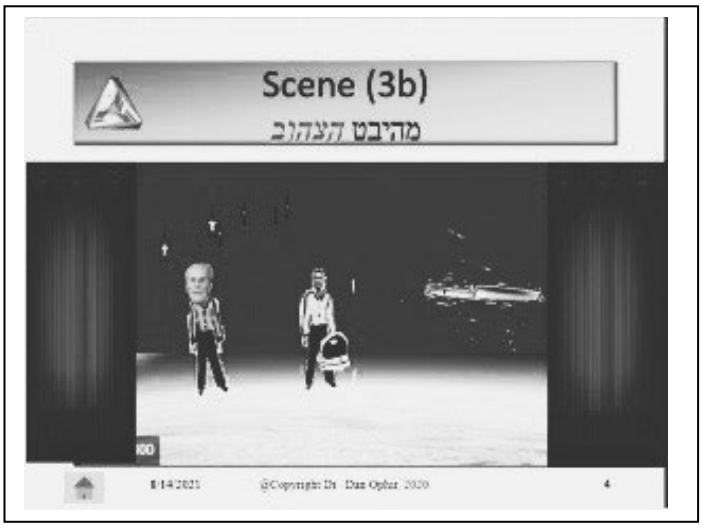


Figure 6: Twins' space encounter, according to the *Twins Paradox* of the *Relativistic Theory*

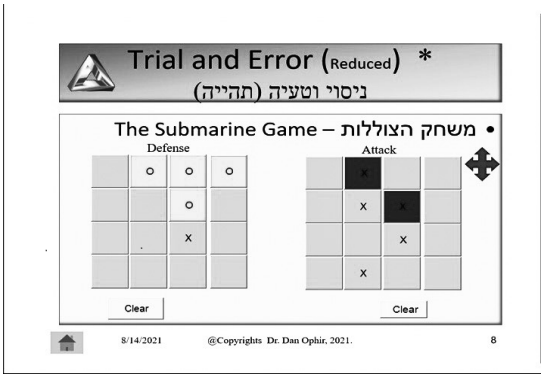


Figure 7: The *Submarine Computerized Game*, embedded in the slide presentation. The left and the right big squares represent the battle fields seen from both opponents' points of view, respectively

Computing-Programming

Computer programming is incorporated in a presentation in the lecture entitled "*Computer Games, Do They Improve Our Thinking Capability*?" The graphical interface to the software in the presentation allows the user to play the submarine game and to experience it in real time (Figure 7).

The above demonstrates how in an entertaining, humorous, interactive, and pleasant way, with the help of built-in musical accompaniment, adapted in rhythm and sound to the nature of the content, something can be presented on the slide, consciously and sometimes subconsciously, allowing popular information to be conveyed to the listener's satisfaction.

3.1.5 Subjects

Exact Sciences

- Bioinformatics - The field of genetics, the structure of the gene, is composed of four nucleotides - amino acids, in a lecture on encryption
- Mathematics - Concept series, Fibonacci series, the concept of the limit, the golden ratio, in the lecture: "*Architecture, Art and Mathematics*"
- 4Biology - Blood Types - ABO, mentioned by Prof. Leopold Hirschfeld, of Jewish-Polish descent, who helped discover our blood types - in a lecture: "*My Story in the background of Polish Israeli Cultural and Scientific Relations*".

The Humanity and Social Sciences

- Communication - The concept of fake news, disinformation (in "*Cryptography and Identification*")
- Psychology - The concept of a reality test – a reality test, verbal and performance intelligence, CBT (Cognitive Behavioral Therapy) (in "*Illusion of Art and Art of Illusion*")
- History - The crucial event of May 26-27, 1941, Atlantic Ocean, west of Brest, the Allied victory over the Nazis, turning points in World War II battles (in "*Cryptography and Identification*")
- Literature - Shaul Tchernichovsky, one of Israel's national poets, wrote in his poem: "A man is not, but a pattern of the landscape of his homeland." This quotation was mentioned in the lecture "*Childhood in the background of Polish Israeli cultural and scientific relations*".

Art

- Painting - Pictures of Francisco Goya, Van Gogh, Escher, Vasarely, Einhorn, and Dali Salvador (in "*Illusion of Art and Art of Illusion*").
- 4Sculpture - The Rapaport sculpture of the Warsaw - Ghetto Uprising (in "*Childhood, Poland-Israel Culture, and Science*").
- 4Music - Gallop in the William Tell Overture, by Rossini; Giovacchini Antonio (in "*Illusion of Art and Art of Illusion*").
- Cinema - "Obscene Proposal" - Robert Radford, "Gold Rush" - Charlie Chaplin (in "*Illusion of Art and Art of Illusion*"). In *Cryptology* – the history of *Enigma* was described using the background of "*Ride of the Valkyries*" (see Wagner R., (1851)).

Technology

- Image Processing - The meaning of the pixel and the RGB primary colors were explained in lectures: encryption, and in a lecture on graphics, respectively.
- Optical Instrumentation - *Sextant* - an instrument for measuring spatial angles; the *Hubble-Space-Telescope,* a telescope built for space exploration; the Helmet-Mounted Display (HMD) – another optical tool. The instruments were included in the lecture: "*Time, Space and Art*".

4. Conclusions

In science, technology, and art two-level entrepreneurship methods were described above. Both were intended to cover a wide spectrum of the audience's interests considering the subjects and their levels. Their purpose was both educational and practical: to make life easier and more pleasant. The mentor/lecturer's advantages were mainly regarding satisfaction in contributing to society, along with some profit.

Regarding the first type of usage, in the academic world there is a term called "lecturer evaluation", in which the students evaluate the lecturers' performance, and in the final project for which I have received the highest possible grade, which is an indication of this kind of activity. Additional academic recognition of these projects is reflected in the high number of citations and viewings of the papers, which were motivated by the *students' final projects*. The publication of those articles, which appear in the references, is evidence of their originality and their academic value, (for example, Mesika L. & D. Ophir D. (2012) and Ophir D. & Pomerantz (2012)).

In the non-academic case, its popularity may be indicated by the *satisfaction index* of the series of the lectures, measured by the number of superlatives, relative to the number of participants in the lectures. These superlatives are included in the feedback received and by the repeated participation of the same individuals in the next lectures in the series.

It appears that the academic and the non-academic parts in this paper have been largely approved. It turned out that the final projects of the students in the computer science and in the management industry departments contribute to their successful employment in industry; for example, one student advanced to the position of vice-director in the Google-Israel development wing.

The series of lectures popularizing science, technology, and art were received with great appreciation, mainly in two public sectors: workers' committees and retired workers. Their satisfaction was expressed in their feedback and very positive questionnaire results. This kind of activity is a kind of entrepreneurship and novelty.

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New Skills and Knowledge for Digital Entrepreneurs in the age of Artificial Intelligence

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Abstract: Digital technologies are becoming increasingly complex and integrated, leading to significant transformations in society and the economy. The article aims to explore and summarize the new opportunities and potential risks of the widespread use of artificial intelligence (AI) in all aspects of life, to define the new skills and necessary knowledge of digital entrepreneurs and to highlight the need for transformation in modern education. Recognizing that the relationship between technology and business is two-way and becoming stronger, revealing that well-prepared employees are a guarantee of success and prosperity of companies in various fields, we try to focus on the main groups of qualities, skills and basic knowledge of students in the age of artificial intelligence. The development of the Internet, expansion of connectivity through social networks, the advent of AI, 3D printing, and immersive technologies like Augmented Reality, and Virtual Reality, require new knowledge and skills, leading to new challenges in education. Qualified personnel in this modern world must have solid professional training and systemic thinking (knowledge, skills, accumulated information), developed cognitive abilities, and personal skills based on collecting and analyzing large amounts of diverse information from heterogeneous sources. Questions arise: how can multiple information sources be combined effectively, and how can the fusion of multiple sources provide additional information to support decision-making processes? Combining information obtained from the real world makes the results heterogeneous and more informative. It follows the need to develop machine learning methods to extract relevant information from increasingly complex data sets. The goal is to improve the accuracy of the applied classification algorithms by combining predictions from multiple models, as well as obtaining a more stable final classification evaluation, effective handling of noisy data, adaptation to changing conditions, and improving stability when solving problems. On the other hand, how to ensure that the enormous potential of artificial intelligence, virtual reality, connection with the physical world, machine learning, and pervasive networks of people and machines will be fully used to improve the quality of life and contribute to the building of stable societies. Changes must be subordinated to policy and investments for reliable artificial intelligence and based on an ethical and human-centered approach. All of these should be established as a fundamental principle of training in Higher education which imposes the need for transformation in modern education.

Keywords: Artificial intelligence, Machine learning, Data fusion, e-Learning, Entrepreneurship

1. Industry Development and Labor Market Change

The new reality in which we live and work is closely related to Artificial Intelligence and Industry 4.0. This necessitates the acquisition of new knowledge and skills by the modern entrepreneur to guarantee the success and prosperity of the company, which is the matter of the main research question in the paper. The first part of the article discusses the basic concepts such as AI, Industry 4.0, machine learning and its application for data mining. The second part presents the challenges facing modern education and the need for new approaches and changes. In the third part, contemporary requirements for an interdisciplinary approach and the need for transformation of modern education, combining theory and practice, are explained.

Comprehensive digitalization of activities in the economy, organizational systems, trade, and services and the penetration of Artificial Intelligence (AI) in all areas has led to the development of industry and a radical change in the labor market. Industry 4.0 is emerging. In Germany, the term "Industry 4.0" first appeared during the Hanover exhibition in 2011. Professors from the Massachusetts Institute of Technology (MIT) Erik Brynjolfsson and Andrew McAfee use the term "second machine age" in their book of the same name, published in 2014 (Brynjolfsson and McAfee, 2014).

According to Schwab (2017), "The fourth industrial revolution is a stage in the development of society, characterized by the rapid development and progress of digital technologies and their massive penetration into all spheres of life." It is based on intelligent and interconnected machines and systems. New concepts appear Internet of Things (IoT), Internet of events, Internet of people (social networks - Facebook, Twitter, LinkedIn, etc.), and Internet of location (mobile phones, smartphones, tablets, etc.). Such networks are created

to restructure economic and societal processes in such a way as to exclude the need for human involvement in a large part of actions and operations.

Digital technologies are becoming increasingly complex and integrated, and as such they are causing significant transformations in society and the economy. Artificial intelligence is at the heart of this transformation because the scientific breakthroughs associated with it form fields whose functioning depends to a large extent on the representation of knowledge and the imitation of human reasoning abilities. Artificial Intelligence and Data Science are evolving: Machine Learning; Natural language procedures; Image recognition; Computer intelligence; Intelligent robotics etc. A rapid development of technologies directly related to Artificial intelligence follows, such as: Web; IoT; Cloud technologies; Computing - supercomputers, GPUs, etc.

According to the study (Chege and Wang, 2020), technological innovation has a significant positive impact on job creation in small businesses and serves as a major engine for economic growth. The effective application of information technology in these enterprises significantly improves their competitiveness and provides them with access to global markets. According to the authors (Ciarli et al, 2021) digitalization is not just replacing jobs, but is related to the transformation of activities and their reorganization. For example, in agriculture, technology-driven digital transformation is bringing change far beyond simply training farmers to operate farm machinery. Instead, farm owners will have to shift to making high-level strategic decisions about software and equipment upgrades, requiring both financial expertise and technical skills.

In the book “Digital Entrepreneurship Impact on Business and Society” (Soltanifar et al, 2021) focuses on digital entrepreneurship and the main factors that influence digital business. The main digital technologies that are considered are related to Cloud Computing, VR/AR, IoT, AI, and Distributed Ledger Technologies. According to the authors, good knowledge of digital technologies is a prerequisite for generating good ideas at the right time and place. Therefore, the digital entrepreneurial personality must maintain the following competencies:

- Creativity, organizational skills, and sense of market opportunities;
- Knowledge of the technical requirements and competition of the surrounding environment;
- Courage to apply creativity to their own business.

Alongside the positive impact that digitalization has, people's dependence on it is also increasing and the likelihood of cyber attacks and security breaches is growing.

Social networks open doors and minimize barriers to connection and communication, but they also give rise to new forms of social anxiety. Digitization facilitates payments and commerce but also stimulates new types of fraud. Technologies that speed up and expand information processing can also drastically cut jobs. The increasing complexity and interdependence of technologies are accompanied by a significant increase in risk factors. This requires studying and deciding on monitoring, controlling, and assessing risk in the context of multi-criteria decision-making, with emphasis on fuzzy logic models, algorithms, and applications (Popchev and Orozova, 2021). In the book "Industries of the Future", Ross (2017) summarizes the main features and dangers: the forces that "unleash unprecedented progress" in lifestyles and wealth accumulation also have the potential to allow identity theft or invasion of personal living space.

With the adoption of digitalization in various spheres, a change is needed in the way of perceiving the world, work, training, and the opportunities that are revealed. People with entrepreneurial skills are constantly looking for new possibilities and ways to achieve their goals. Knowledge of new technologies and ways to apply them will unlock powerful creative energy, help create and offer new services to the market, and offer innovative approaches to solving new and existing problems.

2. The Challenges to Training and the Need for new Approaches

Considering the wide application of artificial intelligence (AI) in various sectors, it becomes extremely important to study its potential impact on the business models (BM) of entrepreneurs (Pfau and Rimpp, 2021). Trained personnel in this modern world must have stable professional training and system thinking (knowledge, skills, accumulated information), developed cognitive qualities, and personal skills such as:

- ability to analyze multiple project perspectives;
- apply a set of appropriate criteria for a realistic assessment of projects in terms of development and implementation time, price, risk, and security;
- to work successfully in a team on real projects with a clear final goal;

- competence in artificial intelligence (AI), big data, and information and communication technologies, to have interdisciplinary thinking, etc.

AI is not a new concept and it has long been present in various spheres of our daily life. Some of these applications are well-known to users, while others often go unnoticed. Examples include shopping recommendation systems, facial recognition technologies, and voice assistants (Intel Corporation, 2020).

Technology continuously monitors and measures various aspects of the learning environment, producing large amounts of data. The sources cover a wide field, including fixed and mobile sensor networks, human-provided data, domain knowledge, and more. The effectiveness of AI methods depends largely on the quality of the data it is trained on. In an educational context, this means providing accurate, representative, and diverse data for training algorithms. Next comes the need to develop methods for collecting, preparing, and managing such data, as well as developing machine learning algorithms to extract relevant information from increasingly complex data sets.

The questions arise: how to efficiently combine several data sources and how to combine the results of the work of different classification algorithms. Data fusion aims to improve classification accuracy by combining the predictions of multiple models, on the other hand obtaining a more stable final classification, dealing with noisy data, and adapting to different changing scenarios and conditions.

According to (Pereira et al, 2024)'s comparative study of automatic data fusion methods, they are divided into early and late fusion categories. Early fusion is divided into sensor data fusion and feature data fusion. Early sensor-level fusion methods can be applied: Bayesian Inference, Kalman Filter, Fuzzy Logic, Artificial Neural Networks, Dempster–Shafer, etc. Early Fusion from Features methods can be Principal Component Analysis (PCA), Singular Value Decomposition (SVD), Multidimensional Scaling (MDS)), and Deep Learning. Late fusion is divided into Late Fusion from Scores and Late Fusion from Decisions.

For example, an artificial intelligence and machine learning method of the type Early feature fusion (Pereira et al, 2024) performs the combination of features extracted from different levels of a neural network at an early stage of the model architecture. This integration allows the unification of both low- and high-level functions, allowing the simultaneous capture of detailed and abstract information. By fusing features at the beginning of the network, classifiers and regression models can generate more comprehensive descriptions of the input data.

This representation has the potential to improve the performance of various tasks, including image classification, object detection, and semantic segmentation. AI models can be improved using early feature fusion, thus advancing several data analytics applications. Figure 1 (Pereira et al, 2024) shows a block diagram of the stated method. Data sources are processed to extract the characteristic features that describe them. The most informative of them are selected. The selected features are used for regression and/or classification. The results can be applied to decision-making.

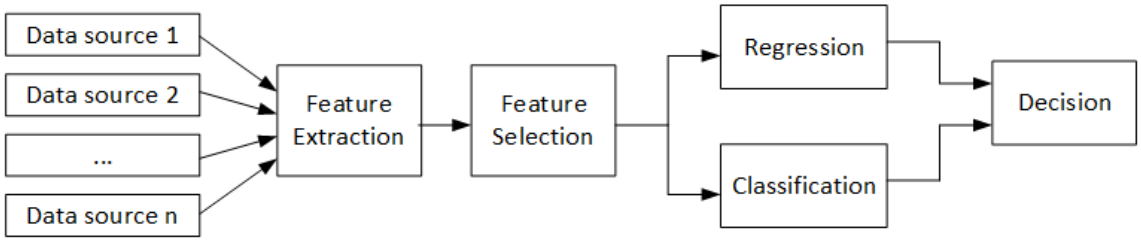


Figure 1: The early feature fusion method

3. Contemporary Requirements for an Interdisciplinary Approach

Current demands on education require an interdisciplinary approach, drawing resources, knowledge, and expertise from both the field of learning and specialists in learning theory, AI, big data, and psychology. Artificial intelligence resources can be methods, algorithms, programs, and positive experience in applying AI in many fields; development of AI-based learning management systems (LMS), intelligent training systems (ITS), etc., general-purpose AI-based intelligent systems (such as recommending systems, recognition and search systems). Cloud computing serves as a medium for AI and as part of our everyday life could be successfully implemented in business and would lead to competitive advantages (Delinov et al, 2022).

Augmented reality (AR) and virtual reality (VR) devices can be used to create interactive online ecosystems for specific training programs, offering participants virtual challenges and tests necessary to successfully complete the training. These platforms can be adapted to any industry, with virtual customers or patients being served by AI bot avatars, resulting in an immersive and engaging learning experience.

Cognitive sciences also provide methods for the development of higher cognitive functions such as critical thinking, problem-solving, innovation, decision-making, etc. On the other hand, the classical basic philosophical theories of learning: behaviorism, cognitivism, constructivism, connectivism of learning, can be a main source of ideas. They are the basis of already established private learning theories such as active learning, problem-based learning, project-based learning, etc.

There are many specific theories of learning, each focusing on particular characteristics or procedures. These theories can be useful in forming certain guidelines or limitations in the development of digital learning. The pedagogical framework TPACK (Mishra and Koehler, 2006) helps educators realize the power of technology and ways to properly integrate it into learning by combining their knowledge and pedagogical principles. According to the model, the knowledge, skills, and experience of the educator are essential to use the technological potential to achieve educational goals.

The successful implementation of young people in the modern world also requires business competence, entrepreneurial spirit, and leadership qualities. A transformation of higher education is needed. The requirement for modernity and the responsibilities towards the educational system requires that in the curricula of bachelor's and master's programs, depending on the professional direction and specialty, training in the following areas, as well as the connections between them, must be included: Artificial intelligence, Big data and their processing (DataScience), Digital Transformation, Industry Development / Entrepreneurship and Cloud computing.

Research in (Kruger, 2021) and their proposed conceptual model connect business functionalities and the necessary competencies that will allow entrepreneurs to cope with the challenges posed by Industry 4.0 and the change in the way enterprises are managed and business in its essence. The main competencies are related to Innovation, Creativity, Integrated business and technology skills, Leadership and communication, Networking, and sales.

The use of modern technologies such as virtual reality (VR), artificial intelligence (AI), augmented reality (AR), and robotics includes different teaching methods, allowing entrepreneurship education to be included in the curricula not only in business schools but also in science and technology students. This can serve as a starting point for changing and updating curricula and programs to meet the requirements of entrepreneurs.

Taking into account the various limitations (financial, available material base, certification requirements, etc.), the learning process can be planned by: appropriate differentiation of the learned content using the means of electronic learning; conducting interdisciplinary research and project work; personalized learning opportunities, collaborative learning in changing roles; international exchange (Erasmus+ program), etc. Personalized learning is a complex and highly uncertain system that can be realized by using Big Data and technologies based on artificial intelligence.

Students must come to the understanding on their own that obtaining knowledge is a complex process of research, gathering and processing data and information, asking questions and answers, forming and testing hypotheses, making a decision, and summarizing. AI tools have the potential to greatly enhance teaching, but they should not replace it. Overreliance on these tools can lead to a loss of human contact and individual attention which are essential components of effective education. The role of transmitters of support, guidance, and motivation is indispensable and a key component of successful education.

4. Conclusion

The article summarizes the new opportunities and potential risks of the widespread use of artificial intelligence in all aspects of life, defines the basic skills and necessary knowledge of digital entrepreneurs and emphasizes the need for transformation in modern education. In the opinion of the authors, the training should focus to a much greater extent on the study of problems from the real world, acquiring knowledge and skills for their use; conducting scientific research together with the students, and activities related to the formation of skills for independent learning, practice-oriented learning and maximum preparation for work in real conditions, as well as nurturing an entrepreneurial spirit during the studies at the university. The implementation of these tasks requires various resources and, above all, knowledge, experience, and prioritized new research and

development agreed upon at different levels, subordinated to the problem of adaptation to the current hyper-connected world. Changes should be subject to policy and investments for reliable artificial intelligence (Policy, 2019) and based on an ethical approach (Ethics, 2019), which should be established as a basic principle of training in the Higher School.

The transformation of higher education in the era of artificial intelligence requires innovative solutions, as well as actions related to the need to overcome contradictions and difficulties of an objective and subjective nature. Constructive cooperation between the Ministry of Education and Science, business, and the Higher Schools of the country is necessary.

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Design Thinking for Frugal Innovation: Unleashing Sustainable Business Models in Emerging Markets

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Abstract: Frugal innovation is a hotbed for low-cost innovative solutions that addresses the needs of underprivileged customers in emerging markets. Many of such frugal innovations are designed and developed by organizations that work at grassroots, and develop solutions in response to the interest of disadvantaged communities. With a central tenet of transforming an existing or undesirable state into a desired state, Design plays a significant role in meeting the unmet needs of such disadvantaged communities. Lately, Design Thinking is increasingly gaining traction as a human-centered approach to innovation that focuses on creative, innovative and iterative development. The foundation of Design Thinking lies in a strong desire to understand more about the people for whom the products and services are developed. When combined with the principles of sustainable business models, design thinking can lead to frugal innovations that not only meet the needs of underprivileged customers but also engender long-term social, economic, and environmental implications. However, studies focusing on the interplay of design thinking and sustainable business models, to unravel the outcome of frugal innovation are scanty. The current study fills this knowledge gap by uncovering how design thinking and sustainable business models can jointly help in improving the outcomes of frugal innovation practices in emerging markets. The research methodology comprises qualitative data collection through a multi-case study strategy using a grounded theory approach. The findings result in a conceptual framework that can be utilized to assess the performance metrics of organizations practicing frugal innovation in an emerging market context. The framework suggests that the outcome of frugal innovation can be measured using various indicators such as affordability, accessibility, energy efficiency, empowerment, and a human-centric approach. By focusing on human-centered solutions and maximizing the potential of frugal innovation, the study's contribution can potentially offer insights for organizations aiming to create a sustainable impact.

Keywords: Frugal innovation, Design thinking, Sustainable business model, Emerging market

1. Introduction

The burgeoning need to solve local problems of emerging markets has become an absolute necessity among organizations. Frugal Innovation (FI) has lately become the linchpin by which firms and organizations create new processes, production systems, and products for unmet local needs (Wozniak & Wereda, 2023). The most recent study on the evolution of FI has demonstrated its critical role in combating the COVID-19 pandemic reviving academic interest in the field (De Marchi et al, 2022). Frugal innovation is characterized by an environment that has resource scarcity, institutional voids, and affordability constraints (Ebolor et al, 2022). This paradigm shifts in end-users' needs and the imperative of addressing sustainable development goals are making organizations change their business model and technological innovations (Hossain, 2020). To successfully respond to this transition, innovators and designers need to steer from a conventional decision-making attitude to a human-centric design strategy for developing affordable and appropriate solutions that establish sustainability. Even though the association between frugal innovation and sustainability has been conceptualized in the literature, there is limited discussion on how such innovative solutions are being designed, developed, and disseminated limiting the potential of frugal innovation.

Design has always been a stimulator for innovation both in the product and service domains (Liedtka, 2018). Over the last few years, design thinking has become a buzzword among businesses and researchers, and it has cemented its position as a study where organizations can gain a competitive advantage from a designer's way of thinking and executing. Design Thinking has been conceived as a potential way of obtaining solutions to complex business problems and managing innovation to newer forms of life (Frisk & Bannister, 2022). Design Thinking acts as a facilitator for businesses and organizations to frame their intention by clearly articulating business models and enhancing the understanding of end users (Sekoboto & Mazanai, 2022). Design Thinking has been employed more and more as a tactic to aid in the development of sustainable business models, a phenomenon that has attracted attention on a global scale (Kurek et al, 2023).

Another critical component that influences the outcome of innovation activity is a sustainable business model (SBM) (Jaksic, 2016). Many times, frugal solutions are developed by organizations from ideation to dissemination without proper consideration of the business model. The sustainable business model is a rising topic of interest

in the management discourse to address the needs of underserved users (Comin et al, 2020). Hossain et al. (2021) mention that a frugal innovation is an appropriate means to serve low-income users, and, developing a sustainable business model around frugal innovation can help in attaining sustainable development. Sustainable business models help organizations in maintaining a competitive advantage by delivering, capturing and creating new value (Dal Mas et al, 2020). As an innovative endeavor, design thinking puts forth the idea of developing goods and services based on human needs, with diverse teams in finding pertinent solutions for complicated issues to develop creative solutions towards sustainability (Carella et al, 2022). Even though design thinking is acknowledged to be a key driver of competitiveness on a global scale, there are still developing nations where design as an instrument of innovation serves a negligible role in terms of contributing to the community. Table 1 outlines the recent discourse around these three concepts and taps on the gap for strengthening research.

Table 1: Comparing recent works on Design Thinking, Business Model Innovation, Frugal Innovation

Author	Focus	Design Thinking (DT)	Sustainable Business Model (SMB)	Frugal Innovation (FI)	Combined Studies (DT+SBM+FI)	Context/Technique
Sekoboto and Mazanai (2022)	Applying DT for circular business model innovation	Yes	Yes	No	No	Case Studies in South- African Small and Medium-sized Enterprises
Carella et al. (2022)	Role of DT in creating new ventures	Yes	No	No	No	Exploratory research among European participants
Ebolor et al. (2022)	Understanding the role of FI in establishing sustainability in construction industry	No	No	Yes	No	Case studies in construction industry
Magistretti et al. (2022)	Uncovering the contribution of DT in research and development phase	Yes	No	No	No	Single case study
Kurek et al. (2023)	Checking the role of DT in creation of BMI	Yes	Yes	No	No	Contextual Review
Current Study	Synergistic role of DT, BMI in developing frugal innovations	Yes	Yes	Yes	Yes	Case Study on diverse organizations

Currently, there is scarce literature on frugal innovation that pivots on the interplay of design thinking and sustainable business models in conjunction. Exploring the concepts together will generate new avenues for discerning how to create, capture, and deliver value for the end users in emerging markets. Frugal Innovation in conjunction with Design Thinking can be used to develop new goods, services, and business models, in addition to changing processes or products (Ebolor et al, 2022). Any decisions made by organizations concerning role of innovation in business models will have a direct impact on performance. Thus, the study aims to investigate how frugal innovations are produced with novel business models that contribute to sustainable development. In response to the aforementioned questions, the study addresses two research questions (RQ):

RQ1: *How does the integration of principles of design thinking enhance the development of frugal innovations that align with sustainable business models?*

RQ2: *What metrics can be used to assess the performance of frugal innovations that have been developed using design thinking a sustainable business models practices?*

With the exploratory analysis of three organizations from an Indian context, the study illustrates how the generation of appropriate solutions is possible when product ideation and developmental and operational concerns are taken into account. Furthermore, the study also positions that a frugal solution should not be only technologically appropriate, but also be backed by sound business models in a given environment. The novelty of the studies lies in utilizing the concept of design thinking and sustainable business models for the development, dissemination, and evaluation of frugal innovation products. The remaining part of the article is

as follows: the next section discusses the methodology. The findings and discussions are presented in section three. Section four ends with the conclusion and proposed contributions.

2. Methodology

The study follows an exploratory approach and implements a multi-case-based strategy. The major intention of using a case-based approach is to investigate the qualitative information through an inductive process. A multi-case study was chosen to intensify the depth of observations; importantly, this enabled the researcher to revisit the primary research questions. According to Yin (2009), the vigor of a case study lies in dealing with multiple, significant sources for research questions allowing a multifaceted analysis. Mignenan (2022) stated that there are three kinds of organizations that are engaged in the approach of frugal innovation: multinational organizations, local organizations, and small-medium scale organizations. The study focused on choosing small-scale organizations that have attracted significant market traction despite the constraints in the development process. An exhaustive search of organizations was made to select the right cases through online databases and public resources. We selected three organizations from a large basket of organizations. The reason for selecting these organizations is because of the reflection of design thinking and frugal innovation in their functioning. The selected organizations fundamentally differ from each other, but they share a certain dimension of similarity. They have been operating in an environment characterized by resources and institutional voids, to address societal, economic, and environmental concerns. The major business idea of all these organizations centers on local development and sustainable operation in rural regions of India.

The first case selected is “X”, a for-profit social enterprise (*name changed to maintain anonymity*) alleviating poverty by giving people access to clean energy, building an ecosystem for sustainable energy innovations, bridging gaps through holistic solutions, and scaling solutions via replication. The inclusive approach followed by X has generated employment for many rural entrepreneurs. The second case selected for the study is “Y”, a development initiative mission that improves the rural economy by conducting science & technology intervention in the traditional practice of rural farm and non-farm production. The third case selected is “Z” an organization actively operating in energy, health, drinking water, skill development, and education. The vision of “Z” is to bring change by involving vulnerable communities from developing countries to design technologies for improving their economic and social well-being.

The data collection involved both primary interviews and secondary responses in the form of field notes, brochures, reports, and website articles. The data collection was done on the frugal innovation, design thinking aspects, and business model of these organizations from their origin to the present time. The data comprises face-to-face semi-structured interviews, field observations, and secondary documents as shown in Table 2. A semi-structured interview was made with six management and technology personnel from these three organizations. The interview was audio-recorded taking permission from the respondents at their organization’s premises. The field observations allowed us to note down their conduct and laid the ground for a contextual understanding of the concepts. Furthermore, the interviewed personnel demonstrated the entire mechanism of frugal innovations and business functioning.

The study follows an inductive approach which is concerned with finding the most probable description of what has happened from the respondents’ context for developing themes (Varma & Dutta, 2022). The data analysis is led by following the ideals of Grounded Theory (Gioia et al, 2013). NVivo12 software, which is frequently used for complex, heterogeneous, and qualitative datasets, was used to analyze the qualitative data (Patnaik & Bhowmick, 2020). The first stage of the analysis concerns with creating the data structure which starts with the data coding procedure. We examined the relationships between the transcripts and organized them into 1st-order codes based on our framed research questions. We further checked the idea that the first-order code might assist us in understanding the respondents' perspective. The data generated from the 1st-order codes were theoretically-focused and abstract.

The first stage further involved repeated cycling between theory and data. Once we reached a manageable number of codes, we handled the data by continually adding and removing codes that were emerging from the structure. We deduced that the saturation of the first-order codes has been reached when no meaningful insights emerged. Using axial coding (Strauss & Corbin, 1998), we looked for connections between and within the structure of 1st-order codes at the second level of analysis. In line with the underlying data structure, this leads to the creation of the 2nd-order codes. As we iterated over the 1st-order codes, we looked for any concepts that would help to clarify the respondents' narration. Second-order codes were created during this iterative process, and they eventually came together to form eight aggregate themes. The degree of importance of each of the themes discovered was once more reviewed throughout each instance in the last level of analysis.

Consequently, the development of data structures fulfills two purposes. First, it offers an apparent summary of the analysis performed on the original data. Second, it offers a foundation for illustrating an in-depth narrative of the study in its entirety. The data structure is shown in Table 3, which shows how the movement from raw data to the aggregate theme was achieved visually.

Table 2: Overview of selected organizations

Case	X	Y	Z
Nature	For-profit	Academic	Non-governmental
Year of establishment	1995	2008	1972
Location	Bangalore	Guwahati	Rajasthan
Product	Solar-energy related products	Agriculture, Energy, Assistive, Animal Husbandry, Textile, and Handicrafts	Solar-energy, Water, Education
No of Employees	100	30	50
Interview (semi-structured) participants	Head consultant, Project design associate	Senior faculty, Project lead	Co-founder, Field engineer
Time (in mins) taken for interviewing each of the respondent	90-120		120

Table 3: Thematic Analysis

First Order Codes	Second-order Codes	Aggregate Dimension
I. Communities trying to work hard to improve their lives and reduce dependency II. We focus to design technologies in response to unmet local needs III. There exists an immense opportunity to utilize rural resources for boosting their livelihood IV. We have to familiarize with community lifestyle to help them talk comfortably about their problems	• *Understand Field Requirements* • *Identifying Opportunities at grassroots* • *Recognizing appropriate solutions* • *Fostering Trust*	*Empathy*
I. Discerning exact needs of community to define the problem statement and identify the gap in the market and community II. Validating community indigenous knowledge and mobilizing scientific ideas to design appropriate solutions	• *Aiming for Productivity* • *User Segmentation* • *Bridging demand and supply*	*Define*
I. Making exhaustive discussions among different stakeholders to identify the best solution II. Involving communities in the development process for bridging the knowledge gap and ensuring improved technical advancement	• *Collaboration with stakeholders* • *Generating Ideas* • *Resource Mobilization*	*Ideate*
I. Ensuring our innovation are efficient than traditional techniques and flexible as high-end technologies II. Checking the compatibility of technologies with the users and local manufacturing facilities for the utility	• *Experimentation* • *Training Partners* • *Networking*	*Prototype*
I. Conducting workshops and engaging communities to evaluate the utility of the technological innovation II. Carrying out demonstration and training with different NGOs for a wide-scale technology adoption	• *Feedback* • *Field Trials* • *Knowledge Diffusion*	*Testing*

First Order Codes	Second-order Codes	Aggregate Dimension
I. Technologies developed are affordable, require less maintenance, user-friendly, efficient and maintain optimal performance II. Technologies have potential for transforming well-being by making proper interventions	• *Delivering customized end-to-end solutions* • *Effective-delivery mechanism*	*Value Deliver*
I. Sensitizing communities regarding opportunities associated with innovation through different workshops I. Increasing technology accessibility and availability to different geographic regions by forming local networks	• *Entrepreneurial Opportunities* • *Developing the appropriate technological solutions*	*Value Create*
I. Increased revenue generation for community members by selling technologies in local markets II. Technologies have potential for transforming well-being by making proper interventions	• *Market Creation* • *Profit accrued on sales*	*Value Capture*

3. Findings and Discussions

The section shares the findings of the empirical analysis concerning the key elements of design thinking (empathy, defining, ideating, prototyping, testing) and sustainable business models (value delivery, value creation, value capture). The obtained themes represent the diverse opportunities, unexploited needs, and constraints overcome by these organizations in their day-to-day activities for creating frugal innovation and delivering value in the livelihood of the end-users.

Empathy and Defining user insights are considered important aspects of design thinking (Micheli et al, 2019). Immersing into the lives of the end users and letting go of the biases serve as the first step in the innovation process (Liedtka, 2018). Our empirical findings support this statement. The significant aspect of empathy lies in how these organizations undertake efforts to understand their end users for whom they are developing and designing innovative solutions. These organizations tap into empathy by identifying the pain points, and behavioral, and physiological patterns of their users, and feeling their perspective. The case of "Z" demonstrated that women from low-income sections can also be innovators and designers. Thus, from the perspective of design thinking, "Z" recognized and empathized with these women and their social conditions. They trained them as innovators who were able to develop low-cost solar products using minimum resources that were appropriate to their socio-economic context. The Define stage in the organizations is undertaken by converting the observations in the empathy stage into meaningful and actionable problem statements. These organizations attempted to give a precise structure to the identified pain points among the end users in the defined stage. Comprehending the users' perspectives, and inferring their undiscovered needs will give clarity to the problem statement. The organization "Y" identified the field requirements of the rural people, interacted with them, understood their perspective, and identified the opportunities associated with upgrading the existing technological innovation.

The ideation stage in organizations is marked by the generation of ideas for translating the defined problem statement. These organizations employ different brainstorming techniques to create ideas for solving the identified problem. For example, "X" conducts brainstorming sessions with the women to generate feasible ideas for designing solutions, thus giving them equal decision-making responsibility. Furthermore, "X" implements verbal expressions and mental imaging for visualizing and creating interesting ideas.

The prototype stage in the organizations is characterized by a rudimentary model of the identified problem statement (Samadhiya & Agrawal, 2022). These organizations create a low-fidelity prototype for seeking answers and try to evaluate if the solution is capable of addressing the intended problem. Testing is the last phase of design thinking in organizations where the prototype is tested in a real-life setting by the actual end users. The practice of prototyping and testing are significantly reflected in the "Y" design activity. Once, "Y" prepares a low-fidelity prototype, it is taken to the field where the local community uses it, if there is any discrepancy in the operation, then the community gives feedback, and the technology is again modified in the lab until the design in the technology is made appropriate. Once the final design is ready for use, it is transferred to the communities with the help of support partners like NGOs, and local action groups. Blank & Dorf (2020) posit that testing solutions from conception to problem resolution verifies their viability from a commercial perspective and their appeal to end-users.

According to Baumeister et al (2015), a sustainable business model considers the interest of the various beneficiary that also includes the community and its ecosystem, and our findings support this concept. Various groups were associated with different stages in the innovation process of these organizations including funding agencies, professional designers, and intermediary organizations that further mobilized the economic, social, and environmental values for the frugal innovation. The major value creation of these organizations is appropriate, affordable, customizable, and good enough solutions that fit local needs. These organizations respond to the unmet local needs at the grassroots and the lack of access to such technological solutions that will improve their living standards and transform their well-being. For example, the organization "Y" creates and shapes an ecosystem where innovation and entrepreneurship can flourish at the grassroots and where the rural end-users can eliminate dependency on external agencies. The new frugal solutions developed eliminated the drudgery and manual labor of the people and resulted in increased productivity.

A major aspect of value delivery in all three organizations is they rely on local resources, and networking opportunities to create delivery at the grassroots thereby bridging the institutional gaps and resource constraints. Utilizing the available resources makes these firms address any financial, or operational issues that may inhibit the development process. "X" operations are a hub and spoke model that ensures the availability of services across different locations by providing financing options. The hub represents the established energy centers in rural areas where the spoke denotes hiring agents, training the local who further acts as a prime linkage to the end-users. Furthermore, it continues to maintain a long-term association with its partners, which facilitates generating a superior quality of product offerings, door-step financing, managing inventory, conducting flexible prototyping, and leveraging capabilities. The three organizations cater to the different constraints in their functional environment with their models of value capture.

Emerging markets often do not have typical institutional support. For example, the organization "Y" does not give direct loans but closely works with financial organizations to provide credit to their customers. It rents products to local customers, where the product or service is often free for the first year, and then an optimal fee is charged for that service. The members visit each service rented to the user once in three months to ensure performance. It helps in curbing dependency on non-renewable resources and mentors' rural people to become entrepreneurs. The "Y" business model constitutes a set of innovative nexuses that seek to diffuse sustainable technologies to the people at the grassroots in an economically viable way.

Thus, the findings from the analysis stress affordability, accessibility, energy-efficient, empowerment, and human-centric solutions as the outcome of frugal innovations when design thinking and sustainable business models are incorporated into the development process. The empirical framework shown below in Figure 1 represents the association between design thinking and business models for fostering frugal innovations. These entire dynamic aids the organization in increasing performance, and sustainability and bringing a positive change in the lives of the community.

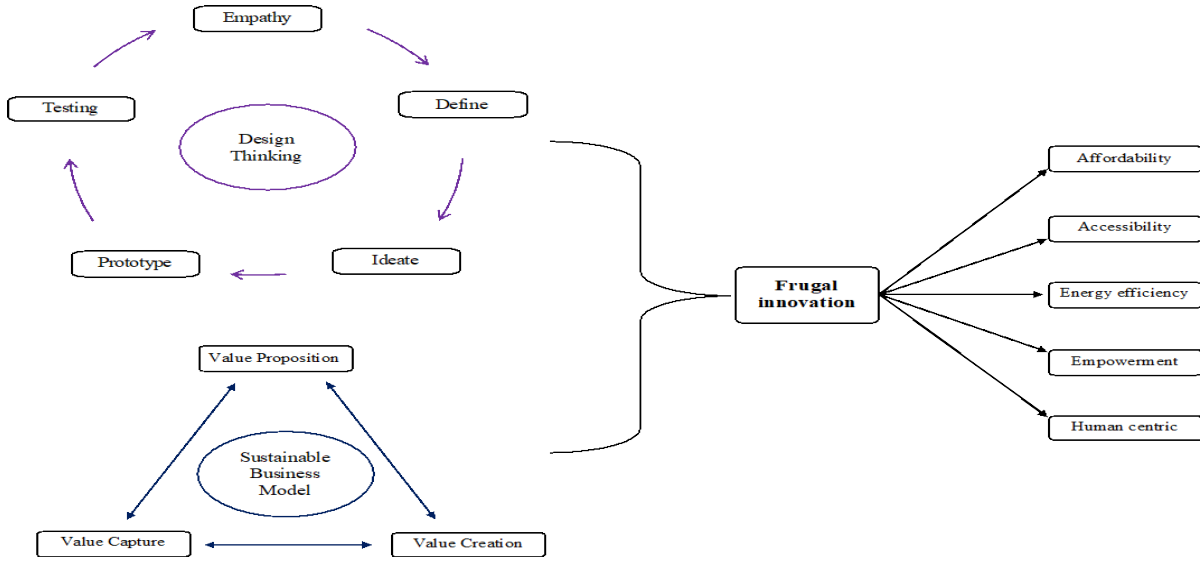


Figure 1: The Analytical Framework

4. Conclusion

The objective of this study was to uncover the desirability, feasibility and, viability of frugal innovation from the lens of design thinking and sustainable business model. The study explored organizations engaged at the grassroots developing human-centered solutions and building a novel sustainable business model. The findings provided a simplified dynamic of frugal innovation, demonstrating a wide range of contextual activities like empathy, define, ideate, prototype, testing, value creation, value capture, and value delivery. Even the research on design thinking, frugal innovation, and sustainable business models have received attention over the years, exploring this concept together for entailing development in the emerging market is still in its infancy. There is a perceptible gap in the existing practice of frugal innovation using design thinking to study the genesis of such innovations. The pairing of 'design' and 'thinking' in design thinking will provide the arena to implement design tools for problem-solving that are not only related to functionality but also to the form of business planning. The theoretical implications of this study lie in uncovering the stages of design thinking for identifying the problems at the grassroots and demonstrating the scope of value delivery and value capture. The study also demonstrated how tenets of design thinking can be applied to small-scale and low-cost innovations.

Organizations engaged at the grassroots have exhaustive knowledge about the rural end-users in emerging markets, when the need arises, they create human-centered solutions making an affordable value proposition for them. This frugal innovation designed through the lens of design thinking is solving problems at the local level which conventional companies have failed to solve. Thus, managers and practitioners need to rethink their strategies for gauging the effects of frugal innovation. Furthermore, this study will make managers, policymakers comprehend the opportunities and impediments linked with the management of frugal innovation. The empirical findings from the study lay the ground for advanced research on the nexus between design thinking and frugal innovation. This study comes with its own set of limitations and outlines pathways for future studies. The study considers three diverse cases of frugal innovation from an Indian context; thus, the findings cannot be generalized to all organizations. New studies can include a larger number of cases from a different geographical context and validate these findings, thereby, generating more insights into the frugal innovation mechanism. The concept of Design thinking and sustainable business model for mobilizing frugal innovation at the grassroots is a new addition to the academic discourse, thus there has been a limited understanding in the context. Future research can delve into how frugal innovation emerges from the ideation to the prototype stage would be interesting to explore.

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The Efficient Applicability Limits of Social Entrepreneurship

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Abstract: The efficiency of social entrepreneurship depends on the ability of social enterprises to be sustainable. So, this paper implies deriving the efficient applicability limits of social entrepreneurship in terms of their sustainability. The more sustainable a social enterprise is, the wider its efficient applicability limits are. So, it's a novel approach towards studying the efficiency of social enterprises and the limits of their efficient applicability. The case study approach is used to estimate these limits, and three social enterprises are taken for this analysis, namely, APOPO, Benetech and Conserve. The insights of this paper suggest that the burden on social enterprises should be dosed, because their viability depends, in most part, on implementing the respective social policy. Under the excessive burden on social enterprises they could be destroyed, whereas under the insufficient burden some of their capacities could be idle, and that would suggest that they are inefficient. Eight factors of increasing the efficient applicability limits of social entrepreneurship (namely the state support of social enterprises, the aid provided for social enterprises by the private sponsors, the support for social enterprises provided by the international organizations, the support for social enterprises provided by the external sources of loan and emission financing, creation of special economic zones in different innovation centres, in which social enterprises are formed, using social enterprises as sub-contractors of the private business in the process of social outsourcing, the position of public opinion towards social entrepreneurship, the strategy of designing and marketing the products of social enterprises) were derived. The measures of the state support, enlarging the efficient applicability limits of social enterprises are provided. Also, the creation of special economic zones in the innovation centres, in which social enterprises are formed, is proposed, as well as the mechanism of subsidizing social enterprises by the state and creating some special conditions for the microfinance and social stock markets as the main external sources of financing social enterprises are suggested.

Keywords: Efficient applicability, Social enterprise, Innovation

1. Introduction

In recent decades, there has been growing interest towards the topic of social entrepreneurship in the scientist community. It is connected primarily with the fact that it presents a new, innovative way of solving social problems under the environment of decreasing public expenditures by the state, and so it is rather an efficient tool of substitution of the state in different social sectors. For a long time the problem of efficient applicability of social entrepreneurship wasn't considered in economic studies, because within the ideological aspect the neoliberal approach towards studying social entrepreneurship predominated. And this neoliberal aspect doesn't allow to consider social entrepreneurship in its inseparable link with the public policy, but the neoliberal economists consider it separately from the state and social system, they consider it as mere ordinary private business maximizing its profit. For example, in such manner it is considered by A.A. Moskovskaya and her colleagues from the Higher School of Economics of Russia (Moskovskaya, 2011). Though in order to use this tool adequately one should determine the limits of efficient applicability of this phenomenon, since under the excessive burden on social enterprises, the risk of degradation of this phenomenon emerges, and in the case of insufficient burden its incomplete development takes place. In most part, the efficiency of social enterprises depends on their ability to be financially sustainable, so their limits of efficient applicability should be determined on the base of their data on their sustainability. The more sustainable a social enterprise is, the wider limits of efficient applicability it has.

In terms of the efficient applicability limits of social entrepreneurship, one can derive two aspects of this phenomenon: sectoral and territorial. The sectoral aspect implies using this phenomenon in respective sectors, which could be in line with the mission of social enterprises. The territorial aspect implies deriving the regions, in which social entrepreneurship is developed to the greatest extent, and that implies deriving the position of local authorities concerning social enterprises, their awareness about the large potential of social entrepreneurs and their readiness to stimulate the development of social enterprises.

2. The Sectoral Aspect of the Efficient Applicability Limits of Social Entrepreneurship

Within a context of sectoral attachment in Russia the most part of social enterprises works in the sectors of education, healthcare and social services. Such sectors as culture, sports, leisure and entertainment are at the third place, according to their popularity. Further processing industries, other services, trade and maintenance take place following the industries staying at the third place (see Table 1). Such industries as mining, household activities, public administration, military security and social care are the least popular industries within the area of social entrepreneurship (Soloviova, 2023). Meanwhile, one should mention that during the period of 2020-

2022 the amount of social enterprises increased in almost all the sectors of economic activities. The processing industries and storage and transportation, excluding the insurance, financial activities and electricity supply due to the low base effect, demonstrate the most significant rates of increase (about three-fold increase). Social entrepreneurship is less active in its development in agriculture and forestry (111%), as well as in the activities of hotels and public catering (149%) and the real estate operations (182%) (Soloviova, 2023). These facts can be explained by the approval that social enterprises have a certain social mission that is focused on executing a special social impact, and this impact can be realized best of all in such sectors as education, healthcare and culture. All the rest sectors are less important in terms of producing the social impact. As a whole, the sectoral structure of social entrepreneurship within the Unified register of the subjects of small and medium-sized entrepreneurship corresponds with that of social entrepreneurship, according to the statistical data of competition "Social entrepreneur", which is held by the Our Future Foundation (OFF, 2020). The sectoral structure of social entrepreneurship is such surprising that one should ask questions: "Why should one use social entrepreneurship, in most part, in education, healthcare and public services? And why shouldn't it be used in mining and oil and gas industry?" The answer to these questions underlies the assumption that using social entrepreneurship in oil and gas industry wouldn't be worthwhile, since its main task is not the profit maximization and rent-seeking, but solving certain social problems on the base of innovative approach. It is the maximum presence of social entrepreneurship in these sectors that determines the limits of its efficient applicability.

Table 1: Distribution of social enterprises of the Russian Federation by types of economic activity, 2020-2022

The section of economic activity classification	2020	2021	2022
Education	662	1864	2013
The activity in the field of healthcare and social services	873	1824	1908
The activity in the field of culture, sports, organization of leisure and entertainment	442	1168	1280
Manufacturing industries	237	577	606
Providing other types of services	158	446	474
Wholesaling and retailing; maintenance of vehicles and motorbikes	152	380	412
The administrative activity and associated supplementary services	80	158	173
The activity of hotels and catering units	61	147	164
The professional, scientific and technical activities	65	138	150
The activity in the field of information and communication	47	114	124
The activity in the field of the real estate operations	37	57	55
Transportation and storage	33	53	54
Construction	27	39	49
Agriculture, forestry, hunting, fishing and fish farming	18	34	42
Water supply, sewerage, organization of waste management and recycling	9	11	0
Financial and insurance activities	1	3	4
Provision of electrical energy, gas and steam; air conditioning	1	5	4
The activity of households as employers; undifferentiated activity of private households on producing goods and services for their own consumption	1	2	2
Public administration and provision of military security; social security	0	2	2
Mining	0	1	1
Total	2904	7023	7517

Source: Data of the Federal Tax Service of Russia (2020-2022)

3. The Territorial Aspect of the Efficient Applicability Limits of Social Entrepreneurship

The territorial aspect implies deriving the regions, in which social entrepreneurship is developed to the greatest extent, and that implies deriving the position of local authorities concerning social enterprises, their awareness about the large potential of social entrepreneurs and their readiness to stimulate the development of social

enterprises. So, for instance, in Russia in such subjects as Moscow, the Moscow region, the Khanty-Mansiysk Autonomous Area, the Republic of Bashkortostan, the Nizhny Novgorod Region and the Primorye Territory the positions of local authorities towards social enterprises is active in the sense that they rather actively support social entrepreneurship initiatives at the local level, providing subsidies for them and other kinds of the state support, without which the development of social entrepreneurship wouldn't attain such great results (see Table 1). So, for instance in the Republic of Bashkortostan in 2021 within the national project "Small and medium-sized entrepreneurship and the support of individual entrepreneurial initiative" 147 social entrepreneurs of the Republic got the measures of state support, which amounted to 70 million rubles, the amount of grants was from 100 to 500 thousand rubles (RBC Ufa, 2022). Later this programme was prolonged as it was in high demand. Speaking about other measures, one can't help but mention that the municipalities provide the financial support for the entrepreneurs to reimburse the costs incurred by them. It is the competition procedure, and social entrepreneurs have the priority in it. The Bashkir microloan company provides loans at preferential rates, and the category of social entrepreneurs is allocated into the special category, and the annual interest rate of this company is about 3.5% for social enterprises. The Republic of Bashkortostan and the Regional Leasing Company, that hasn't allocated the category of social entrepreneurs into the special category before, agreed that social entrepreneurs would have preferential rates. In terms of the size in Russia the microenterprises predominate over other enterprises (Soloviova, 2023), and first of all it is connected with the fact that it is easier for the organizations that have small sizes to meet such criteria as the necessary share of employees belonging to the category of socially vulnerable people and the necessary share of expenditures connected with their wages. The significant decrease of amount of social enterprises (so, for instance, in the Tambov region in 2022 it was 0, as compared with 2021 when it was 7 in the region (see Table 2)) can be explained by the fact that these enterprises decided not to confirm their status because they didn't benefit from inclusion into the register before.

Table 2: Region leaders and region outsiders according to the amount of social enterprises in the regions of Russia in 2020-2022

2020	2021	2022
5 region leaders		
The Moscow region (292)	The Moscow region (711)	The Moscow region (774)
The Khanty-Mansiysk Autonomous Area (291)	The Republic of Bashkortostan (347)	The Republic of Bashkortostan (391)
The Republic of Bashkortostan (194)	The Nizhny Novgorod Region (343)	The Nizhny Novgorod Region (343)
Moscow (192)	The Khanty-Mansiysk Autonomous Area (296)	The Khanty-Mansiysk Autonomous Area (296)
The Nizhny Novgorod Region (165)	The Primorye Territory (290)	The Primorye Territory (290)
5 region outsiders		
The Kaluga region (0)	The Republic of Tuva (9)	The Republic of Tuva (9)
The Kostroma region (0)	The Republic of Dagestan (8)	The Republic of Dagestan (8)
The Republics of the North Caucasus (except Chechnya) (0)	The Tambov region (7)	The Republic of Ingushetia (7)
The Republics of Kalmykia, Mordovia and Tuva (0)	The Republic of Ingushetia (7)	The Kostroma region (5)
The Ulyanovsk, Kurgan regions, the Jewish Autonomous region (0)	The Kostroma region (3)	The Tambov region (0)

Source: Soloviova (2023).

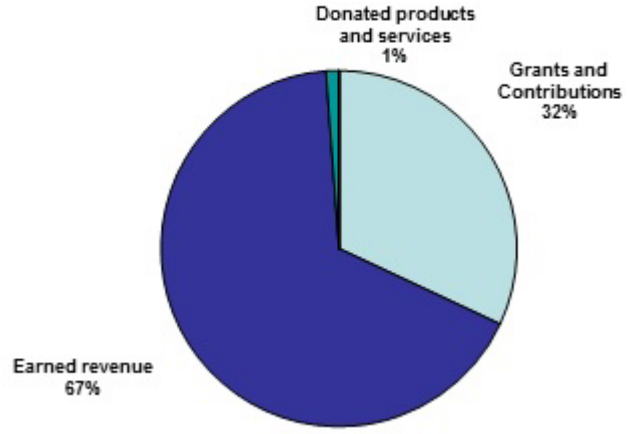
As a whole, the territorial aspect shows that the efficient applicability limits of social enterprises are wider in the regions, where the local authorities actively support social entrepreneurs, and they are narrower in the regions, where social entrepreneurs don't find any benefits from inclusion into the respective register. It is the support of local authorities at different levels that is the main factor of increasing the limits of efficient applicability of social entrepreneurship in the respective regions within the territorial aspect of this problem.

4. Three Cases of Determining the Efficient Applicability Limits of Social Enterprises

In order to determine the efficient applicability limits of social enterprises, it is sufficient to present just three examples characterizing the level of their financial sustainability, and, hence, characterizing the level of their

efficient applicability. Here three cases of social enterprises in terms of their efficient applicability limits are presented, allowing for the fact that in each of them a special factor of increasing the efficient applicability limits of social enterprises is presented. So, for instance, in the first of them the significant impact of the aid provided by the external private sponsors is emphasized, in the second one the significant influence provided by the governmental sources of financing is noted and in the third one a special role of creating the structure division on the development of design and marketing strategy of social enterprise is highlighted.

The first example is connected with the social enterprise "Benetech", which can be named as the most progressive social enterprise in the USA. This enterprise was initially named "Arkenstone" and it was engaged in manufacturing a special reading machine for the blind people. Later the company sold this business to a commercial distributor and focused on producing the software such as, for instance, Bookshare, Human Rignts, Route 66 and Benetech labs. Its total amount of financial sources consisted of 33% of its external sources and of 67% of its own income in 2008 (see Figure 1). Later, in 2017 its total income from software sales was 10.078.925 dollars (see Table 3), which is approximately 13-fold greater than the total sum of the donations, that were made to it. So, the limits of efficient applicability of this social enterprise are rather wide reflecting the high level of its financial sustainability. But at the same time this enterprise had a large share of the financial support provided by private sponsors, namely grants and contributions from the private sources of financing. It was at the level of 32% of the total amount of financial sources of Benetech's projects in 2008 (see Figure 1).



Source: Fruchterman (2008)

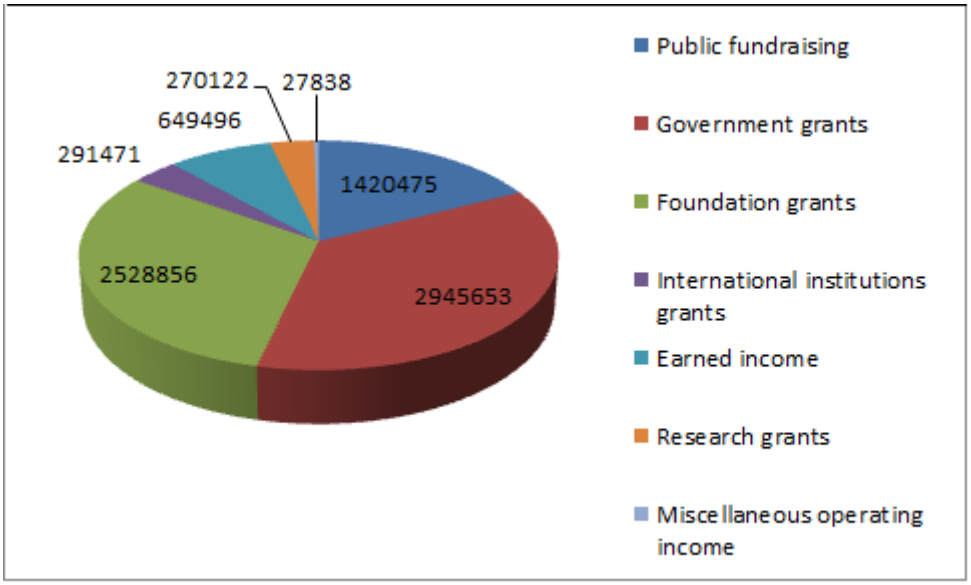
Figure 1: Financial sources of Benetech in 2008

Table 3: Financial support and income of Benetech in 2017

Financial support or income	Value (US dollars)
Donations	793.147
Services/products provided	412.078
Payment for engineering and consulting services	5
Income from software sales:	
Bookshare	9.439.665
Human rights	569.102
Route 66	99
Benetech labs	70.059
Interest income	6.413
Rental income	22.392
Total financial support and income	11.312.960

Source: Benetech (2018)

The second example is connected with the social enterprise “APOPO” from Mozambique. This enterprise is engaged in landmine and tuberculosis detection, and is a very successive social enterprise, but it always needs some financial support from the external sources. During the period of twenty-one years since its foundation APOPO has developed into a mature organization. 2018 was marked by great progress – not only expanding its existing landmine detection program in Cambodia and securing independent registration in Angola but also enabling it to reach even more tuberculosis patients in Africa with the incredible expansion from 73 partner hospitals in two countries at the beginning of the year to 142 hospitals in three countries at the end of the year. The structure of financial sources of this company is rather diverse. In 2022 more than 90% in this structure consisted of external sources, and the share of the government grants was the largest and comprised 2945653 US dollars, and only 0.5% were of its own income (APOPO, 2022) (see Figure 2). As the definition of this phenomenon says, “a social enterprise is an organization that applies commercial strategies to maximize improvements in financial, social and environmental well-being” (Wikipedia, 2013). It can be structured as a charity or non-governmental organization and can require some external sources of financing during the periods of its formation. According to the authors of the website Social Change Central (2024), there are four stages of a social enterprise, namely the incubation stage, the birth stage, the nurturing stage and the maturity stage. At the nurturing stage the social entrepreneur is searching for grant opportunities and reaching out within different networks to get barriers moved. At this stage a social enterprise is not self-sustainable. So, the limits of efficient applicability of this enterprise at this stage can be high, but only due to the massive government support, by means of the government grants. This enterprise can reach some degree of sustainability only at the maturity stage. As the authors of the aforementioned website say, addressing to the social entrepreneur running this enterprise at the fourth stage: “Your impact is where you wanted it to be, your finances are stable, and you have a solid and well-functioning team” (Social Change Central, 2024).



Source: APOPO (2022)

Figure 2: The structure of financial sources of APOPO in 2022 (in US dollars)

The third example is connected with Conserve India. It was established in 1998 as an NGO, and it emerged as a social entrepreneurship company in 2004. Conserve has developed a proprietary handmade process for transforming everyday plastics like bags, chips packets, and biscuit wrappers into "Handmade Recycled Plastic," a novel fabric that may be used as a form of vegan leather, for fashion accessories, home furnishings, and even to make low-cost housing tiles. It also works to create valuable apparel from plastic waste. “We started collecting plastic waste that has no resale value and so nobody else was collecting it, from the Yamuna River and other diversified waste streams which otherwise would have ended up in the ocean or landfills. Landfills are disease's breeding grounds, and they are wreaking havoc on the unorganized sector of the ragpicker population who live right next to landfills” says Ms Kanika Ahuja, Director of Conserve India (AIM2Flourish, 2022). Kanika Ahuja's parents started Conserve India as a non-profit organization, and Kanika has worked for Conserve since she was a child. She was involved in several of Conserve India’s initiatives to clean up plastic garbage from slums, land fields, and water bodies, which posed a severe threat to the environment and society. Kanika quit her lucrative

corporate job and joined Conserve India full-time in 2016. She launched a for-profit brand LIFAFFA for marketing and selling Conserve products made of upcycled plastic with a global reach. LIFAFFA, the marketing arm of Conserve India is responsible for designing and marketing the products. LIFAFFA sells its products through online platforms. The quality and aesthetics of the products helped the company to attain a fiscal year revenue of 100,000 USD in 2021 amidst the Covid-19 pandemic. The company was profitable and had faster growth, with a Compound Annual Growth Rate of 30% before the pandemic. So, the limits of efficient applicability of this social enterprise are rather wide due to the strategy of designing and marketing the products.

5. The Main Financial Sources of Social Enterprises

So, we can derive five main kinds of financial sources of social enterprises: conventional financing, social investment, government contracts, crowdfunding and internal resources. Consider the estimates of their real availability for social enterprises on the example of the USA (presented below in Table 4).

Table 4: Comparison of different financial options for social enterprises

Financial Options	Timeliness	Amount	Stability	Mission	Distance
Conventional Financing	OK	Good	OK	Poor	Good
Social Investment	Poor	OK	Good	Good	OK-Varies
Government Contracts	Poor	OK	Poor	Good	OK
Crowdfunding	Good	Poor	OK	Good	n/a
Internal Resources	Good	OK	Good	n/a	Good

SCALE: Poor = smaller / worse, OK = medium, Good = higher / best

Source: Tulchin, Yi-Han Lin (2012)

Factors defined:

Timeliness: level of effort needed to obtain the cash

Amount: Funding levels likely from that source

Stability: Availability of capital over time

Mission: How motivated the option is by an enterprise's purpose

Distance: How far the option is to the U.S.

So, we can conclude that in terms of the level of effort needed to obtain the cash, that is of the ability of receiving it in time, the conventional financing is the most available way, and social investment and government contracts are less available in that case. But in terms of funding levels social investment and government contracts are rather available, though that is not the case for crowdfunding.

Social enterprises are rather vulnerable in terms of their presence at the market, because they experience a large deficit of financial sources. At the same time it is hard to overestimate the benefit that they provide for the society as a whole, because in terms of social usefulness and social value that they provide they can cover the amounts that are invested in them by the external sponsors. In this sense they are really very effective enterprises, so the financial aid which is provided for them by the external sources is justified.

6. The Main Factors of Increasing the Efficient Applicability Limits of Social Entrepreneurship

After doing this analysis we can derive 8 main factors of increasing the efficient applicability limits of social entrepreneurship:

1. *The state support of social enterprises*: Beside the example of successful social entrepreneurship state support in Bashkortostan, one should also highlight the special programme of supporting social entrepreneurs in the USA during B. Obama presidentship named "Pay for success", according to

which, a certain sum was returned to the investor in the case if the target of the project he invested in was fulfilled, the sum he invested in was returned to him and he would get a certain premium, if the target of the project was overfulfilled, but he wouldn't get anything, if the target of the project wasn't fulfilled (Vanroekel and Greenblatt, 2013). In the process of financing this project the finances of taxpayers were involved, and that meant that this project was financed at the expense of the state budget.

2. *The aid provided for social enterprises by the private sponsors*: At the initial stage of social enterprise formation the aid provided by the private sponsors, such as the Our Future Foundation for Regional Social Programs providing interest-free loans for social entrepreneurs, plays an important part in this process.
3. *The support for social enterprises provided by the international organizations:* At different stages of formation and development of social enterprises the international organizations, such as, for instance, UNESCO, Global Development Group and Hawk Rock Foundation, play a special role in these processes.
4. *The support for social enterprises provided by the external sources of loan and emission financing:* Such institutions as micro-financing organizations and social stock exchange play a crucial role in the development of social enterprises in those countries, where they emerge. So, they need to be derived in a separate section.
5. *Creation of special economic zones in different innovation centres, in which social enterprises are formed:* The special economic zones should be formed in such centres as “Skolkovo” (in Russia) with special preferential tax rates for individuals and organizations that invest in social enterprises.
6. *Using social enterprises as sub-contractors of the private business in the process of social outsourcing:* Social outsourcing is the process of transferring the enterprises of social infrastructure to the management of the private sector companies. This process was named “Race to the bottom” in the economic literature, because the private sector companies pursued, first of all, their own interests, not the interests of these enterprises, and saved on everything (In the Public Interest, 2014). As a result, these enterprises were moved to the regions, where the real estate was cheaper than that at the initial place, but where the crime rate was higher than there. This resulted in numerous facts of rapes of the children’s home wards, and the staff was underpaid, so only low-skilled employees could be hired. Social enterprises couldn’t compete on equal terms with a big business in this process, because they had limited financial resources at their disposal, and so they had to be content with the role of sub-contractors, being in service of the big business and performing those functions which were left by the big business for these enterprises (Williams and Richardson, 2012). But even being in this role, they were faithful to their responsibilities and didn’t save on their costs if it threatened to turn into a real catastrophe. On the contrary, due to their main mission that was focused on solving social problems on the base of innovative approach, they solved these problems quite successfully and without any damage for those projects, which were provided for them under the sub-contractual management, which is the most important thing there. So, the role of sub-contractors in service of the big business is one of the variants of increasing the efficient applicability limits of social entrepreneurship until the level of qualitative management of the social infrastructure entities which were transferred to social enterprises on the base of sub-contracts.
7. *The position of public opinion towards social entrepreneurship:* One should take into consideration the position of public opinion towards this topic. To what extent does the public opinion perceive the feasibility of social entrepreneurship? The results of public opinion polls comply with the picture of social entrepreneurship development in different regions. Respectively, in those regions where the level of social entrepreneurship development is relatively low, less people can say that they are familiar with this concept. So, for instance, according to the study of the researcher group ZIRKON (2008), in the Central, the Northwestern, the Siberian and the Far East Federal Districts 7-10% of the respondents answered confidently that they knew what this concept meant. As compared with them, in the Southern, the Volga and the Urals Federal Districts the quantity of the people knowing something about this phenomenon constituted only 4-5% of the respondents.
8. *The strategy of designing and marketing the products of social enterprises:* As we can see from the experience of LIFAFFA, a good strategy for designing and marketing the products can help social enterprises to develop. So, the case of Conserve India can be a good example on this topic.

7. In Conclusion

So, we can summarize our conclusions concerning the definition of the main factors of increasing the efficient applicability limits of social entrepreneurship. First, a very important role of the state support of social enterprises in this process at different levels is noted. Second, a special role of private sponsors in this process is derived. Third, an important role of international organizations in the process of promotion and support of social entrepreneurship is emphasized. Fourth, a huge role provided by such intermediaries as microfinance institutions and social stock market in this process is noted. Fifth, the conclusion stating that in order to increase the efficient applicability limits of social entrepreneurship, one should create the special economic zones in the innovation centres is derived. Sixth, the efficient applicability limits can increase under involving these enterprises into the process of performing the roles of sub-contractors in service of the big business in the process of social outsourcing. Seventh, in order to emerge in new regions, social enterprises should be supported by the public opinion in these regions. And finally the last conclusion is the necessity to create within a social enterprise the special division on the development of designing and marketing strategy for this enterprise.

The actual efficient applicability limits of social entrepreneurship in terms of its sectoral and territorial specifics are outlined in this paper. In terms of the sectoral specifics, the most significant presence of social entrepreneurship in such sectors as education, healthcare and culture is noted and the least significant presence of it in such sector as mining is noticed, and that can be explained by the special mission of social entrepreneurship focused on maximization of the social value produced by it, and not on rent seeking and profit maximization. In terms of the territorial specifics the conclusion that the most significant part of social enterprises contained in the specified regions is due to the active governmental policy at these regions is substantiated. Also the main factors increasing the possible efficient applicability limits of social entrepreneurship in terms of the special policy on forming the respective institutions of supporting social entrepreneurship at different stages of its evolution are provided.

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Robert K. Merton and Innovation-Related Topics: Three Theoretical Ideas

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Abstract: As in other disciplines, such as organization science, sociology, and economics, there are good reasons for scholars in innovation and entrepreneurship research to revisit the classics within and outside their own research fields. Robert K. Merton (1910–2003) is not usually explicitly connected to innovation research, but to fields such as the sociology of science and knowledge. However, his scholarly productions include texts relevant to innovation and entrepreneurship. In 1935, he published on invention and innovation in American industry, and in 1938, he put forward the idea of innovation as deviant behavior or nonconformist adaptive behavior (Merton 1938a). In 1945, he began writing about the concept of serendipity, which he later discussed several times. This paper discusses how theoretical insights from Merton may inspire entrepreneurship, creativity, and innovation research. The discussion is framed around Merton's innovation-related ideas and their relevance today, based on 20–25 Merton publications from 1934 to 2004 drawn from his larger scholarly production. The paper extracts three main examples of Merton's theoretical ideas and insights. The first is his interest in simultaneous independent discoveries (Merton 1961a; 1961b), which has later been seen as a zeitgeist perspective on (scientific) creativity. The second is his view of innovation as deviant behavior and an adaptive response (Merton 1938), which is relevant to, among others, discussion of the dark side of innovation. The third is his interest in the idea of serendipity in scientific discovery (Merton 1945; 1948a), which is relevant today in relation to entrepreneurial opportunity and accidental innovation.

Keywords: Robert K. Merton, Accidental innovation, Invention, Discovery, Scientific creativity, Deviant behavior

1. Introduction

Robert K. Merton, the founder of the field of sociology of science, contributed to several fields, and the literature on his contributions is extensive. As in other disciplines, such as organization science, sociology, and economics (e.g., Becker, Knudsen, and March 2006; Adler 2009; Swedberg 2009), exploring classics within or outside the innovation field may be useful. Good reasons exist for exploring Merton's scholarly production in relation to entrepreneurship and innovation research. As will be shown, he made several contributions that can be connected to innovation-related topics. To the examples above (e.g., serendipity, deviant behavior, invention), several can be added, such as the role of sociological factors in the rise of science and inventions (Merton 1935b; 1938b), which he addressed in his doctoral dissertation, which "dealt, in part with the sources of innovation in science and technology" (Zuckerman 2010, p. 260). His publications are not much explored within such a frame of innovation-related topics. However, in the contemporary literature on different innovation-related topics, at least three have a possible connection back to Merton: serendipity in entrepreneurship and innovation (Austin, Davin, and Sullivan 2012; Dew 2009; Murayama, Nirei, and Shimizu 2015; Garud, Gehman, and Giuliani 2018; Busch 2022; Busch and Barkema 2022; Busch and Grimes 2023; Fultz and Hmieleski, 2021), zeitgeist in relation to the selection of new ideas (Simonton 2004; Czarniawska 2009), and discussions on the dark side of innovation (e.g., Coad et al. 2021; Biggi and Guiliani 2021). Motivated by these observations, this paper explores and discusses some of Merton's innovation-related ideas by asking: What are his innovation-related ideas about—and to what relevance today?

Methodologically, the theoretical discussion is based on 20–25 Merton publications selected from his large scholarly production. His scholarly production between 1934 and 2004 comprised 20 books, more than 150 articles, and numerous introductions and prefaces. One book was written in 1958 and published posthumously in 2004 (Merton and Barber 2004). The search process comprised of exploring and reading his publications, especially those that are connected to his sociology of deviance and sociology of science. In addition, secondary literature was explored to check for alternative interpretations and to be sure that important and early publications were included in the theoretical discussion. The selection process was about selecting ideas to focus on and of selecting early Merton-publications on these theoretical ideas. In some cases (e.g., serendipity), Merton developed his thinking on that idea. Therefore, several later publications were included in the discussion. In other cases, Merton revised, elaborated on, and revisited earlier publications (e.g., Merton 1938a). Since some publications are later reformulations (e.g., his ideas regarding deviance), the publication list is reduced during the process. The references to contemporary literature that illustrate the relevance of his ideas are also kept to a minimum. The number of publications, in other words, could be seen as a limitation of this discussion—but they are examples.

Further, the paper is based on the argument that science and sociology of science are relevant for understanding creativity and innovation and that analogical reasoning between these two domains is relevant (Simon 1985). Discoveries can be seen as a type of innovation or scientific innovation per se (Mulkay 1972). Interestingly, though mentioned in the context of the antecedent conditions of innovations, Merton (1961a) cited Bacon, who said, "All innovations, social or scientific, 'are the births of time'" (Merton 1961a, p. 473), which also illustrates this view. Discoveries can be seen as equivalent to inventions and new theoretical formulations (Merton 1967). A scientific law can thus be compared to a new business idea, organizational idea, or piece of technical equipment. Though there are other views on the innovation process (e.g., Schumpeter 1939), several emphasize a connection between scientific discoveries, basic research, inventions, and innovation (e.g., Dosi 1988, p. 1136), for example, that science was the origin of synthetic chemistry, the transistor, and bioengineering. Others use the term science-based innovation (Garud et al. 2018, p. 125), which implies the science–innovation connection. Finally, there are subfields concerned with the commercialization of academic research, technology transfer, and academic spin-offs.

The paper is organized as follows: The next section briefly surveys Merton's ideas that are relevant to this theoretical discussion. Then, the three selected ideas are presented and discussed. Finally, the paper concludes and suggests future studies.

2. Merton on Invention, Innovation, and Scientific Discoveries

Merton (1935a), in one of his first articles, investigated the causes of variation in the rate of industrial invention, for example, the sociocultural factors influencing the rate of invention within specific industrial fields: "It is with … the rate of invention within specific fields of industry and the rate of adoption of inventions – that this paper is most directly concerned" (Merton 1935a, p. 455). He referred to Schumpeter (1926) when he discussed the individuals in control of a given industry and attitudes to introducing innovations/inventions (1935a, p. 468). Merton (1935a) used patent data to study the rise and fall of innovation by industry.

In 1938, Merton published both his doctoral thesis (Merton 1938b), originally dated 1935 (Merton, 1935b), and an article entitled "Social structure and anomie" (Merton 1938a). In the latter, he used the term "innovation as deviant behavior." His doctoral thesis was on science as a social institution. In this study of the rise of science in 17th-century England and how ascetic Protestantism (unanticipated) contributed to the rise of scientific thought, he set out to analyze the scientific revolution of the 17th century. He dismissed the Carlylean heroic explanation that this arose from "the simultaneous appearance of geniuses" (Merton 1938b, p. 364) and wrote that the "more plausible explanation is to be found in the combination of sociological circumstances" (p. 364). In his analysis of science and military technology, he used words such as entrepreneur, innovation, intellectual genius, scientific genius, and century of genius. He found that need is important as a source of invention only if it appears in a "cultural context … which places a high value upon innovation, which has a tradition of successful invention and which customarily meets such needs through technological invention rather than through other expedients" (1938b, p. 517). He concluded that the growth of science was not due to the chance concentration of a handful of geniuses, but that "the cultural soil of seventeenth century England was peculiarly fertile for the growth and spread of science" (1938b, p. 597).

Merton's interest in the concept of serendipity came out of his exploration since 1934 of how and why intentional social actions often had unintended consequences (Shulman 2004). In 1936, Merton (1936) published an article in which he discussed unanticipated and unintended consequences, a topic he followed up in 1940 in relation to bureaucratic structures (Merton 1940) and in several other publications (Merton 1998). This led him back to study science as a social institution and to an interest in the role of the unanticipated in scientific discovery (Shulman 2004). Serendipity became related to this problem (Merton and Barber 2004, p. 141). In 1945, Merton described the serendipitous component of research as "the discovery, by chance or sagacity, of valid results which were not sought for" (Merton 1945, p. 469n). He noted that fruitful empirical research may also originate new hypotheses, and three years later, he wrote that under certain conditions, a research finding gives rise to social theory. He said that the "serendipity pattern refers to the fairly common experience of observing *an unanticipated, anomalous and strategic* datum which becomes the occasion for developing a new theory or for extending an existing theory" (1948a, p. 506, italics in original). Each element of the pattern is explained by Merton (1948a), and he wrote that "Serendipity is here connected to unanticipated consequences" (p. 506). Merton and Barber wrote a book on serendipity in 1958 that was published posthumously (Merton and Barber 2004). It was a study of the travels and adventures of the serendipity concept since Horace Walpole first used it in a letter in 1754, spread through time and domains, such as science, over the following 200 years. With the pursuit of serendipity came the book *On the Shoulders*

of Giants (Merton 1965/1993), which traced the use and reception of an aphorism across fields and centuries. Serendipity is an aphorism that is about discovery, invention, and accumulation of knowledge (Merton 1965/1993). Both books represent studies of sociological semantics (Zuckerman 2010).

Merton was interested in discoveries, inventions, and theoretical ideas. In 1967, Merton (1967) discussed the early and later formulation of ideas, continuities, and discontinuities in theoretical ideas, which he compared somewhat to multiples (discoveries) in physical and biological sciences (p. 20). He also used a vocabulary to designate varying degrees of resemblance between early and later formulations of scientific ideas and findings. He was interested in multiple discoveries in science by scientists working independently of one another (Merton 1961a, 1961b; 1963), as well as the role of genius in science (1961a; 1961b), which will be discussed in Section Three. This interest also included priority disputes among scientists (Merton 1957) (i.e., disagreements among scientists involved in multiple discoveries over who deserved priority). For example, Isaac Newton raised charges of plagiarism against Leibniz regarding who should get credit for inventing calculus. Furthermore, the theory of natural selection was developed practically identically by Alfred Russel Wallace and by Charles Darwin (Ogburn and Thomas 1922, p. 83), a dispute that "stabilized at that point, with due credit to both" (Merton 1957, p. 653). Later, Merton (1968) proposed a Matthew effect in science (i.e., that the more eminent scientist in a collaboration [paper or project] or cases of independent multiple discoveries tends to get most credit).

Merton had many more ideas and concepts than included here. These include the theorem of functional alternatives (equivalents or substitutes): "just as the same item may have multiple functions, so may the same function be diversely fulfilled by alternative items" (Merton 1949c, p. 34, italics in the original). He later noted that "it has often been suggested that the functional equivalent of a patent office be established in science to adjudicate rival claims to priority" (Merton 1957, p. 654), which he also raised in discussing scientific genius (1961a; 1961b). Finally, in discussing the innovative organization, Merton (1965) pointed to the importance of context. In the same publication, he defined the "*act* of innovation" as a "socially valued departure from past practice or thought" (p. 50).

3. Three Relevant Theoretical Ideas

This section discusses three theoretical ideas extracted from Merton's work in relation to this paper's topic.

From multiple discoveries to a zeitgeist perspective

The writer and politician Victor Hugo, who lived parts of his life in Paris, is often attributed with a quote that underlines the power of ideas when they resonate with the zeitgeist. One variant of this quote is that nothing is so powerful as an idea whose time has come. The term and the meaning of zeitgeist can be traced to Goethe in 1827 (Boring 1955), and Campbell (1960) used the term "simultaneous independent invention" early on (p. 386n). Illustrating this phenomenon in relation to theoretical thought, Penrose (1959) noted indirectly that "after having laboriously worked out for myself what I took to be an important and 'original' idea, I have often had the disconcerting experience of subsequently finding the same idea better expressed by some other writer" (p. 2n). She pointed implicitly at a common problem of multiple discovery—several people can come up with the same discovery or formulation independently, which is something noted by others (e.g., Kroeber 1917): "[a] phenomenon that many inventions have been made two or more times by different inventors, each working without knowledge of the other's research" (Ogburn and Thomas 1922, p. 83). Famous examples of multiples are Newton/Leibniz, Darwin/Wallace, the discovery of the law of genetic inheritance by Gregor Mendel, Hugo de Vries, Carl Correns, and Erich von Tschermak (Simonton 2004), and the inventions of the airplane and the telephone (Ogburn and Thomas 1922).

Merton (1961a) further developed the cultural view of discovery from Ogburn and Thomas (1922) in particular and referred to their compilation of some 150 cases of independent discovery and invention, where "they concluded that the innovations [!] became virtually inevitable as certain kinds of knowledge accumulated in the cultural heritage" (Merton 1961a, p. 475). Merton used the word multiple for the "multiple and independent appearance of the same scientific discovery" (1961a, p. 475) when he (Merton and Barber, in Merton 1961s) studied 264 such multiples. He (1961a, p. 477) argued that "all scientific discoveries are in principle multiples, including those that on the surface appear to be singletons" and "such occurrences suggest that discoveries become virtually inevitable when prerequisite kinds of knowledge and tools accumulate in man's cultural store" (Merton 1961a; 1961b; 1963, p. 237).

Merton also discussed the conception of scientific genius (Merton 1961a; 1961b), which he first addressed in his doctoral dissertation (1938b). He observed that those of "great scientific genius will have been repeatedly

involved in multiples … because the genius will have made many discoveries altogether" (Merton 1961a, p. 484). Indeed, the "men of scientific genius are precisely those … whose work in the end would be eventually rediscovered. These rediscoveries would be made, not by a single scientist, but an entire corps of scientists" (p. 484). The single scientific genius thus becomes, according to Merton, "the functional equivalent of a considerable array of other scientists of varying degrees of talent" (1961a, p. 484; 1963, p. 249). Merton thus had a functional interpretation of genius and constrained/defined the genius sociologically rather than psychologically. He argued in another publication that discoveries have been duplicated by less prominent scientists and thus that the "genius is superfluous to a sociological concept of scientific progress" (1961b, p. 306). Further, he wrote that "discoveries and inventions become virtually inevitable (1) as prerequisite kinds of knowledge accumulate in man's cultural store; (2) as the attention of a sufficient number of investigators is focused on a problem – by emerging social needs, or by developments internal to the particular science, or by both" (1961b, p. 306; see also 1963, p. 237).

The argument on multiples was later called "the *zeitgeist* theory of creativity" (Simonton 1979, p. 1603, italics in the original), the zeitgeist perspective on scientific creativity, and a social deterministic interpretation of multiple discoveries (Simonton 2004), in which the individual creator is reduced to being a mere agent of zeitgeist, precluding both the role of chance and genius (Simonton 2004, pp. 10–11). The individual creator is downplayed: "it is the sociocultural system as a whole, embodied as the spirit of the times, which is ultimately responsible for any given technoscientific advance" (Simonton 1979, p. 1603). Conversely, if the perspective has some relevance to the demanding task of scientific discovery, then it could also be relevant for technological solutions, organizational ideas, and business ideas in a time of high availability of prior knowledge and AI-based tools. Attempts to do something new or original may in retrospect just be following an idea whose time has come because the zeitgeist may be more effective than any leader or interest group who attempts to select ideas (Czarniawska and Joerges 1996), similar to cultural heritage (accumulated knowledge) and social developments that may direct "the attention of investigators to particular problems" (Ogburn and Thomas 1922; Merton 1961a, p. 475). The term zeitgeist has therefore been discussed in relation to such a selection of ideas, so-called master ideas, organizational fashion (Czarniawska and Joerges 1996, pp. 36–37), and institutional entrepreneurship and the emergence of institutions (Czarniawska 2009, pp. 427, 438). Certain similarities can also be observed in relation to organizational-level technological innovation. Cohen and Levinthal (1990) talked about accumulated prior knowledge and noted that the accumulation of knowledge enhances organizations' ability to convert this knowledge into further innovations.

Innovation as deviant behavior

The second extracted idea is innovation seen as deviant behavior. Merton (1938a) outlined a typology of deviant behavior that included four modes of adaptation—innovation, ritualism, retreatism, and rebellion—as alternatives to the fifth category of conformity. He perceived innovation as a mode of adaptation—a response or type of behavior (a nonconformist innovative type of behavior) to strains/tensions within social structures. For example, innovation is more likely when the dominant cultural goal is accepted but the avenues for employing legitimate means are blocked, thus exerting pressure or strain toward deviant behavior (p. 678). Merton discussed innovation in relation to business crime and crime (1938a; 1949a), but he did not see it exclusively through the lens of negative deviance. He later stressed that he saw innovation as a "neutral term" (1955, p. 45). Merton can be connected to both innovation with negative connotations (i.e., a negative form of deviance) and innovation with positive connotations or a positive form of deviance (e.g., Mainemelis 2010). For example, Vaughan (1982) argued that that the idea of deviant behavior can be used in relation to unlawful organizational behavior (pp. 1378-1379) and Mainemelis (2010) showed that creative deviance may be important in developing successful ideas.

A contemporary example is research on the dark side of innovation, in which keywords constitute perverse effects, the noxious consequences of innovation (Biggi and Guiliani 2021), and negative and unintended consequences (Coad et al. 2021). While Merton mostly paid attention to behavior (e.g., response, mode of adaptation, and innovative act), this new research is more impact-oriented, even though Merton also indicated that it is not easy to decide whether the outcome is legal, illegal, good, or bad (Merton 1949a). Biggi and Giuliani (2021) referred to Merton (1936) regarding the view that innovations might have unintended direct effects and negative side effects on society and the environment. They identified five strands of scholarly research on the noxious impacts of innovation. One strand was concerned with the dark side of technology acceptance (p. 26), the work-related consequences of telework, and social media. Merton can enrich this discourse through a greater focus on behavior or response than on outcome. Merton's theory focuses on the emergence of patterns of deviant behavior. Finally, Merton can also be an important

contribution to studies of the effect side or outcomes of innovation (unintended consequences). In relation to the topic of dark side of innovation, a couple of contemporary examples can be found in digital platform companies (e.g., Facebook and Uber). Several of these companies have introduced new employment arrangements where much of their workforce is defined as independent contractors rather than employees. The result is new working conditions, and not in favor of the employees-contractors. Another example is Facebook's innovative business model, based on data as resource, which is an element in this company's success. On the other hand, data on user activities may also be used in inappropriate ways. One recent example is Meta's controversial plans to use their users' public posts and images on Facebook and Instagram to train AI tools belonging to the parent company Meta.

Serendipity in science, entrepreneurship, and innovation

As noted in the introduction, recent literature has discussed serendipity in entrepreneurship and innovation (e.g., accidental innovation). For example, Swedberg (2021) referred to Merton's version of serendipity as an alternative approach when he advocated Schumpeter (1934/2021) in relation to creative behavior: "Merton's idea that scientists sometimes stumble on a discovery by mistake (serendipity)" (Swedberg 2021, p. xii). Although Merton was not the first to discover this phenomenon and word (see Merton and Barber 2004), as mentioned, it was a recurring topic during his scholarly production (1945; 1948a; 1965/1993, 1998; 2004), and he devoted a whole book to it (Merton and Barber 2004). Merton's version was that scientists sometimes make discoveries as a result of chance combined with wisdom—what he called serendipity or the serendipity pattern (Merton 1945, p. 469n; 1948a, pp. 506-7), and it was about unanticipated consequences: "Serendipity, which refers to the search for one thing that turns up another, is obviously related to the problem of unanticipated consequences, and was intimately connected with the discovery's absorbing interest" (Merton and Barber 2004, p. 141). Two cited and famous examples of serendipity are Columbus's discovery of America and Fleming's discovery of penicillin in 1928 (Dew 2009), and early mentions of serendipity included Cannon (1940). When Campbell (1960) included the idea of serendipity in his evolutionary model of creative thought, he referred, among others, to Merton. As seen earlier, several later studies referred to serendipity (e.g., Austin et al. 2012; Busch 2022). In relation to scientific creativity, Simonton (2004) favored a chance viewpoint, which includes the phenomenon of serendipity (Simonton 1979, p. 1604). When Dew (2009) wrote about serendipity in entrepreneurship, he referred to Merton and Barber (2004) and said that the "vast majority of research on serendipity involves scientific discoveries" (p. 736). He defined it as "search leading to unintended discovery" (Dew 2009, p. 753), or "some combination of search (directed effort), contingency (favorable accidents), and prior knowledge (sagacity)" (pp. 736). Dew (2009) argued that serendipity plays an important role in entrepreneurship and is a quite prevalent feature of entrepreneurship (e.g., the discovery of opportunities) and that entrepreneurs and entrepreneurship scholars intuitively "conceptualize entrepreneurial opportunity in terms of serendipity" (pp. 735–736). In the contemporary literature on innovation and entrepreneurship, examples are mentioned in relation to new market (Denrell, Fang & Winter 2003; Dew 2009), contexts of high uncertainty such emerging markets (Busch & Grimes 2023), tackling environmental challenges (Busch & Barkema 2019; Busch & Grimes 2023) as well as coming up with list of examples of serendipity in invention and discoveries (Roberts 1989; Austin et al. 2012).

4. Conclusion

As described, Merton was not the first to define all three extracted ideas, but he further developed them. The three extracted ideas are about the role of the spirit of the times (the zeitgeist), deviant behavior (the dark side and unintended consequences), and accidental innovation. These insights could be of interest for scholars interested in the emergence of new ideas, the bright and dark sides of innovation (avoiding pro-innovation bias), and entrepreneurial opportunities (entrepreneurship and opportunity recognition). This relevance can further be seen in Simonton's (2004) presentation of four perspectives or viewpoints on scientific creativity (logic, genius, zeitgeist and chance). He saw Merton as an important representative of the so-called zeitgeist perspective. In fact, Merton early on also discussed genius viewpoints (1938b; 1961a; 1961b) and even chance viewpoints (1945; 1948a; 1965/1993; 1998; 2004). Many of the cited contemporary studies have benefited from Merton, for example, from Merton and Barber (2004). Future studies could explore Merton as a classic source to understand accidental innovation, how the accumulated knowledge store (zeitgeist) may affect new solutions in an age of information availability and AI, and the bright/dark side of innovation in different contexts.

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Business Research and Development: Is There a Substitution Effect of Public Support?

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Abstract: The importance of research and development is reflected in the fact that one of the main priorities of the EU's development policies is increasing spending on research and development in EU member states (EC, 2010). Enterprises do not always have enough internal financial resources to launch their own innovation projects, and therefore they turn to external resource providers (Wang et al., 2016). The paper is aimed at examining the impact of corporate expenditures on R&D from the point of view of their funding sources and analysing the occurrence of the substitution effect of public support for R&D in EU 27 countries. These countries also have the highest level of public financing of research and development, that is, they use the public support of business innovations to the highest extent. The analysis showed that in the EU 27, the substitution effect of public support for research and development is not significant, or rather the complementarity of both types of expenditure prevails at the national level, as public funding of corporate research and development seems to have a positive effect on private research and development and investments. Our analysis is based on available secondary data for 27 EU member states. for a twenty-year observation period (2000-2020). The results have been achieved by using a methodology that includes cluster analysis, panel regression and correlation analysis. We bring new empirical evidence on the relationships between public support and business research and development expenditures. The research results showed the main sources of funding for corporate research and development. It concerns the business enterprises, government and abroad. The cluster analysis determined three clusters, divided according to the structure of the financing of R&D enterprises in EU countries. The results of the cluster analysis were partially in line with the current results of the European Innovation Review. Our findings provide policy implications for the public support policy.

Keywords: R&D funding, Public support policy, Substitution effect, Public, Panel regression and correlation analysis

1. Introduction

According to several previous studies, innovation is considered an important determinant of economic growth (Akcali, and Sismanoglu, 2015, Blanco et al., 2015, Falk, 2007), as well as the competitiveness of companies (Abdal et al, 2016). Although research and development ("R&D") and innovation are not the same thing, research and development is a key component of innovation. Innovation and research and development are becoming a significant part of the policies of countries and transnational unions such as the European Union. This is shown by the EU's "Europe 2020" strategy, which calls on member states to invest 3% of their GDP in research and development (EC, 2020). However, it is important not only to look at R&D spending as one aggregate indicator but also to consider the contributions of different innovation actors to R&D funding. Since it is known that companies are the main innovation actors that create the largest number of innovations in the national innovation system, the contribution is aimed at financing corporate research and development. The problem for companies is the lack of resources for starting their innovative activities. Their effort is to obtain financial resources in various forms. In this direction, public support for innovation from government sources to businesses is significant, which does not always bring the desired effects and can crowd out private investments. In addition to examining the impact of corporate spending on research and development in the EU 27 countries from the perspective of their funding sources, our research deals with this unwanted effect of public support.

2. Literature Review

R&D spending is known as a driver of innovation and productivity (Diaconu, 2019) from the perspective of government as well as businesses. Foreign studies have documented that there is a significant correlation between business R&D spending and national competitiveness, economic growth, government spending, employment growth, etc. (Olakojo, King, 2023; Diaconu, 2013; Coad, Rao, 2010; Nekrep, Strašek, Boršič, 2018). According to foreign studies, we can say that BERD has a huge potential for the country from both the macroeconomic and microeconomic levels.

According to the OECD survey (2019), many companies do not engage in innovation activities, even though discussions about the importance of innovation in the economy and the importance of business investments in research and development have a positive impact on its competitiveness. However, there are real barriers that limit business investment in research and development. These are, for example, factors preventing companies from investing in (Spielkamp and Rammer, 2009) and financial restrictions that prevent companies from investing in innovations (D' Este et al., 2012). Companies do not always have enough internal financial resources to launch their own innovation projects and therefore they turn to external resource providers (Wang et al., 2016). The practice also points to the absence of financial resources for the introduction of innovations as a barrier to support investment in innovations in enterprises (EK, 2014). A firm's access to financial resources varies depending on the size of the firm as well as its specialization (OECD, 2004). Foreign sources for financing innovative and research and development activities can be obtained from various economic entities. Companies most often obtain these resources from other companies (e.g. banks).

OECD (2015) lists five main innovation actors that can finance corporate R&D. These are business enterprises, government, universities, private non-profit organizations, and institutions from abroad. These entities help to finance private innovation projects and overcome obstacles to innovation. In addition to private investment (EIB, 2019), the most important source of financing for innovative businesses is the public sector through the government. No less important is the help of universities and private non-profit organizations, their support is mainly non-financial, mainly in the form of cooperation and joint research (Perkmann, Walsh, 2007; Abidin et al., 2014; Rybnicek, Königsgruber, 2018).

Falk (2006) brought significant results, which showed the compatibility of BERD and GERD based on the use of the GMM model. The study yielded the findings that R&D expenditures conducted by universities are significantly positively related to business sector R&D expenditures, suggesting that public sector R&D and private sector R&D are complementary. Direct R&D subsidies and the share of high-tech exports are significantly positively related to the R&D intensity of the business sector.

The main reason for the involvement of the public sector (and other innovation actors) in the financing of business research and development is the fact that otherwise, the market would invest in innovation activities less than is socially acceptable. Intellectual property rights and state-funded R&D subsidies should therefore stimulate innovation (Leibowicz, 2018). The effects of public support on private R&D investments can have a positive or negative impact (the so-called substitution effect) on private R&D investments. Despite the many advantages of public support for innovation, according to the economic literature, there are also limitations, which we call state failures (Guellec and Pottelsberghe, 2000).

From the perspective of several foreign studies, it can be argued that it is the variable "higher education" that represents a statistically significant variable in the BERD assessment (Aruzhan et al., 2016; Falk, 2006). Government R&D funding represents a less efficient source of funding than BERD, but the synergy of BERD and GERD has a positive impact in terms of patents in the country (Aruzhan et al., 2016).

Shelton and Leydesdorff (2011), through multivariate linear regression models, showed the synergy of GERD and BERD resulted in long-term and sustainable benefits in publications. Research focusing on the impact of scientific productivity on business efficiency has yielded findings that scientific productivity is positively associated with business efficiency (Van Looy, et al., 2011).

These failures are closely related to the issue of complementarity, where we can encounter several types of negative effects: displacement, substitution, leakage, and dead weight (McPherson, McDonald, 2010). Many authors deal with the substitution and displacement effect of subsidies. Guo, Guo, and Jiang (2016) argue that research on the effects of government R&D support programs is inconclusive. It has been proven that businesses that have been given government subsidies achieve higher productivity and profitability. It was also found that these enterprises grow faster, have better access to external financing, invest more funds in research and development and show a higher social return. On one hand, many studies found an additionality between public support and private R&D investment (Ali-Yrkkö, 2005; Sadraoui, Zina, 2009; Afcha, López, 2013; Liu, Li, Li, 2016; Carboni, 2017) According to their results R&D subsidies stimulate private R&D investments in enterprises.

On the other hand, many studies suggest that public R&D support programs do not stimulate business performance. Moreover, several studies have even found that government R&D subsidies crowd out private R&D (Hussinger, 2008, Görg. 2008, Zúñiga-Vicente et al., 2014). Firms awarded with public support could

reduce their own investment into R&D beyond the level that would have been performed without this support (Zúñiga-Vicente et al., 2014).

The occurrence of the substitution or effect of subsidies therefore varies depending on the region and industry in which the company operates (Capron, Van Pottelsberghe de la Potterie, 1997; Jin, Shang, Xu, 2018). Therefore, it is appropriate to examine the regional dimensions of their operation, for example in a specific EU member state.

3. Material and Methods

The contribution is aimed at examining the potential effect of corporate expenditures on R&D from the point of view of their funding sources and analysing the occurrence of the substitution effect of public support for R&D in EU 27 countries. The objective contains two research questions:

RQ1: Do private companies use enough of their own resources to finance corporate R&D in EU 27 and thus contribute to the structure of corporate spending on R&D?

RQ2: How does public support for corporate R&D increase corporate investment in R&D? Is there no substitution effect?

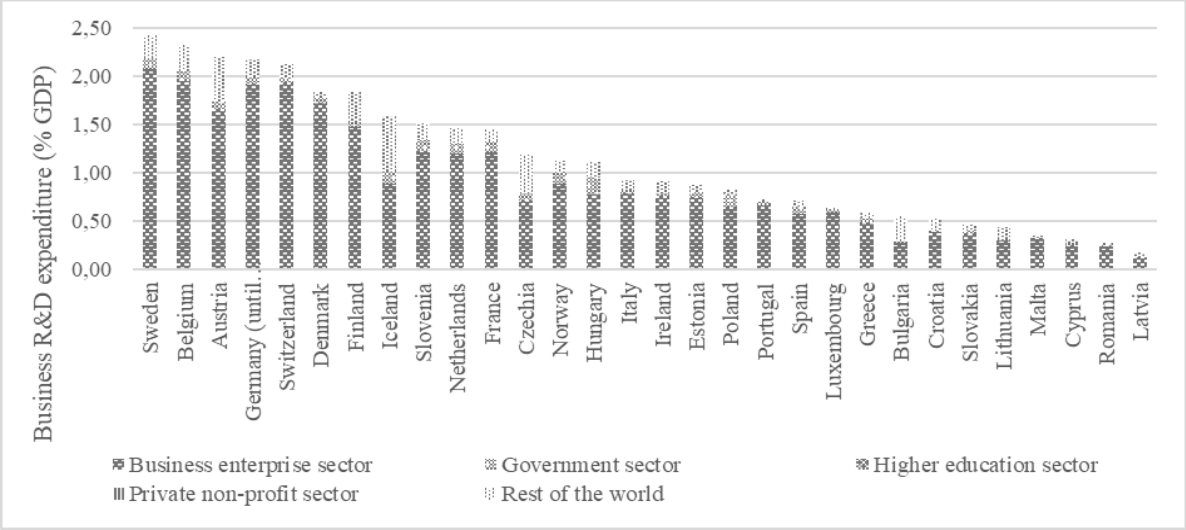
As part of the analysis, secondary data are used from the Eurostat, OECD databases within the "Innovation Indicators" section. The key indicator (GERD - Gross Domestic Expenditure on R&D) examined in the paper expenditure on research and development of the EU member states according to the source of funding. Eurostat distinguishes five possible financial sources that can be used to finance research and development: sources of business enterprises, governments, universities, private non-profit organizations and sources from abroad (e.g. FDI), development aid, remittance flows). As for aid from EU sources, up to 70% of the volume of interventions is significantly redistributed through the EU budget in the form of shared financing through government sources. The redistribution of the sources is further decided by the government of the member state (EC, 2021). Since business enterprises are generally identified as the key innovation actors involved in most R&D activities in the country, we focus on the financial resources used to finance business R&D (BERD - Business Enterprise R&D Expenditure). We used cluster analysis, panel regression and correlation analysis based on secondary data analysis.

From the point of view of the preferences of the importance of public support, in this research we focus on updating the structure of research and development financing in the long-term perspective of the created clusters, consisting of countries with a comparable structure of their financing, as well as on the possible extent of occurrence of the substitution effect, mainly between public support and corporate innovations (Pisár, et.al., 2020). From the available data we obtained, we performed a cluster analysis that illustrates clusters of countries with a comparable corporate R&D funding structure. A hierarchical agglomerative algorithm was also used in combination with Ward's method. The given method was used due to the fact that this procedure was applied to a sample of updated secondary data for the monitored twenty-year period (2000-2020), as it appeared to be the most suitable due to the contour coefficient achieved.

To determine the degree of substitution effect due to the negative impact of public support, we will perform a regression and correlation analysis on panel data, specifically on a sample of all 27 EU member states for the years 2000-2020. The regression is also based on a combination of least squares and cross-sectional fixed effects model. The logarithms of the data will be used in the regression analysis to achieve a normal distribution of the data. To test the causality of the selected variables of this analysis, we will use the granger causality hypothesis.

4. Results and Discussion

Public support from EU resources and increasing the growth of member states' expenditure on research and development is one of the main priorities of the EU 27. As part of the group of innovative actors, we will examine the scope of companies' expenditures on research and development, since a large part of these expenditures takes place in enterprises.

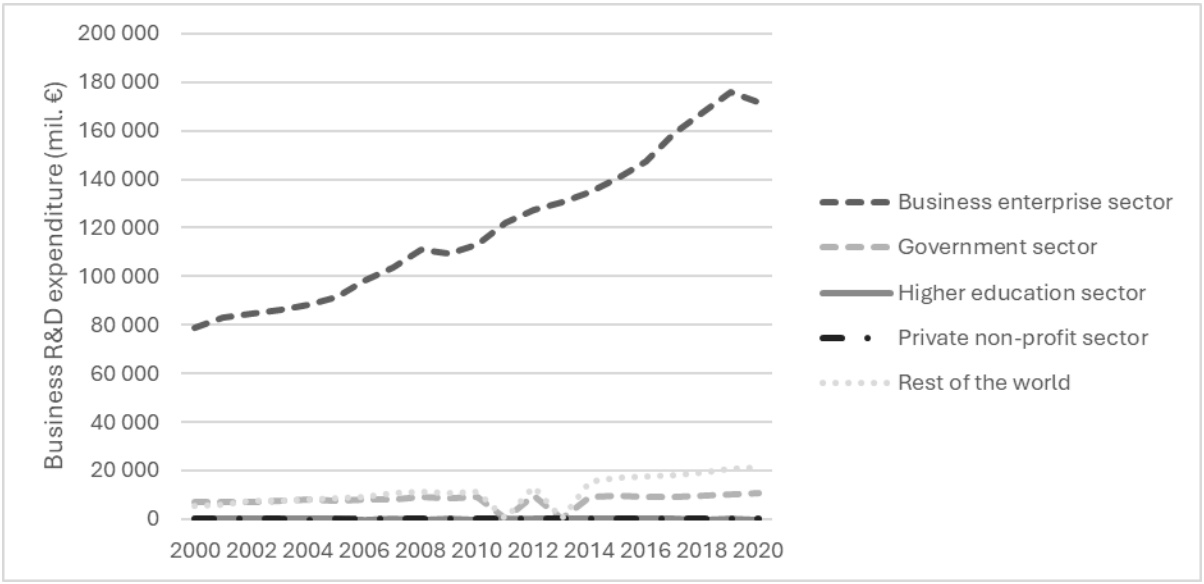


Source: Own research, Eurostat Database.

Figure 1: Business R&D funding in the EU member states in 2019 (% of GDP)

Other innovative actors thus participate in the financing of corporate research and development (Figure 1). The graph shows the difference in investments in research and development between EU countries. In countries such as Sweden, Germany or Belgium, companies spend more than 2% of national GDP on research and development, but elsewhere this value is lower than 0.5% (e.g. Cyprus, Latvia or Romania). In almost all surveyed countries, firms mostly use private financial resources, which means that they mostly use their own profit or resources from other private enterprises (e.g. commercial banks).

Abroad sources (especially FDI) constitute the second important source of financing for business innovations. However, the amount of funds from abroad is different in individual EU countries. Abroad resources used to finance business R&D appear to be mostly used in countries with open economies. There are different results on the level of public financing in the monitored countries. In countries such as Hungary, Slovenia, Sweden, public support using subsidy resources from the EU budget represents a significant part of their R&D expenditures. On the contrary, in other countries their use is small (e.g. Latvia, Lithuania or Romania).



Source: Own research, Eurostat Database.

Figure 2: Development of business R&D funding of innovation actors between 2000 - 2020 (as aggregate value of the EU, mil. EUR)

Graph 2 shows the financing of corporate R&D from the sources of other innovative actors, namely universities and private non-profit organizations. It is interesting that in all EU member countries the values are almost

negligible. It proves that the share of institutions in their financing is not that significant, which is also supported by the economic theory. We also examined the evolution of corporate R&D funding in the EU over a longer period, the contributions of different innovation instigators to corporate R&D expenditure as the aggregate value of all EU Member States are also examined. The results of the analysis, based on the development over time, confirmed that from 2020 the company's own resources are participating in the financing of R&D expenses for a long time. This is a level of 67% of the total corporate expenditure on R&D with a growing tendency over time.

In the monitored period, the share of foreign acquisitions in public financing represented 6-7% of the total R&D expenditures of companies in EU countries. The increase in the share of external resources (from the public sector or from abroad) in absolute numbers was caused by the drawing of subsidy resources from the EU budget and the growth of public expenditure on FDI. As a result of the growth of corporate resources, the share of external resources in corporate R&D records the same level. Using the available data for a twenty-year period (2000-2020), we performed a cluster analysis. We have grouped individual clusters with a comparable corporate R&D funding structure (Table 1).

Table 1: Structure of R&D funding of EU 27 countries in 2019 (statistical variables per country cluster)

Member country cluster	Business enterprises	Government	Abroad
Cluster 1 (FR, HU, NL, PL, SI)	1,01 (0,248)	0,122 (0,031)	0,136 (0,040)
Cluster 2 (BG, CR, CY, DK, EE, GR, IE, IT, LV, LT, LU, MT, PT, RO, SK, ES)	0,54 (0,377)	0,0275 (0,019)	0,075 (0,062)
Cluster 3 (AT, BE, CZ, FI, DE, SE)	1,633 (0,458)	0,08 (0,018)	0,312 (0,093)

Source: Own research, Eurostat Database.

Note: the table shows the specific values of the statistical variables. These are mean values and standard deviation values in parentheses (.)

The resulting Silhouette coefficient (value 0.59) confirmed the appropriateness of choosing a cluster algorithm by classifying EU member countries into three clusters. The results of processing the average values of the corporate R&D financing structure brought several conclusions. In the cluster of 3 EU member countries (namely Austria, Belgium, the Czech Republic, Finland, Germany and Sweden), the highest private support for corporate R&D, including the use of foreign resources, can be noted precisely as a result of FDI support. They are also dominant with the highest innovative performance. We assume that these resources (both corporate and foreign) are one of the success factors of these countries in the areas of innovation and R&D support. Through cluster analysis, we achieved results that were partially comparable to the European Innovation Scoreboard (2021), which confirms the fact that corporate financing of research and development is a factor in the country's innovation performance. The conclusions of the analysis showed that corporate R&D is financed mainly from private sources and funds from abroad, primarily from FDI and also shared financing from EU budget sources. These are countries with a medium level of innovation performance, included in cluster 1 (France, Hungary, the Netherlands, Poland and Slovenia).

Table 2: Correlation matrix of R&D expenditure funded by actors in EU members in 2000-2020

	Business enterprises sector	Government sector	Higher education sector
Business enterprise sector	1	0.9879	0.7146
Government sector	0.9879	1	0.7129
Higher education sector	0.7146	0.7129	1

Source: Own research, EViews based on data from Eurostat.

Based on the existence of a relationship between corporate and public financing of corporate R&D, we examine the possible impact of the substitution effect of public financing of R&D in EU countries. According to

the data in Table 2, correlation and regression analysis were performed between these relationships. We also examine the impact of higher education financing on corporate R&D, since the higher education sector also takes the form of public universities. We included possible time lags in the effect of government and university funding sectors on corporate R&D investment in the regression analysis. As part of the analysis, we do not take into account the potential effects of government support on corporate R&D, as companies do not yet use this form of support.

Table 3: Granger causality analysis of innovation actors in EU member states based on 2000-2020 2 time lags (model research results)

Null Hypothesis:	Observations	F-Statistic	Probability
GOV does not Granger Cause ENT	500	4.77426	0.0088
ENT does not Granger Cause GOV		4.19205	0.0157
UNI does not Granger Cause ENT	500	20.1425	4.E-09
ENT does not Granger Cause UNI		7.25737	0.0008

Source: Own research, EViews based on Eurostat data and published methodology by the authors Pisar, et. al. (2020).

The analysis further showed a positive correlation between the investigated variables (Table 3). The relationship between government and education funds shows a positive correlation, and there is also a very high positive correlation between corporate and government spending. Granger causality was further used to determine whether selected variables were suitable for regression analysis, as correlation does not necessarily imply causation. The conclusion of the Granger causality tests confirmed the rejection of the hypothesis that government funding and university funding does not cause Granger funding of businesses, as it is clear that this test runs both ways, i.e. from government funding and university funding (at the 1% significance level) to business funding in both cases.

Table 4: The impact of selected innovative actors on private investments in the EU in the years 2000-2020 with different time lags (results of regression analysis)

	T	T-1	T-2
Constant	-0.05314***	-0.05345***	-0.05345***
	(-6.5741)	(-6.6011)	(-6.5880)
Government expenditure	0.85528***	0.10111***	0.85544***
	(98.6578)	(98.6074)	(98.5045)
Higher education expenditure	0.06058**	0.06149**	0.06148**
	(-2.11825)	(2,14715)	(2.1448)
R^2	0.9761	0.9760	0.9760
R^2 adjusted	0.9760	0.97595	0.9759
Observations	502	501	500
Durbin Watson statistics	1.8067	1.8075	1.7874
Akaike info criterion	-1.9695	-1.9687	-1.9667

Source: Own research, EViews based on Eurostat data and published methodology by the authors Pisar, et. al. (2020).

*Note: T-statistics are shown in parentheses (.). Respective significance levels according to p-values are indicated as: */**/*** examined at 10%/5%/1% significance levels.*

Using the Akaike information criterion, we examined the model in detail without a time lag, with a time lag of one year, and with a time lag of two years (Table 4). We are based on the authors' published methodology (Pisár, et. al., 2020), which defined the use of the Akaike criteria in the evaluation of the influence of selected innovative actors on private investments in the EU over an earlier time period.

According to the results of this criterion, we selected a model without a time delay. A regression model examined the effect of public and university funding of corporate research on corporate investment in

corporate R&D without time lag. Based on the results of the model, changes in funding from public sources and universities explain 97.61% of changes in R&D funding of private enterprises. The regression line of the influence of public and university funding on business funding is as follows:

$$\hat{y} = -0.05314 + 0.85528gov + 0.06058uni \quad (1)$$

where gov represents the government funding coefficient and uni represents the university funding coefficient. The P-values of the T-statistics of university and government funding are statistically significant in the model. Therefore, we can interpret the impact of both public funding and university funding on corporate investment in research and development. We can conclude that in this case there is no substitution effect of public R&D support, which occurs when companies replace their investments in R&D with public support. It can therefore be said that in EU member countries, public support for R&D, especially through the use of shared financing from the EU budget, has a positive effect on private R&D investments.

Our research brings some new empirical evidence to the discussion on the relationship between public support and business R&D expenditures. Contrary to for example Görg (2008) and Zúñiga-Vicente et al., (2014) we found no evidence of the crowding-out effect. Our conclusions are consistent with the results of many authors investigating the occurrence of the substitution effect and the impact of public support on private investment in research and development, which confirm the positive effect of public support on private investment in research and development (David, Hall, Toole, 1999; Ali-Yrkkö , 2005, Choi, Lee, 2017) and are partially consistent with other studies (Aristei, Sterlacchini, Venturini, 2015). We therefore see public support for corporate research and development as an important part of financing innovation and research and development in the EU.

5. Policy Implications

The results obtained provide several conclusions and policy implications. We consider business spending on R&D to be one of the key elements of the country's innovation performance, which is also reflected in the EU's Europe 2020 strategy. It emphasizes the growth of spending on R&D as one of the strategy's main goals. Although the structure of corporate R&D expenditure financing is different in individual EU countries, public R&D support is an important part of corporate R&D funding, especially when it comes to shared funding from EU sources.

Since our results confirm the positive impact of public R&D support on private R&D investment in cluster 1 countries (namely France, Hungary, the Netherlands, Poland, and Slovenia), we propose to intensify their public R&D support. This will leverage the level of private R&D investment in these countries, with the potential to increase the innovation performance of the countries under study. One of the main contributions of our paper is an international comparison of the structure of corporate R&D funding, which provides interesting policy implications at the EU level. While many studies are concerned with investigating the effects of public support for R&D and innovation, they are not focused on the structure of corporate R&D funding, although our research is not unlimited. We did not consider in our analysis other factors that can influence private R&D investments, as we focused only on its financing. Based on the results of the analysis of the positive impact of public financing on GDP growth using regression models (Granger causality), it can be recommended to narrow the analysis of the substitution effect only to a certain group of EU countries. This would provide more concrete results that would lead to recommendations useful for public policy makers.

6. Conclusion

Published studies point to innovation as a key element in the growth and competitiveness of companies. Despite these positives, some companies do not engage in innovative activities precisely because of the lack of financial resources that are necessary to support innovative projects. Therefore, other actors also participate in the financing of entrepreneurial R&D activities.

The results showed that corporate research and development is mostly financed by private sources, followed by foreign funds and public sources. We have created three clusters of EU member countries with a similar structure of corporate funding of research and development. The results of this part of the cluster analysis were identical to the results of the European Innovation Scoreboard, which indicates the importance of the financing of corporate research and development as one of the factors of the country's innovation performance. We confirmed the assumption that the substitution effect of public support for research and development does not occur in EU member states, since public funding of corporate R&D seems to have a positive effect on private investment in R&D.

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Covid-19 and the Impact on Cyprus' SMEs Tourism Enterprises: Lessons to be Learned

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Abstract: The objective of this work is to identify the major lessons learned from the Cyprus's tourism Small & Medium Enterprises (SMEs), following the recent Covid-19 pandemic. Further, the purpose was to reach out to SMEs owners, managers, and entrepreneurs in order to identify specific issues during and after Covid-19 pandemic, such as management practices in terms of acquiring professional assistance, applying online sales, their opinion about the measures applied by the Republic of Cyprus, and the European Union, as well their knowledge about the Recovery and Resilience Plan (RRP). A quantitative research method and a probability sampling methods have been applied. The research has reached out to SMEs with the valuable assistance of the Cyprus Chamber of Commerce and Industry (CCCI). Lack of access to financial support and professional assistance, and poor knowledge of the RRP, calling for a more effective communication approach by the national authorities has been identified. Tourism's SMEs sustainable development is highly influenced by acquiring the relevant assistance, calling for all stakeholders to apply the appropriate practices and measure in order to enhance Tourism's SMEs sustainable development.

Keywords: Republic of Cyprus, Tourism, SMEs, Innovation, Sustainability, Covid-19, RRP

1. Introduction

The Covid-19 emergence has led to a massive impact on global economy, creating concerns over its sustainability and ability for innovation (Song and Zhou, 2020) and a sharp fall of global economy (Mou, 2020). For the Cyprus economy, the impact of Covid-19 has been massive as the country has experienced its worst economic performance since the banking and financial meltdown in 2013 (IMF, 2021). Several controversial policies by the national authorities have created problems for the country's SMEs, with the tourism industry to experience major problems considering that it is the largest industry in the country Kakoullis et al. (2021). Consecutive lockdowns imposed by national authorities led to negative impacts on several industries and businesses, especially those with limited ability to overcome challenges (Verschuur, Koks and Hall, 2021; Rahman et al, 2021). The pandemic's impact on tourism has also led to social problems, such as life-quality in several countries, especially those dependent on tourism (UNWTO, 2021). Despite positive signs the problems remain as the recovery pace is slow, causing concerns in terms of arrivals and revenue. Such fluctuations are clearly revealing tourism industry's sensitivity and how sudden crises can lead to a greater level of uncertainty (UNWTO, 2022). The pandemic has triggered the development of policies by national governments to support businesses that have been affected by lockdowns. However, focus has been paid on specific areas such as employment, innovation, regulative aid, inclusive emergency packages, governance, promoting demand, sustainable development planning, and strategic marketing (Kreiner and Ram, 2020). Therefore, the objective of this research is to identify the challenges related to the Cyprus' SMEs related to the above issues.

The current articles followed the analysis of extensive literature review from credible resources in order to provide the appropriate scientific background (Snyder, 2019). Following the Quantitative research methodology, the research has applied a statistical analysis using IBM.SPSS Statistics 25 for Windows. A set of conclusions, recommendations, and limitations have been applied in order to ensure a comprehensive approach, and enable future research.

2. Literature Review

2.1 The Role of SMEs in the Cyprus and European Union Economy

Defining SMEs has been a challenge as this is influenced by several factors, such as the size of the country's economy and industry (Cacciolatti and Lee, 2015). The European Commission (2022) realizes this challenge, as a major driver for SMEs in obtaining financial support though targeted programs designed by the Union, as they constitute the backbone of its entire economy, providing opportunities for innovation and entrepreneurship. The European Commission (2022) outlines the relevant parameters on which SMEs are defined, with these enterprises to be divided into three subcategories; namely medium-sized, small and micro.

SMEs play a key-role in the development of European Union (EU) economy as they contribute €4.357 trillion, creating opportunities for innovation and entrepreneurship. EU SMEs are highly affected by several factors such as the need for innovation that will enable them to overcome competition and take advantage of the opportunities provided. Innovation for SMEs is influenced by several key-drivers such as Research & Development (R&D), networking, and access to edge Information Technology (IT) (Hervás-Oliver et al, 2021). SMEs have played a significant role during economic crisis, creating opportunities for entrepreneurship and innovation, especially in countries that have experienced economic decline (Južnik Rotar, Kontošić Pamić and Bojnec, 2019). The Cyprus' economy is highly benefited by the SMEs' operations, as the latter contribute 75.5% of the country's GDP, employing 82.6% of the country's workforce (European Commission, 2023). The country's SMEs are highly affected by innovation investments, hence, the collaboration between both the public and private institutions is considered as of a vital importance (Masouras et al., 2021).

2.2 Access to Financial Support

Gaining access to financial support is essential for sustainable development and innovation for SMEs, especially for those businesses operating within a responsible environment, enabling them to attract external investments (Durst and Wolfgang, 2021). A major problem confronted by SMEs refers to the high percentage of Non-Performing Loans (NPL). Considering SMEs' impact on national economies, failure to obtain financial support will potentially holdback innovation (Shihadeh, Gamage and Hannoon, 2019). Poor political decisions constitute a major obstacle in obtaining financial support by SMEs, hence, requiring more practical measures (Ghosh, 2022). Recent problems related to inflation and high interest rates have caused concerns over the EU's SMEs to obtain valuable access to financial support and overcome their cashflow challenges (Boccaletti et al., 2024). Poor policies developed by the EU have become a major concern in relation to the Union's SME, hence, negatively impacting their competitiveness (Batrancea et al., 2022).

SMEs in advanced tourism economies such as Spain face serious problems in obtaining access to financial support. This is mainly due to lack of providing financial statements revealing their profitability and ability to pay back their loans. This requires from the tourism' SMEs to operate in a more professional manner, especially following financial crises, therefore, create opportunities to become more resilient and innovative (Moya-Martínez and Del Pozo-Rubio, 2021). Similar are the problems in the emerging tourism country of Vietnam, in which tourism SMEs are facing obstacles in accessing financial support. These obstacles have intensified during the pandemic, forcing tourism SMEs, to search not only for formal, but sadly, informal financing (Van Song et al, 2022).

H_1: The majority of tourism SMEs in the ROC is facing difficulties in obtaining financial support from banking institutions.

2.3 Inflation and Tourism

Inflation in Tourism is influenced by several external factors such as pandemics, economic crises, wars, armed conflicts, and other hazards, that lead to a major negative impact on the industry's businesses, especially those that do not possess the relevant knowhow and financial capability to overcome problems. The European Central Bank (ECB) (Lis and Nordeman, 2021) provide some important insight and suggest that consecutive lockdowns and other related measures by national governments have led to a massive impact on tourism-related services with inflation to have deteriorated in the industry.

Inflation in tourism and other related services has hit the lower-income classes, with this being visible in several regions across the world, with the SMEs suffering from such consequences due to lack of cashflow and access to funding (Gössling and Schweiggart, 2022). Overcoming these challenges requires from all businesses to ensure innovation, product, and service diversification. This approach can enable them to ease the inflation problems and increase their resilience (Rogerson, 2021). The negative inflation consequences have also hit West African Economic and Monetary Union (WAEMU). This calls for policy-makers to implement measures that will overcome the pandemic's spillovers (Coulibaly, 2021).

H_2: The majority of tourism SMEs in the ROC is concerned about the Inflation consequences.

2.4 Government Assistance

The problems of limited access to financial support from SMEs start from poor governmental schemes, especially during difficult times, with the problems to be identified in operations such as supply chain and HR,

(OECD, 2021). The role of Public and Private Partnerships (PPP) can potentially mitigate the negative impact of the absence of governmental support (Corredera-Catalán, di Pietro and Trujillo-Ponce, 2021). The benefits of PPP and government assistance in the tourism SMEs has been clearly visible during the recent pandemic (Turkson et all., 2021; Kousi, Mitsi and Simos, 2021). For SMEs in developing countries, such as Cyprus, governmental support constitutes a major mediator for establishing a competitive advantage and improvement of operational performance and productivity (Jayeola et al., 2022).

2.5 Republic of Cyprus (ROC) and the Recovery and Resilience Plan (RRP)

The problems developed in EU economy have forced the Union to take a comprehensive approach towards resolving the extensive negative consequences, with the Recovery & Resilience Facility to be an important tool. The European Commission (EC, 2022) clarifies that *"As part of a wide-ranging response, the aim of the Recovery and Resilience Facility is to mitigate the economic and social impact of the coronavirus pandemic and make European economies and societies more sustainable, resilient and better prepared for the challenges and opportunities of the green and digital transitions."*

For the fragile Cyprus economy that has in recent years experienced serious problems such as the 2013 banking system meltdown (Clerides, 2014) which was, sadly, enhanced by banking mismanagement and governmental failures to control the upcoming domino effect leading the country to high risk (Brown et al, 2018), the RRP is considered to be a life-saving tool with the government paying attention to its effective implementation and it is based on five major pillars (public health, green economy, competitiveness, digitalization, and HR).

The Cyprus RRP refers extensively to the tourism sector, focuses on its positive impact, however it points out the negative dimensions and states that *"Cyprus's travel and tourism sector is currently reliant on international visitors and specifically the tourism receipts from two countries which account for two-thirds of total visitors. The lack of diversification in the number of countries that travel to Cyprus could expose the country to a demand shock due to economic, social and political developments"* (RRP, p. 20).

H_3: The majority of tourism SMEs in the ROC has limited knowledge about the country's RRP.

H_4: The majority of tourism SMEs in the ROC has not acquired professional assistance to restructure their businesses.

H_5: SMEs that have acquired professional assistance are more likely to develop their online sales compared to those that have not acquired professional assistance.

3. Methodology

The researchers provided a Questionnaire of 21 questions, with a pilot Questionnaire (20) to have been provided, with minor changes to have been made, mainly in terms of wording. The Questionnaire was based on previous research and adjusted to the needs of the current work. This research applied Quantitative research method through the support of the Cyprus Chamber of Commerce and Industry (CCCI) and a non-probability sampling method has been applied. The sample covered the entire ROC territory, with attention to be paid on the four major tourist regions, namely Pafos, Larnaca, Limassol, and Famagusta). The targeted research audience is the SMEs owners within the country's tourism industry. 258 questionnaires were distributed with 207 answers; a total 80.23% response rate. All data collected were analysed using IBM.SPSS Statistics 25 for Windows in order to enable greater analysis (Saleh, 2023).

4. Statistical Analysis

Data were analysed using IBM.SPSS Statistics 25 for Windows. For the purposes of this study, a sample of 207 participants were selected. Follow Table 1 presents the frequency and percentage distribution for the participants demographic characteristics. Regarding gender at the sample of the 207 participants (business owners and/or managers, and/or entrepreneurs), 149 (72%) were male and 58 (28%) were female, revealing that most business owners within the ROC are males, complying with the official statistics. Regarding age groups, 60 (29%) were between 34-41 years old, 51 (24,6%) were between 42-49, 44 (21,3%) were between 26-33, 42 (20,3%) were above 50 and 10 (4,8%) were between 18-25. Regarding the district of operation of the sample, 65 participants (31,4%) were in Pafos, 47 participants (22,7%) in Limassol, 41 participants (19,8%) in Larnaca, 38 participants (18,4%) in Famagusta and 16 participants (7,7%) in Nicosia. Further, regarding the area of operations (Question 4) of the sample of the 207 participants, 145 (70%) were in urban areas and 62 (30%)

in rural areas. The distribution is in alignment with the population distribution within the ROC, consequently, there is a comprehensive overview of geographical participation.

When the participants were asked about the degree of SMEs' difficulty to obtain financial support from a banking institution 55,6% find it very difficult/difficult, 22,2% find it neutral, and 20,7% find it easy/very easy. As a result, 115 participants (55,6%) confronted serious problems in relation to getting access to financial support to overcome existing problems and possibly finance new operations therefore, Hypothesis 1 is accepted.

Regarding the degree of someone's belief that the current inflation will affect Cyprus' Tourism development 61.5% expressed the concern that the current inflation shall very highly/highly influence the Cyprus tourism development a4,8% expressed the opinion that inflation shall not affect the tourism operations. This reveals SMEs' concerns over the sector's future and their ability to overcome possible problems, thus raising the need for further national support, therefore, Hypothesis 2 is accepted.

Regarding the degree of someone's awareness of the Cyprus RRP 68% replied negatively and only 19% replied negatively, therefore, Hypothesis 3 is accepted. This creates serious concerns over SMEs' ability to inform themselves about such important issues that would to a great degree ease the problem of getting access to financial support.

When the participants were asked whether someone during and/or after Covid period has acquired professional assistance to restructure their business, 72,5%) responded negatively while 27,5% responded positively. These answers can be combined with Question 21 which is related to whether SMEs have developed their online sales in which 58,5% responded positively while 40,6%) responded negatively. Despite the two results not being fully compatible, it is an obvious fact that SMEs have taken advantage of the opportunity to expand their sales network by developing their own skills through social media and other online means. Therefore, Hypotheses 4 and 5 are accepted.

In addition, when the participants were asked according to the degree of someone's belief that the Cyprus Deputy Ministry of Tourism responds to the challenges of SMEs in the Tourism sector, 100 participants (48,3%) rated the second lowest and only 21 (10,1%) rated the second highest scale. Importantly, none of the participants has answered that have a full positive opinion over the Ministry's support. The overall participants' perception is that there is poor assistance, hence, creating serious concerns over the governmental support which requires substantial improvement.

Table 1: Frequency and percentage distribution for the demographic variables of the Participant characteristics

Demographic Variable	Category	N	Percentage
Gender	Female	58	28.0%
	Male	149	72.0%
	Total	207	100.0%
Age	18-25	10	4.8%
	26-33	44	21.3%
	34-41	60	29.0%
	42-49	51	24.6%
	50+	42	20.3%
	Total	207	100.0%
District of Operations	Nicosia	16	7.7%
	Limassol	47	22.7%
	Larnaca	41	19.8%
	Pafos	65	31.4%
	Famagusta	38	18.4%
	Total	207	100.0%

Demographic Variable	Category	N	Percentage
Area of Operations	Rural	62	30%
	Urban	145	70%
	Total	207	100.0%
Professional Assistance Acquirement	Yes	57	27.5%
	No	150	72.5%
	Total	207	100.0%
Type of Business	Pub/Bar	4	1.9%
	Restaurant	32	15.5%
	Traditional Tavern	15	7.2%
	Souvenir Shop	30	14.5%
	Watersports	18	8.7%
	Car hire/rent	20	9.7%
	Mini markets	16	7.7%
	Retail	30	14.5%
	Apartments for Rent	8	3.9%
	Other	33	15.9%
	Total	207	100%
Knowledge of RRP From 1 to 5 (1 being the lowest level and 5 being the highest level), to which level are you aware of the Cyprus Recovery and Resilience Plan (RRP)?	1	74	35.7%
	2	66	31.9%
	3	27	3.0%
	4	30	14.5%
	5	9	4%
	Total	206	99.5%
	Missing Values	1	0.5%
	Total	207	100.0%
ROC Deputy Ministry of Tourism Response	1	35	16.9%
	2	100	48.3%
	3	51	24.6%
	4	21	10.1%
	5	0	0%
	Total	207	100.0%
SMEs Inflation Concerns	1	0	0%
	2	10	4.8%
	3	69	33.3%
	4	73	35.3%
	5	54	26.1%
	Total	206	99.5%
	Missing Values	1	0.5%
	Total	207	100.0%
Access to Financial Support from Banking	Very Easy	3	1.4%
	Easy	40	19.3%

Demographic Variable	Category	N	Percentage
Institution	Neutral	46	22.2%
	Difficult	53	25.6%
	Very Difficult	62	30.0%
	Total	204	98.6%
	Missing Values	3	1.4%
	Total	207	100.0%

Further, Table 2 reveals that there is a statistically significant relationship and frequency between whether someone has acquired professional assistance to restructure his/her business and whether they develop their online sales (p<0,001). More specifically, those who develop their online sales were more likely to acquire assistance (36,4%) compared to those who did not develop their online sales (15,5%).

Table 2: Comparison of Acquiring Professional Assistance and On-line Sales

Chi-Square Tests						
	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)	Point Probability
Pearson Chi-Square	11,608[a]	2	,003	,002		
Likelihood Ratio	12,633	2	,002	,001		
Fisher's Exact Test	11,454			,002		
Linear-by-Linear Association	8,552[b]	1	,003	,004	,002	,002
N of Valid Cases	207					

a. 2 cells (33,3%) have expected count less than 5. The minimum expected count is 55.

b. The standardized statistic is 2,924.

5. Discussion

The EU SBA Act (2011) identifies the obstacles confronted by SMEs to obtain access to the relevant financial/funding support. Further, the Act raises the importance for SMEs to gain such support, calling for the national governments to enable this through the development of specific programs, e-government, and e-procurement. Therefore, the research results are in full alignment with the EU preliminary identifications.

Spanish tourism has confronted serious problems during the pandemic, such access to financial support and poor innovation (Corredera-Catalán et al, 2021). Yao and Liu (2023) identify that China's SMEs, especially those operating within the vulnerable tourism sector have been incredibly affected in terms of obtaining financial support. Arcuri and Pisani (2023) identified the negative effects of Covid-19 on Italy's SMEs, with access to funding opportunities to have been hurt dramatically. The authors have identified that SMEs that have implemented more sustainable policies, including those related to green economy, realized improved financial results and increased their opportunities in obtaining access to financing leading to innovation. Such findings are in consistency with previous research in Italy in regards to the financial performance and access to financial support by Italian SMEs, that have hurt the country's overall macroeconomic goals (Di Bartolomeo, D'Imperio and Felici, F. 2022). The European Economic and Social Committee (2022) adds to the previous findings related to Italy's SMEs during the pandemic and suggests that companies that have strategically focused on digital transformation and/or transition experience increased opportunities to enjoy a sustainable economic growth in the turbulent post-pandemic era.

Brexit has led to a massive impact on UK's SMEs as uncertainty had prevailed. This was enhanced by limited governmental support creating further problems over the country's sustainable development (Sindakis and Aggarwal, 2022). For the country's SMEs, Brexit concerns were increased due to continuous lockdowns and inability to obtain financial support, especially at the pandemic's initial stages. Such problems were only eased

as a result of the government's support through the British Business Bank which provided £5 billion, assisting SMEs to overcome problems (Assefa, 2023).

6. Conclusions

The objective of the current research was to identify the lessons learned by the Cyprus' tourism SMEs, following the recent pandemic. This quantitative research of 207 questionnaires focuses on delivering the appropriate assistance to both internal and external stakeholder and contribute to the existing literature. The pandemic outbreak has led to serious impacts on the operations of the country's SMEs, with the access to financial support to remain a serious concern. This is added to the recent financial problems confronted in the country as a result of the banking and financial crisis which led the country's economy into a deep recession. SMEs' owners are seriously concerned over the acquired support by the national authorities, especially the Deputy Ministry of Tourism. The role of the government of the Republic of Cyprus has been evaluated as a negative one, as the pandemic has brought tourism industry before a new reality which the government did not handle in the best possible way. The pandemic was an opportunity for SMEs to acquire professional support by a substantial percentage (47,3%), and improve their online sales (84,5%). SMEs are also facing serious problems in obtaining access to financial support, an issue that is holding them back from developing their operations and becoming more competitive and innovative. Tourism industry entrepreneurs can use these results in order to identify threats and opportunities for future investments.

7. Recommendations

Tourism SMEs are considered as the backbone of the island's national economy, especially since the country has gone through consecutive economic and health crises that have created high level of uncertainty. Such uncertainty must be eased in order to enable tourism SMEs to overcome problems and become a source of innovation. The official authorities must take strategic decisions in order to ensure that these challenges shall be eased, hence, providing them the ability to become key-players in the sector's sustainable development. The RRP constitutes a powerful tool in the hands of the national authorities that need to ensure that this will be transferred towards the country's SMEs, with the tourism sector to be considered as a top priority within the specific plan. Lack of full use of the RRP will only increase the problems and create further concerns over the industry's sustainable development. Considering the repeated recommendations provided by EU's SBA Fact Sheets, focus on RRP's success should constitute a necessity rather than an option for the country's national authorities. The Deputy Ministry of Tourism's role, as the official body that possesses the legitimate power to provide support as well as to implement strategies that will substantially enhance the sector's SMEs performance and sustainable development, is of a crucial importance. Findings are indeed worrying, calling for the Deputy Ministry to take actions towards not only in regard to policy making, but most importantly, toward increasing its communication with SMEs. SMEs should focus more on acquiring information to ensure that they will have improved opportunities for financing and innovation. Information about national and EU funding opportunities, such as RRP can easily be obtained, hence, SMEs should work closer with the both the authorities and Chambers to eliminate the problem.

Limitations

The current research faces specific limitations that are mainly concerned with the sample size and confidence level, the Questionnaire formulation, the data collection method. Lack of previous academic research on the topic also in the ROC create limitations, therefore, further research can contribute towards the results' credibility.

Disclaimer

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Appendix: Questionnaire

Question 1: Gender
Male
Female
Question 2: Age
18-25
26-33
34-41
42-49
50+
Question 3: District of Operations
Nicosia
Limassol
Pafos
Larnaca
Famagusta
Question 4: Area of Operations
Urban
Rural
Question 5: Type of Business
Pub/Bar

Restaurant
Traditional Tavern
Souvenir Shop
Watersports
Car hire/Rent
Retail
Apartments for Rent
Other
Question 6: How many people work in your business?
1-5
6-10
11-15
16-20
21+
Question 7: How many years has your business been operating?
1-5
6-10
11+
Question 8: What is your opinion about the Cyprus Government's measures in relation to the Tourism Industry during the Covid-19 period?
Strongly Positive
Positive
Neutral
Negative
Strongly Negative
Question 9: What is your opinion about the European Union's measures in relation to the Tourism Industry during the Covid-19 period?
Strongly Positive
Positive
Neutral
Negative
Strongly Negative
Question 10: Has your business faced financial problems during the Covid-19 period?
Yes
No
I prefer not to say
Question 11: If you have answered Yes in Question 10, to which level these problems were (1 being the lowest level and 5 being the highest level)?
1
2
3
4
5
Question 12: During the Covid-19 period the Revenue of my business has:
Increased over 20%
Increased between 11-20%

Increased between 1-10%
No Change
Decreased between 1-10%
Decreased between 11-20%
Decreased over 20%
Question 13: Have you received financial support from the Government?
Yes
No
I prefer not to say
Question 14: If you have answered Yes in Question 13, to which level this financial support has supported your business (1 being the lowest level and 5 being the highest level)?
1
2
3
4
5
Question 15: If I need financial support from a banking institution, I find it:
Very difficult
Difficult
Neutral
Easy
Very easy
Question 16: During the Covid-19 period, did you lay off any of your employees, and if Yes, how many employees did you lay off?
1-3
4-6
7-10
11+
I did not lay off any employees
Question 17: From 1 to 5 (1 being the lowest level and 5 being the highest level), to which level are you aware of the Cyprus Recovery and Resilience Plan (RRP)?
1
2
3
4
5
Question 18: From 1 to 5 (1 being the lowest level and 5 being the highest level), to which level do you believe that the Cyprus Deputy Ministry of Tourism responds to the challenges of SMEs in the Tourism sector?
1
2
3
4
5
Question 19: From 1 to 5 (1 being the lowest level and 5 being the highest level), to which level do you believe that the current Inflation will affect Cyprus' Tourism development?
1

2 3 4 5
Question 20: During and/or after the Covid-19 period I have acquired professional assistance in order to restructure my business: Yes No I prefer not to say
Question 21: During and/or after the Covid-19 period I have developed my online sales: 1 2 3 4 5

Innovative Learning Practices as a Driver of Students´ Performance

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Abstract: Higher education institutions have faced the imperative of adapting pedagogical approaches to meet the demands of the twenty-first century and the changing needs of their students. This study investigates how active learning methodologies impact undergraduate students' academic performance in two different academic fields: engineering education and the social sciences. The study was conducted in a Portuguese higher education institution, the Polytechnic University of Coimbra, using a sample of 97 undergraduate students. Results reveal that active learning approaches particularly problem-based learning (PBL) enhance student engagement, learning experiences, and competencies. Moreover, the research indicates significant differences in the effectiveness of these approaches between engineering and the social sciences, with engineering students demonstrating a more pronounced improvement in their academic performance. These findings highlight the importance of integrating innovative active learning practices into higher education environments to better prepare students for the challenges of modern societies.

Keywords*:* Active learning practices, Problem-based learning (PBL), Higher education, Students 'performance

1. Introduction

Implementing active learning methodologies in the classroom's contexts is seen as central to the success of the educational process. These innovative educational practices are expected to boost student's engagement with the learning process. The future graduate needs to acquire not only technical skills but also transversal and human-centered skills and attitudes, such as adaptability, flexibility, interdisciplinary collaboration, teamwork, creativity, communication, critical thinking, and complex problem-solving, to be prepared for the demands of the twenty-first-century labour market (Leal-Rodríguez and Alborat-Morant, 2019).

Bonwell and Eison (1991), in their seminal work Active Learning: Creating Excitement in the Classroom, define active learning as "instructional activities involving students in doing things and thinking about what they are doing." This is a broad concept that includes a wide range of teaching and learning strategies in which students are required to engage actively in the learning process. Active learning stands thus in contrast to traditional learning approaches in which students are passive receivers of knowledge from an expert. Methods that promote active learning focus on developing students' skills and values rather than transmitting knowledge and require that students process content themselves to learn. The learners are engaged in discussions, teamwork, real-world problem-solving, decision-making, and cooperative hands-on projects to develop higher-order thinking skills such as convergent thinking, creative thinking, and analytical thinking, which are crucial for students to succeed in today's world (McGuinness, 2021; O'Loughlin, 1992; Carr et al., 2015; Petress, 2008). The role of the teacher in active learning classrooms is substantially different from the traditional methods. Instead of functioning as a transmitter of knowledge or an expert with answers, the teacher assumes the role of a facilitator of learning processes, guiding students on their journeys of self-discovery by offering advice but also allowing the students to work out their strategies and making their own mistakes (McGuinness, 2021). In this way, the teacher provides support and tools for the students to do their own research into the topic they need to learn about or the problem they need to solve.

There is evidence in the literature that active learning methodologies improve students' learning outcomes and performance (see, for example, Sukackė et al., 2022; Mabley et al., 2020; Li et al., 2019; Freeman et al., 2014; Trullàs et al., 2022). Focusing on engineering education, Sukackė et al. (2022), conducting a systematic literature review on the implementation of three active learning methods (problem-based learning, project-based learning, and challenge-based learning), point out that "implementing active learning methods in engineering education is becoming the new norm and is seen as a prerequisite to prepare future engineers not only for their professional lives but also to tackle global issues''. Leal-Rodríguez and Alborat-Morant (2019), in turn, from an empirical study involving a sample of 80 students belonging to a Bachelor´s Degree in Business Administration at a Spanish Business School, show that promoting innovative experimental learning practices constitutes an effective approach to improving students' competences and academic performance. In the same view, Deeley

(2010) points out the benefits of experience-based learning, demonstrating that, overall, this learning approach has the potential to lead to students' intellectual and emotional enhancement. Chapman et al. (2016) also demonstrate that innovative learning methods have a positive impact on the class and improve students' performance. Moreover, Trullàs et al. (2022) conclude that problem-based learning is an effective approach to medical education based on a scoping review of available international evidence concerning the effectiveness and usefulness of PBL methodology in undergraduate medical teaching programs. The results demonstrate that through PBL students not only acquire knowledge but also skills that are required in the medical profession.

The positive effect of active learning methodologies on students' performance has already been demonstrated in studies such as Zancul et al. (2017), Fernandes et al. (2014), and Alves et al. (2016). However, despite the huge potential of innovative learning practices for fostering and enhancing learning, their implementation in classroom contexts has been limited. Indeed, several studies highlight that implementing active learning approaches is a challenging and complex process that requires a paradigm shift and involves great effort and time from all HEI stakeholders, namely leaders, teachers, students, and staff (Membrillo-Hernández et al., 2019; Zancul et al., 2017; Namasivayam et al., 2017).

Against this background, this paper aims to contribute to this literature stream by providing new empirical evidence on the role of innovative active learning methods based on collaborative problem-based learning (PBL) on students´ engagement, learning experience, and competencies. This study was carried out within the context of a Portuguese higher education institution, the Polytechnic University of Coimbra, using a sample of students from two different scientific areas, engineering, and social sciences.

The remainder of the paper is structured as follows: Section 2 describes the methodology used in this study. Section 3 presents and discusses the empirical results. The last section draws the main conclusions.

2. Methodology

The study involved a sample of 97 undergraduate students from the Polytechnic University of Coimbra, from two different scientific areas: 32 engineering students (bachelor's degree in sustainable cities management) and 65 social sciences students (bachelor's degree in media studies).

The research instrument used in the present study to collect the data from our group of respondents was an online questionnaire. For measuring the responses, a 7-point Likert scale was used. A Likert-type scale is a psychometric scale commonly used in survey research, namely in the social sciences. It is used when there is an order in responses and distances between categories are not quantitative. When responding to a Likert questionnaire item, respondents specify their level of agreement or disagreement on a symmetric agree-disagree scale for a sequence of statements. The range of the Likert scale captures the intensity of the respondent's attitudes towards a particular question (Aktas Altunay and Ezgi Yilmaz, 2023).

In our active learning experiment, the students are asked to carry out a problem-based learning (PBL) process in which they learn about a subject by working in groups to find a solution for a real-world problem. This approach is applied throughout the entire academic semester as the primary learning and teaching method. Following Eddy and Dan (2016), the PBL process comprises seven stages, as described in Figure 1.

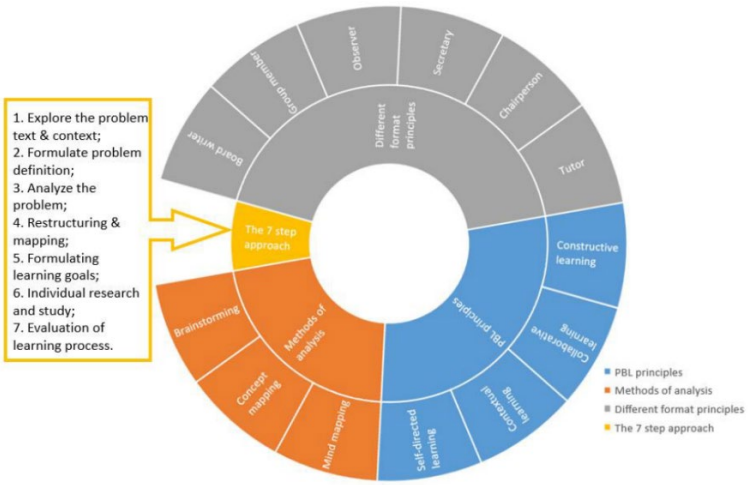


Figure 1: Problem-based learning process (adapted from Eddy and Dan, 2016)

It should be noted that throughout the different phases of the learning process, students, organised in small teams (from four to six members), make use of a variety of techniques and tools, such as brainstorming, researching relevant sources of information, mind mapping, or future scenario planning, to engage in the learning process, achieve the learning objectives, and come up with innovative and effective problem solutions.

As discussed above, in classroom-based PBL, the teacher's role is to be a facilitator who supports students through their learning process and whose main mission is to guide and engage the students, monitor the stages, provide advice and material suggestions, and inspire discussions when student teams are working together (Masek, 2016).

3. Results

The first evidence of the PBL´s implementation as an active learning methodology concerns the students' satisfaction level with participation in this pilot program, as illustrated in Figure 2. Most of the students (86%) are satisfied with the implementation of the PBL methodology. Although represent a residual part of the sample, 3% of the students have a negative, or very negative judgment about their participation. After analysing both education areas separately, engineering students are the most satisfied with their participation. Moreover, no negative opinion has been registered, and 75% of students have chosen "agree" or "strongly agree" to evaluate their perception. It should be noted that considering only the highest grade on the Likert scale, three times more answers (34% against 9%) have been expressed among engineering students.

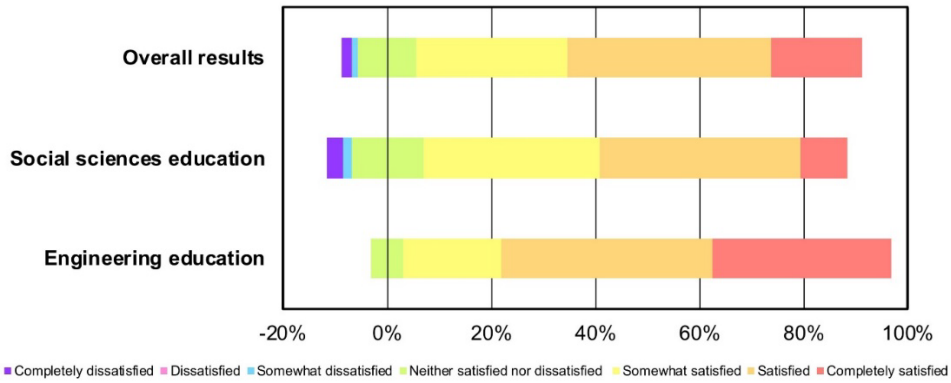


Figure 2: Students' degree of satisfaction

To better understand the satisfaction level expressed by the students, the remaining questions of the survey addressed different essential aspects, namely, questions aiming to understand students' motivation and engagement. This assessment is achieved through two questions related to class dynamics and productivity, whose results are illustrated in Figure 3 and Figure 4, respectively. Starting by analysing the joint results of both groups of students, 85% of students agreed that this pedagogical approach improved both class dynamics (Figure 3) and class productivity (Figure 4). These two parameters are an indirect way to evaluate students' motivation to attend and actively participate in classes. Indeed, according to annual reports presented by bachelor pedagogical coordinators, the main reason for academic failure is related to student absenteeism. Identical conclusions have already been identified in other studies conducted in Portugal (Teixeira, 2013), and it is worth mentioning that this problem has already been pointed out in the seventies of the last century (Mohamed et al., 1974). This latest study shows that, already in the 1970s, students' attitudes were identified as the main determining factor in the level of absenteeism. Thus, if students recognise that their time in the classroom is properly used, i.e., classes are productive, and that the learning process is student-centered, i.e., classes are dynamic, students feel intrinsically motivated to attend all classes, using to good advantage of all the benefits that being present in the classroom brings. Finally, it is worth mentioning that only 4% of the students answered that the PBL methodology didn't contribute to improved class performance.

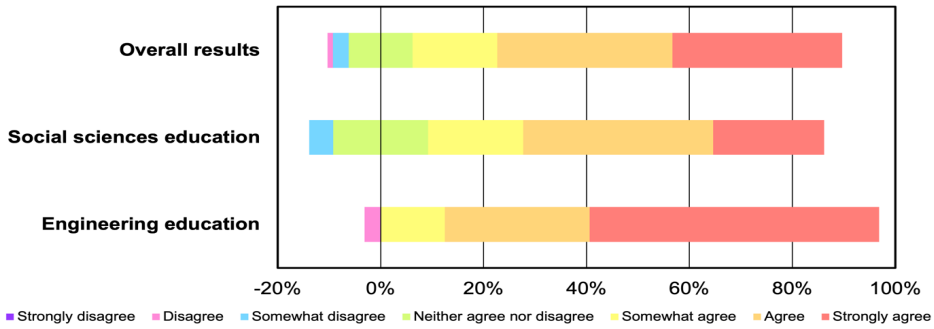


Figure 3: Students' perceptions on the improvement of class dynamics

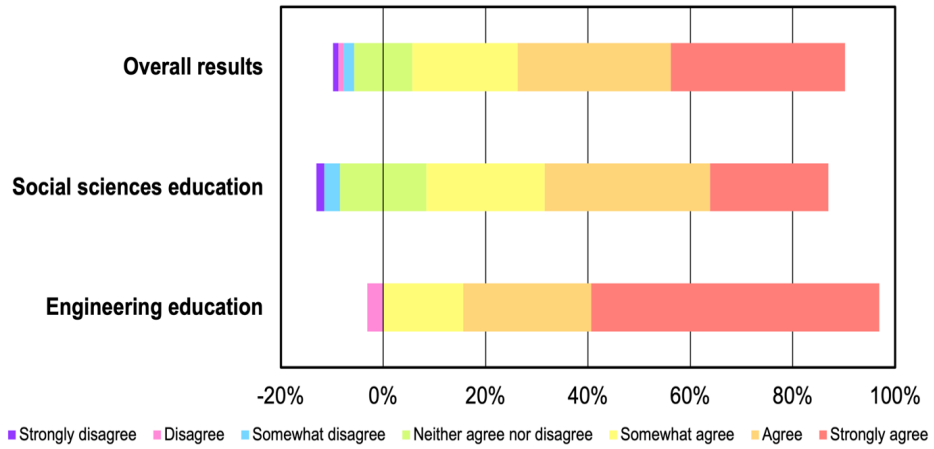


Figure 4: Students' perceptions on the increase of class productivity

When comparing the perceptions of social sciences and engineering students, it is also clear that the implementation of PBL as an active learning methodology is far more appreciated by engineering students. Not only 97% of the students have a positive perception of this student-centered approach (20% more than students from social sciences education), but the answer "strongly agree" represents more than 50% of the opinion, which contrasts with only 22% of social sciences education respondents. Another interesting observation is that engineering students didn't show neutral opinions when asked if class dynamics (Figure 3) and class productivity (Figure 4) had improved. These findings may derive from the fact that the implementation of active learning methodologies represents a very different paradigm when compared to lecturing and exercise-solving classes, which continue to be the common pedagogical approaches.

As concluded by Neves et al. (2021), educators need to be competent in technical and professional issues, but they also need to develop their pedagogical skills to be able to develop innovative teaching strategies and methodologies. Indeed, the outcomes from the present innovative learning approach experiment show that students are satisfied with this pilot program.

Intrinsically related to students´ motivation is their level of academic performance and their willingness to see this active learning methodology implemented in other subjects. These two fundamental pieces of evidence are depicted in Figure 5 and Figure 6, respectively. Based on students' positive perceptions of class dynamics and productivity, it is expected that their perception of the influence of the PBL approach on their final grade (Figure 5) would be positive, which is confirmed by the empirical outcomes. Overall, 85% of students consider that their experience allowed them to achieve better academic results. Although the numbers are not expressive, 3% of students answered that PBL methodology didn't influence their final grade, and 12% had no opinion. This conclusion is in line with other studies carried out in several educational areas, such as natural sciences (Aidoo et al., 2016), health sciences (Qin et al., 2016), and humanities and social sciences (Kozanitis and Nenciovici, 2022). Comparing social sciences and engineering students' perceptions, the previously identified pattern remains. For 56% of engineering students, PBL methodology strongly contributes to a higher final grade, compared to only 15% of social sciences students (Figure 5). Some students seem to have no well-defined position (6%), but no students have negative perceptions. In contrast, 5% of social sciences students don't recognise the added value of this pedagogical approach for their final grade.

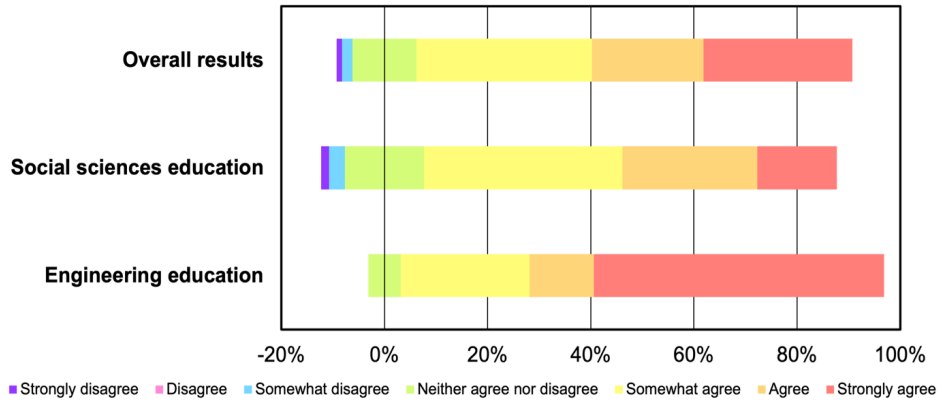


Figure 5: Students' perceptions on the increase of final grade

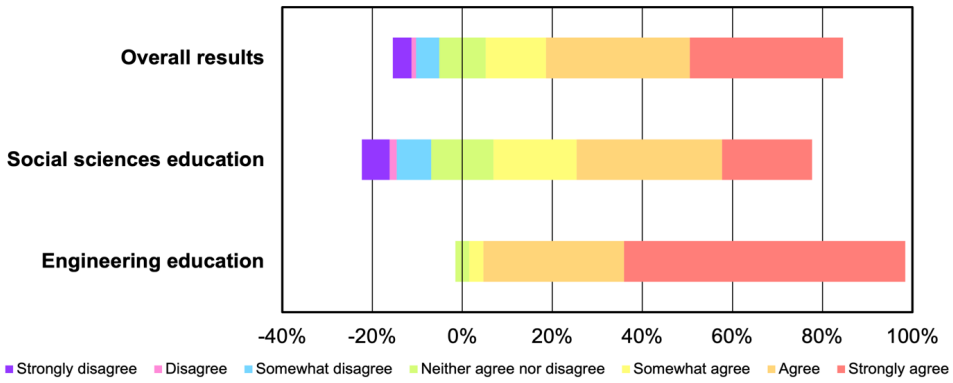


Figure 6: Willingness to the implementation of the PBL methodology in other subjects

Considering the previous positive effects of both classes' environment and final grades, the results illustrated in Figure 6 are expected, i.e., most students (79%) would like to see active learning methodologies implemented in other subjects. Once more, engineering students tend to be more willing to see this type of approach replicated in other subjects. In the first analysis, one may think that results may be related to the different completion rates of full-time bachelor's students in each field of study. However, according to the OECD (2022), in Portugal, the completion rates in the fields of education and STEM (science, technology, engineering, and mathematics) by the end of the theoretical duration of the curricula are almost identical, at 61.5% and 62%, respectively.

The last group of questions proposed in the online survey aimed to assess the impact of PBL on students' social skills, thinking competencies, and self-learning abilities. Eight different skills were assessed, among them the so-called 21st-century skills (World Economic Forum, 2016): critical thinking (problem-solving), creativity, communication, and teamwork (collaboration), digital competencies, and data analysis. Leadership and entrepreneurship are also part of the character qualities that students need to acquire or develop during their academic path to success in today's world.

Analysing the overall results, which are illustrated in Figure 7, it can be stated that more than 75% of all the inquired students consider that their skills or competencies have been positively impacted by the PBL learning process. The 21st-century skills of critical thinking (problem-solving), creativity, communication, and data analysis are, undoubtedly, the areas in which the outcomes are more noticeable (86% of the students' perceptions are positive). In contrast, students' perceptions of the impact of the PBL approach on entrepreneurship, leadership, and digital competencies present the worst results, highlighting 10% of the negative answers. The number of students without a formed opinion is equally considerable.

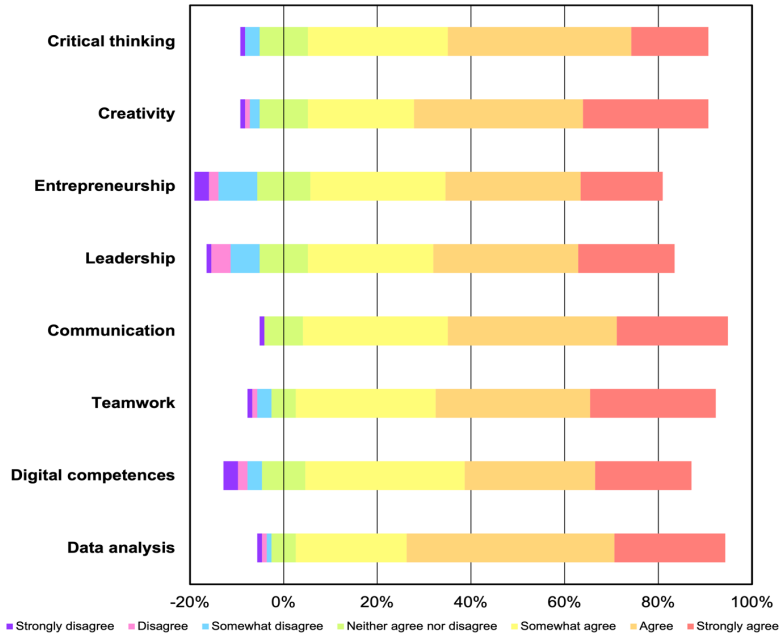


Figure 7: Students' perception on the improvement of transversal skills: overall results

Although further investigation is required, these results may arise from the pedagogical approach itself. Indeed, and in contrast with other student-centered methodologies, such as co-creation and project-based learning, PBL practices do not presuppose direct contact with third-party organisations or companies. This lack of competitive atmosphere or the non-existence of a well-defined goal does not stimulate the entrepreneurial profile of students, as they may not be able to understand the applicability of the proposed challenges.

Regarding digital literacy, results show that the implementation of the PBL methodology does not directly affect this competence. Although students are invited to use digital tools that are unfamiliar to many of them, there is no obligation to use them. Students can achieve all the goals by using common digital resources that they already dominate. Finally, problem-based learning implies that students work in groups of four to six members. Therefore, teamwork is naturally developed, but only a small number of students take on a team leadership role.

The discrepancy between the two fields of education identified in the previous analysis remains valid when examining students' perceptions of the impact of PBL methodology on their skills. Social sciences students (Figure 8) tend to have a less positive perception than engineering students (Figure 9).

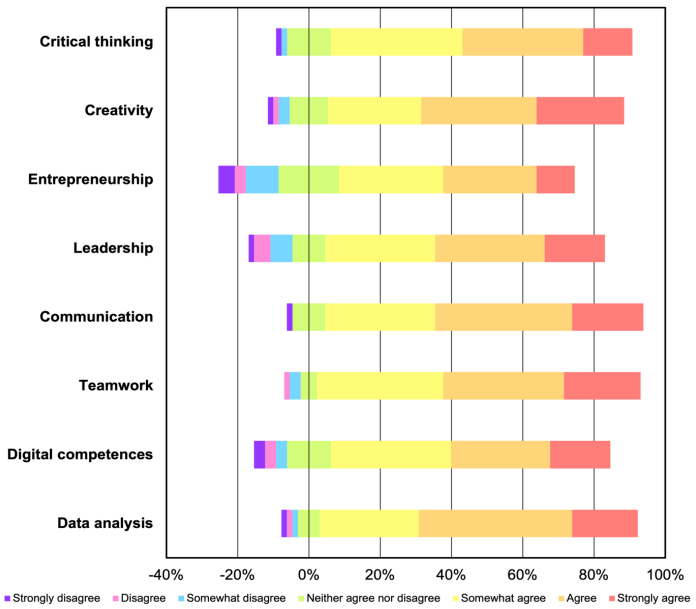


Figure 8: Students' perceptions on the improvement of transversal skills: social sciences education

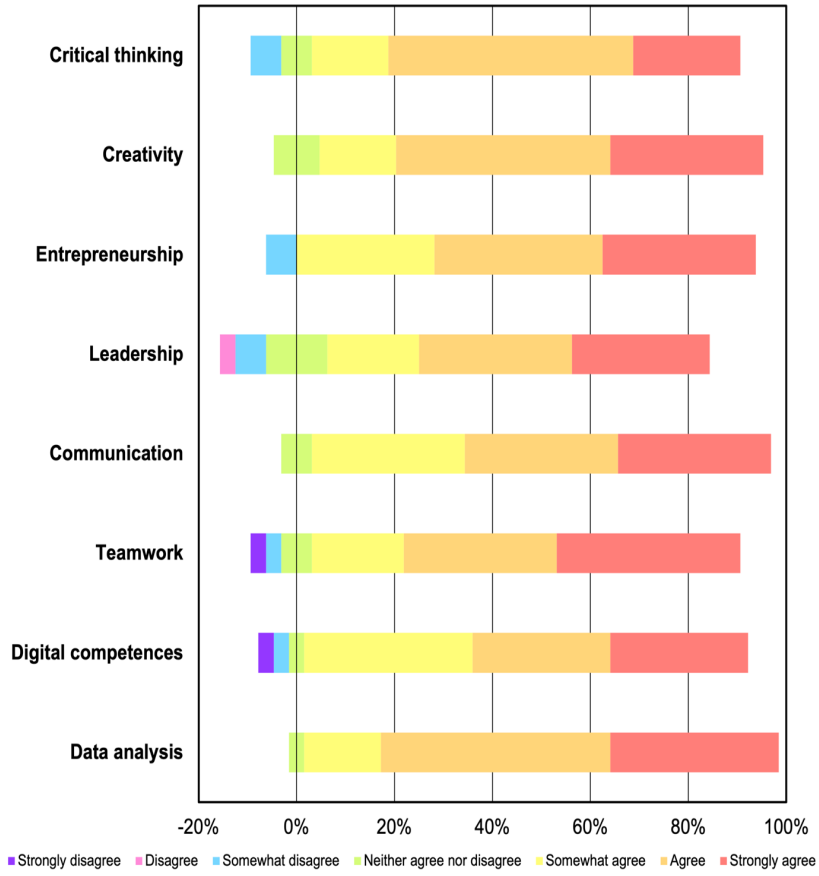


Figure 9: Students' perceptions on the improvement of transversal skills: engineering education

4. Conclusions

There is an evident and pressing need for a change in the prevalent approaches and methodologies employed in higher education. An alternative to conventional learning paradigms is the shift to student-centred education through active learning approaches. Numerous studies have demonstrated the effectiveness of these strategies in increasing students' motivation and performance. The results of this study corroborate and enrich these conclusions. The high degree of students' satisfaction and their desire to use innovative teaching and learning practices in other disciplines should be noted. Regarding classroom dynamics and productivity, two factors that will boost student motivation during the learning process, most students agree that using the PBL technique improves these aspects. These metrics offer insight into how students develop a stronger connection with the curriculum, which leads to more active and diligent engagement and improved integration with teachers and the school community. The active methodology has helped teachers make their lessons more fruitful and efficient. Moreover, when the PBL technique is implemented, it is evident that students are becoming more conscious of their actions and taking more responsibility. Memorization-focused learning has given way to the practical application of knowledge-based learning. When comparing engineering education to social science education, the results reveal notable variations in PBL strategies' efficacy, with engineering students demonstrating a more pronounced improvement in their academic performance. Concerning competency progress, most students reported that they had developed more transversal skills, particularly in the areas of communication, creativity, critical thinking (problem-solving), and data analysis.

These findings foster a redefinition of the pedagogical role traditionally assigned to educators and the exploration of more innovative learning practices. From the perspective of students, it is evident that the integration of active learning methodologies is perceived as conducive to achieving more favourable academic and professional outcomes. Empirical evidence regarding students' satisfaction indicates a positive influence on motivation and engagement within both classroom settings and the broader learning context.

Acknowledgement

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Managing Open Twin Transition in SMEs: A Case Study in the Fashion Industry

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Abstract: According to the French Agency for Ecological Transition, ADEME, the textile sector is projected to contribute to 26% of global greenhouse gas emissions by 2050, highlighting the significance of sustainable fashion. The current market, influenced by increasingly conscientious consumers seeking transparency regarding product origins and production conditions, alongside stricter regulations, compels fashion companies to diminish their environmental footprint by embracing progressively sustainable and eco-friendly practices. With the ability to purchase garments online from anywhere in the world, the necessity of providing clear and accurate information to customers and the supply chain about product features through a document in a smart format has become essential. Consequently, digitization has become imperative in the fashion industry, with the digital passport serving as a pivotal milestone in advancing towards an eco-friendly and more digitalized sector. However, small, and medium-sized enterprises (SMEs) face an uncertain landscape where standards and technologies may not always be mature or readily accessible. Furthermore, limited internal expertise and scarce financial resources often pose challenges in independently developing new technological solutions. One proposed solution is to adopt open innovation approaches. This qualitative research study employs a single case study approach, presenting insights from a small enterprise in the fashion industry specializing in label printing. Utilizing primary data sources such as multiple interviews with managers and secondary sources like detailed briefings of company meetings with technological partners and machinery suppliers, the study aims to shed light on the initial phase of an open innovation approach by SMEs amidst the challenges of twin transition. It highlights that the shift from internal RD& to open innovation is not a direct one, but an iterative one. Scholars will gain a deeper understanding of open innovation mechanisms within SMEs, while practitioners will gain insights into building innovation networks to navigate twin transition challenges.

Keywords: SMEs, Twin transition, Open Innovation, Case study

1. Introduction

In an era of globalized online shopping, the transparency and traceability of garments have become increasingly vital. The introduction of the "*digital passport*" for garments marks a revolutionary step in the fashion industry's journey toward sustainability and digitization. This digital document, accessible through QR codes, NFC, or blockchain technology, encapsulates the entire lifecycle of a garment—from the sourcing of raw materials to its final disposal. It provides comprehensive details such as the origins, manufacturing processes, environmental impacts, and recyclability of the product (*Forbes – 01-16-24*) The digital passport is not just an informational tool; it is a strategic response to the urgent need for an eco-friendly transformation within the fashion industry. Initiated by visionary leaders like Federico Marchetti and supported by an innovative collaboration under the Fashion Task Force, this initiative leverages technology to enhance consumer engagement and foster responsible production practices. By equipping consumers with detailed knowledge about their clothing's environmental and social footprint, the digital passport empowers them to make informed purchasing decisions (*Il Sole 24 Ore*).

When a company, particularly a small-to-medium enterprise (SME), faces a situation of uncertainty, it may begin to collaborate with customers and suppliers (Nieto and Santamaria, 2010). Choosing an open innovation approach represents both an opportunity for SMEs to keep pace with the challenges posed by the market (Van de Vrande, 2009), but also a criticality due to their limited formalization and smaller networks (Spithoven, Vanhaverbeke, and Roijakkers, 2012).

This paper, starting from the challenges posed by the twin transition and the opportunities offered by open innovation, aims to understand through which mechanisms small-to-medium enterprises transition from a closed to an open innovation approach. This is a phenomenon still scarcely explored in the literature, which merits the attention of both scholars and practitioners. To do this, a case study related to the fashion industry is presented, where the anticipated introduction of a digital passport for clothing presents many uncertainties for smaller firms. The paper provides a) a brief literature review on open innovation in SMEs b) a detailed

presentation of the methodology used c) the presentation of findings and their theoretical discussion. The paper concludes by providing directions for future research lines.

2. Literature Review

2.1 Open Innovation: SMEs vs Large Enterprise

In the realm of open innovation (OI), the comparative strengths and weaknesses of small and medium-sized enterprises (SMEs) versus large firms are nuanced and complex. Large firms enjoy resource advantages, and SMEs leverage behavioral strengths such as entrepreneurship and flexibility, which foster quicker decision-making and innovativeness (Narula, 2004). SMEs also adeptly align employee incentives with innovative efforts, enhancing their responsiveness to market opportunities (Holmstrom, 1989; Zenger, 1994). However, SMEs face significant challenges, primarily in accessing critical resources and capabilities for innovation (Hewitt-Dundas, 2006). Large firms, with their scale and scope advantages, are better positioned for innovations that demand specialized teams or sophisticated equipment, allowing them to amortize the fixed costs of innovation across higher sales volumes (Cohen and Klepper, 1996). In contrast, SMEs often struggle with technological resource acquisition, recruitment of skilled staff, and continuous employee training (Bougrain and Haudeville, 2002). The implementation of OI strategies also varies with the size of the enterprise. Large firms typically focus on R&D collaborations during the technology exploration phase, whereas SMEs emphasize the commercialization phase (Lee, 2010; Narula, 2002). SMEs can benefit from limited internal resources by engaging in vertical collaborations with suppliers and clients to innovate effectively (Nieto and Santamaria, 2010). As SMEs mature, they often adopt more formal structures to manage their innovation processes, gradually mirroring the structured and professionalized innovation approaches of larger firms (Vareska van de Vrande et al., 2009). Nevertheless, SMEs inherently face greater risks in engaging with OI due to their limited formalization and smaller networks (Spithoven, Vanhaverbeke, and Roijakkers, 2012). Larger firms generally make more extensive use of OI practices to introduce new products or services, benefiting from cost and time efficiencies sourced from external knowledge (Chesbrough, 006). Conversely, SMEs are adept at responding to market needs through organizational flexibility and less bureaucracy, though they are constrained by resource limitations (Cassiman and Veugelers, 2006). Interestingly, while SMEs may introduce fewer new products or services compared to large firms, their reliance on OI results in a significant portion of their turnover being derived from such innovations, effectively equalizing the impact of OI practices on both SMEs and large firms (Spithoven, Vanhaverbeke, and Roijakkers, 2012). This indicates that while large companies have superior absorptive capacity, the tangible impacts of OI practices on market introduction and turnover generation from innovations are comparable across firm size (ibidem)

2.2 Open Innovation in SMEs

Van de Vrande (2009) highlights that SMEs adopt OI to keep up with market developments, swiftly develop products, incorporate new technologies, and enhance their innovation processes and brand reputation. Additionally, Venturini and Verbano (2012) emphasize that SMEs seek external partners to compensate for internal skill shortages, integrate diverse competencies, stimulate creativity, and share risks and costs associated with new technological developments. However, the implementation of OI is not without challenges. Igartua, Garrigós, and Hervas-Oliver (2010) discuss barriers such as limited time and financial resources, and managerial issues. Muzzi and Albertini (2015), among others, point out that the limited size of SMEs often results in challenges like constrained cognitive capacities and lack of experience in collaboration, which are barriers to effective OI. Ahn (2017) and others further categorize these obstacles according to the types of OI—whether it involves acquiring knowledge (inbound OI), co-creation (coupled OI), or transferring knowledge (outbound OI). MEs face both internal and external barriers in adopting OI. Internally, common challenges include a lack of time, financial resources, expertise, and a culture resistant to openness (Grimaldi, Greco, and Cricelli, 2021; Lam, 2013). These internal barriers are also reflected in attitudes like the ‘not invented here’ or ‘not sold here’ syndromes, which can stifle innovation efforts (Chesbrough and Crowther, 2006).

Externally, SMEs struggle with finding appropriate partners, dealing with demand uncertainty, navigating legal ambiguities around intellectual property, and overcoming administrative burdens (Dziurski and Sopińska, 2020). The challenge of finding partners is compounded by issues like lack of social and cognitive proximity, which can hinder effective communication and collaboration (Albats, 2020). Granstrand (1997) noted the growing need for firms to possess multiple technological competencies due to the increased knowledge content in products and cross-fertilization of technology areas. Rajneesh Narula (2002) observed that firms are increasingly adopting non-internal technology development strategies such as strategic alliances and outsourcing, benefiting firms of all sizes. According to Cassiman (1999), Hagedoorn (2000), Bayona (2001), and Caloghirou (2003), technological

collaboration serves as a strategic mechanism to enhance technological capabilities, access new markets, secure public funding, and complete the innovation process. María Jesús Nieto and Lluís Santamaria (2006) stated, "Technological collaboration may be a good way to improve innovativeness of SMEs strengthening and complementing their lack of resources and capabilities." Narula (2002) highlighted that both large and small firms engage in R&D collaboration to shorten innovation time and access complementary technologies, but large firms are better positioned to form partnerships. Narula (2001) differentiated firms' decisions on internal versus external R&D based on the centrality of technological competence to their activities, with strategic competencies likely developed in-house and less critical ones through partnerships or outsourcing. SMEs weigh the use of non-internal means more cautiously due to their vulnerability and concerns over losing technological assets Narula (2001). Innovation partnerships stimulate SMEs' innovation capabilities, helping them overcome growth barriers due to limited resources and boosting their competitiveness (van Dijk, 1997). Nieto and Santamaria (2006) also suggested that technological collaboration can significantly enhance SMEs' innovation capacities, allowing them to bridge the gap with larger firms. Jill L. Sawers, Marthinus W. Pretorius, and Leon A.G. Oerlemans (2008) highlighted the potential hazards of collaboration for small firms, particularly the asymmetric nature of partnerships which often benefits larger firms more. They noted the importance of safeguarding strategic capabilities through formal and informal mechanisms to prevent unintentional knowledge flows to larger partners. They identified three main safeguarding mechanisms: market, bureaucratic, and informal social mechanisms, with trust playing a critical role in the success of partnerships.

As emerged from the literature review, scholars have long studied open innovation. The literature, however, appears to be still fragmented. Many studies focus on the antecedents and the outcome of OI in SMEs, however, the mechanisms that govern the change toward an open innovation approach are still quite unexplored in SMEs. This topic is becoming more relevant since European SMEs, particularly those working in the fashion industry, will be facing a huge challenge in adapting to the twin transition.

3. Methodology

The present study has been conceived as a descriptive single case study Yin (2014). The case study methodology is particularly fitting when research inquiries are open-ended and aim to dissect intricate phenomena (Yin, 2014), such SMEs shift towards open innovation. This research project has the main objective of understanding the complex dynamics that govern the change from a closed approach to innovation to an open approach to innovation. The unit of analysis is the single SME, taken as an object of analysis in the month through which open innovation has been pursued. The fashion industry has been set as the setting of the case for the challenges offered by the introduction of the "digital passport". Data has been collected from 8 interviews with managers of the firm (see Table 1); only decision-makers have been involved in the interviews. All the interviewees were interviewed in multiple rounds and semi-structured interviews were used. The first interview was used to understand the situation ex-ante, while a further round was used to deep dive into the relationships with the different external partners and the action that the company undertook to tackle the twin transition (i.e. digital passport). Interviews have been complemented with the verbatim transcript of 7 meetings with external partners and summary reports of other informal meetings. Data collected refers to a period of 12 months. Other materials have been collected to triangulate data (such as documents for a public call). The names of the companies involved in the meeting have been anonymized. This study will present an explorative analysis.

Table 1: List of meetings recorded and transcribed verbatim

REPORT MEETING		
DATE	**COMPANY**	**ATTENDEES FROM ITALIAN LABEL FACTORY**
24/07/2023	Blue	Sales manager and tech leader
24/07/2023	Black	Sales manager
13/10/2023	Red	Sales manager and tech leader
28/11/2023	Green	CEO
07/11/2023	Yellow	CEO
16/11/2023	Purple	CEO, sales manager, tech leader
21/11/2023	White	Sales manager

Table 2: Company description

COMPANY	DESCRIPTION
Blue	involved in making machinery for effective label weaving
Black	is part of the Arancione Group and is involved in the development of RFID technology implemented in the world of weaving and woven labels
Red	makes machinery for the packaging stage of woven labels (cutting, folding, and bagging)
Green	assembles weaving machinery by buying the various components (loom body, pavilion, etc...) from different suppliers which he then operates through the implementation of his own software
Yellow	offers a consultancy service in which its technical knowledge and contacts are made available to create a kind of partnership during which the client is assisted and supported in the process of conceiving, developing, and introducing an invention that is then filed with a joint patent
Purple	produces machinery for automatic labelling of different types of products, offering its expertise in electronics, logic, and software within a partnership with another company that instead supplies the mechanical and component parts
White	deals only with the trade and distribution of RFID microchips (even in small quantities)
Arancione	is a group within which several companies, operating in the textile supply chain, are included to offer all the products needed by garment makers and brands to carry out the final stage of garment making and customization
Azzurro	is engaged in microchip manufacturing by investing in research and development in the field of RFID technology
Rosa	oversees packaging and trading the finished garments that will then be sold directly to the end consumer

4. Case description

"*Italian Label Factory*" (anonymized name) is an Italian SME active in the textile sector of fashion and apparel, established in 1961, which has contributed to the disastrous environmental impact. Its core business is the production of woven ribbons and labels for garment packaging and customization.

On the customer side, *Italian Label Factory* is very active and involved in terms of innovation and collaboration, having a kind of internal R&D department made up directly of its own sales team. This team offers insights based on past work and leverages its skills and knowledge, working closely with customers to support them in the development of new products that better meet their needs (and potentially those of others as well). By combining multiple roles simultaneously (R&D and sales), the company avoids having a dedicated internal R&D department, saving resources, and increasing flexibility. On the supplier side, Italian Label Factory is less involved in terms of R&D, lacking the necessary skills to have a specific internal department but relying on its trusted and longstanding suppliers who propose new technologies and/or improvements that enhance the performance of existing machinery using feedback received from various customers. Although resources are saved by not allocating them to an R&D department, lacking any internal innovative competence poses the risk of becoming dependent on suppliers who can decide whom to provide their technologies/innovations to (including competitors).

The green transition to reduce the environmental impact caused by the textile sector is no longer postponable, and Italian Label Factory has always been very sensitive to these issues. Already in 2019, it implemented the use of recycled yarn proposed by the most avant-garde suppliers, but today, to be sustainable, it is necessary to have visibility and control over one's own production chain by tracking one's garments even after the sale, optimizing their disposal and recycling process. The digital passport encapsulates a multitude of opportunities by optimizing logistic processes and reducing the environmental impact of each garment. Being in 2024, the only risk is that of mistiming by moving too early in offering customers a more expensive product whose benefits they do not fully understand yet. Moving too late, they would lose the advantages linked to being the first to find a solution, risking having to comply with already registered patents.

5. Findings

To better understand the mechanism that led Italian Label Factory to open innovation, we read the data collected using a micro perspective and segmenting the transition from internal *R&D only* to open innovation in several phases:

Phase 0 – Uncertainty and open-innovation dilemma. Italian Label Factory finds itself in a context of high uncertainty where there are still no precise laws regarding the restrictions that will come into force from 2030 and the parameters to comply with them. To improve the global sustainability of the textile sector, it was thought to develop a solution that could reconcile RFID technology with classic woven labels into a single product and, through the traceability of garments, optimize the management of logistics and their disposal/recycling. From the beginning, it was necessary to determine whether it was better to develop a solution internally using one's own skills and contacts to fully enjoy the potential advantages or whether to collaborate through partnerships with suppliers and customers, with whom the potential advantages of developing a winning solution would also have to be shared.

Phase 1. The first approach to open innovation. Through discussions with Italian Label Factory's current machinery suppliers (Blue), it was investigated how they could support their project and how they were addressing the introduction of the digital garment passport.

> *"From the very first phone contacts with Blu, it was clear that it was not going to be as easy as we initially imagined" (Owner of Italian Label Factory).*

Having sensed the opportunity from the beginning, Italian Label Factory thought it could not develop a winning solution on its own: it contacted the main and historical supplier of weaving machinery, Blue, to commission a loom capable of weaving the label and simultaneously inserting RFID technology. Blue had abandoned the research and development of RFID technology implemented in classic weaving, ceding the dedicated division (Black) to the Orange group. Speaking with Black, they had patented with Orange a particular self-adhesive RFID to be applied to the back of the woven label as an interim solution.

Phase 2 – Back to a closed innovation approach. Managers from Italian Label Factory perceived feeling was that somehow, they wanted to disincentivize Italian Label Factory from working with them and adopt this kind of solution. The perceived hostility, however, convinced the company that they were moving in the right direction and that the self-adhesive solution is indeed currently feasible to meet the need for traceability of garments.

> *"We come back disappointed but at the same time we interpreted this hostility in wanting to share this new technology as a kind of increased awareness in the fact that we are moving in the right direction"(Sales manager of Italian Label Factory).*

Therefore, Italian Label Factory tries to invest internally with a closed innovation to develop a similar solution to offer to its customers.

Phase 3 – Towards an open innovation approach. The absence of an internal R&D department (supplier side) and any competence to develop a loom capable of reconciling the weaving of labels with RFID technology and knowledge in the field of RFID to develop an interim solution like the self-adhesive one, however, pushed Italian Label Factory to rely on Yellow, a consulting firm for innovations in traceability and logistics, which offers its technical knowledge and contacts to find the best manufacturers in the world to supply, accompanying and supporting the process of conceiving, developing, and introducing a new innovation to then file a joint patent.

Phase 4 – Building an innovation network. The contacts suggested by Yellow were abandoned and it was decided to share the project with more actors where each provides their skills, knowledge, technologies, and machinery to develop and offer this product to the final customer. The company understood that such a challenge should be addressed in a multi-partner open innovation network.

Phase 5 – Open-innovation: co-development of a solution. In the following months of meetings and ecological transition, Italian Label Factory has collaborated more by broadening its base of suppliers by turning for the first time to the direct competitors of Blue.

> *"I recalled that when I met with Green this summer during ITMA 2023, they mentioned something about the digital passport and the opportunity it represented for all players in the textile supply chain. Considering recent developments, I felt it was my duty to contact them and arrange a meeting as soon as possible" (Owner of Italian Label Factory).*

Green is a very innovative reality sensitive to the theme of the introduction of the digital passport having understood the potential, the limits of the self-adhesive solution, and the inability to develop a loom capable of weaving the yarn with the aluminum fiber antenna simultaneously. The collaboration was successful. The solution devised in collaboration with Green consists of weaving a tubular label with a small cut on the back that creates a sort of pocket inside which the RFID chip will then be mechanically inserted. This slit is then closed by sewing the label on the garment so that the chip does not come out separating from the garment during its useful life.

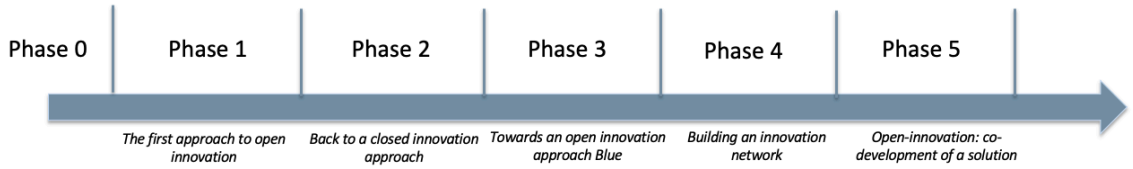


Figure 1: Project timeline

6. Discussions

This work, although exploratory in nature, sheds light on the mechanisms that lead an SME to adopt an open approach.

Nowadays textile companies are working in the same context that is described in the literature by Milliken (1987) when it comes to the concept of environmental uncertainty. These SMEs are experiencing a high level of environmental uncertainty due to the lack of critical information regarding the content of the regulations that will govern the use and introduction of the digital garment passport in 2030. Consequently, it's not possible to predict future events by regulatory forces ("*state uncertainty*"), and we as not able to understand what impact this innovation will have on companies ("*effect uncertainty*"), and which solution will be the most appropriate to adopt ("*response uncertainty*") between that of self-adhesive RFID and that with the tubular tag containing RFID (or another one not yet thought of). Therefore, companies in the textile supply chain remain in a stalemate where they are unable to make decisions since they do not yet know the standards to which they will have to adhere.

To reduce this uncertainty, as also explained by Schoemaker and Day (2009), Italian Label Factory keeps in constant contact with the actors in its supply chain leveraging extended networks to gather more information and scan weak signals about potential opportunities coming from the market and decides to change its approach by "*adopting multiple perspectives to get a better peripheral view".*

Italian Label Factory has changed its approach and, as explained earlier by Chesbrough (2003), has shifted from seeking a solution through close innovation in which it relied solely on its own internal R&D and its own strengths and resources, to an open innovation approach by relying on external information and resources by opening up to collaborations with other players in the supply chain with whom knowledge, ideas and technologies are shared so as to make up for the scarce resources in the innovation phase that distinguish SMEs from large companies.

Through this type of approach, as explained by Dahl and Moreau (2002), SMEs can compete in the market by finding better solutions than those sought by large companies through their R&D departments since they are the result of the vision and mix of skills and knowledge of several actors at once. This is the case of Italian Label Factory and the actors who participated in the partnership, who were able to develop a solution (tubular label with RFID inside the pocket) that was far better than that of the big industry giants (self-adhesive application of RFID on the back of the woven label) and able to meet the requirements of the introduction of the digital garment passport.

One of the most important contributions of this work in the academic literature is the explanation of open innovation in SMEs as a trial-and-error approach between closed and open innovation approaches. Moreover, it shows that this process is first guided by a more passive approach (*exploitation of the known partner*) and then by a more active approach (*scouting of a new partner).* We show that the transition from internal R&D to open innovation is not a linear process, but an iterative process that makes the company shift multiple times from closeness to openness and vice versa. Leveraging pre-existing knowledge ties and tackling hostility and

discouragement, searching for a partner appear to be the antecedents that led an SME to shift several times from internal R&D to open innovation.

From a practitioner's point of view, this paper offers interesting insight that managers could follow. It shows how building on existing ties could lead to hostility or discouragement in pursuing an open innovation approach and trying to stick to internal R&D. If the company locks in with this approach it will be not able to tackle new challenges. Moreover, it highlights how open innovation between companies that face similar challenges can lead to the development of new products, more effective than the ones offered by the market.

7. Conclusion, Limitations, and Further Research Avenues

This research paper achieves a dual objective. On one hand, by situating itself within the literature on open innovation, it confirms some of the evidence from both qualitative and quantitative studies concerning open innovation in small and medium enterprises (SMEs). On the other hand, it enriches the literature by exploring the mechanisms that enable a small firm to transition from a closed to an open innovation approach. Moreover, it utilizes the perspective of open innovation to understand how SMEs handle the twin transition, an emerging trend of great significance for both practitioners and scholars.

However, this study is not without limitations. Although the use of a single-case study is beneficial for understanding new phenomena, such as the twin transition in SMEs, future research could aim to broaden the sample of cases by a) extending the analysis to the fashion industry, considering other types of productive activities that will be impacted by the introduction of the “digital passport,” and b) expanding the analysis with a cross-industry perspective. It should be noted, however, that this case clearly represents the complexities and the climate of uncertainty that many small enterprises are currently facing. The data was collected over a 12-month period of the project conducted by Italian Label Factory. Although this time frame is sufficient to study the phenomenon in question—specifically the transition from a closed to an open approach—it would be interesting to conduct a longitudinal analysis that follows the company up to 2030 and the official introduction of the digital passport.

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Business Model Innovation Toward Sustainability: A Case Study in Outdoor Fitness Equipment

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Abstract: A novel competitive landscape requires managers to innovate business models. Drawing on a theoretical framework that classifies Business Model Innovations (BMI), the paper contributes to the literature studying business model innovation toward sustainability in outdoor fitness equipment (OFE). The OFE is an empirical setting worth investigating because emerging trends disrupt the fitness industry. The Pandemic has shifted how these firms deliver their services. The concept of wellness has evolved from "being in shape" to "achieving a well-being state," which includes mental, spiritual, and physical health. Differently from the pre-pandemic period, consumers' focus is on feeling better rather than looking better physically. Relying on a case study approach and using multiple semi-structured interviews, the paper offers empirical evidence of BMI in the OFE. The company innovated its business model (BM), embracing novelty and differentiation and moving from rethinking customer segmentation. Further, the case shows how BMI widens value creation toward a sustainable path, generating social and environmental value. The value chain and the company's ability to partner with its suppliers are pivotal. While the challenges generated by changes in customers' habits trigger the BMI, the suppliers' know-how and alignment with the company's value proposition drove the innovation toward a SBM. The paper contributes to the literature on BMI and SBM. The evidence allows future research to explore how partnerships among companies operating along the same value chain emerge for the sake of the BMI toward sustainability. Practical and managerial implications are offered.

Keywords: Business model innovation, Sustainable business model, Outdoor fitness equipment, OFE

1. Introduction

The fitness market was significantly impacted by the Covid-19 outbreak. Notably, the Pandemic has drastically changed how these firms do business. For instance, before the pandemic, gyms and clubs were at the top of the exercise industry hierarchy. In 2020, the consulting firm Deloitte reported that "clubs in Europe lost 15.4 percent of their members, or more than 10 million people, even when closures were relatively brief". Although they experienced a sharp decrease due to COVID-19 restrictions, the future expectations seem positive since "the gym and health clubs market share is expected to increase by USD 101.18 billion from 2020 to 2025". Moreover, as reported by the European Health & Fitness Market Report 2022 developed by Deloitte and Europe Active, the European fitness market is rapidly growing. In addition, the COVID-19 restrictions and lockdowns have forced many customers to adopt alternative workout methods, such as home workouts with zero equipment or with few home devices like the ones offered by Peloton or Mirror. Several studies showed a drastic change in consumer behaviour, confirming the increase of consumers' awareness about the positive impacts of fitness and wellness activities (Chow, 2013). Since a growing number of people prioritize their well-being, they are more engaged in physical exercise today than before. In fact, after the advent of the Pandemic, they have proved to be more inclined to improve their quality of life by adopting a healthier lifestyle. As the Mindbody 2022 Fitness report discussed, "just as 2020 created new paths to connection and wellness, 2021 reinforced the need to make those paths sustainable". The concept of wellness has evolved from being in shape to achieving a well-being state, which includes mental, spiritual, and physical health. Differently from the pre-pandemic period, the consumers focus on feeling better rather than looking better physically. Notably, the main reasons consumers focus more on wellness are to improve their health status, live a long and healthy life, and, finally, be healthy to enjoy life. Consequently, many trends have occurred in the last couple of years. According to the American College of Sports Medicine (ACSM), many new fitness trends have emerged after Covid-19. In 2021, the "Worldwide Survey of Fitness Trends", annually conducted by the ACSM's Health & Fitness Journal, established the following main emerging trends: online training, wearable technologies, bodyweight training, outdoor activities, high-intensity interval training (HIIT), virtual training, exercise is medicine, strength training with free weights and fitness programs for older adults. Because of the impossibility of working in physical gyms and clubs, people relied on other workout methods, like online live, on-demand exercise classes, and health-wellness coaching. Consequently, there has been a proliferation of fitness Apps that offer live and on record virtual classes. Further, the demand for fitness has expanded toward a new target customer: older adults. More precisely, one of the most interesting target ages is the Silver Age, which ranges from Baby Boomers (people born in the United States and Western Europe between 1946 and 1964) to Over 70. It is common knowledge that the population-aging phenomenon is increasing worldwide.

Consequently, the market size is drastically growing because of demographic reasons; further, people in the Silver Age are characterized by a higher expenditure capacity than the younger age groups. As the London Business School estimated in 2021, the expenditure capacity of over 50-year-old people in the United States accounts for USD 7.1 trillion per year. However, in 2032 the expectation of the same spending capacity for the same target age is estimated at USD 13.5 trillion per year. Therefore, the Healthy Longevity market represents a very good investment opportunity for businesses in the fitness sector. Finally, given new emerging trends and customer targets, businesses must understand how to include them in their business strategy.

Emerging trends are disrupting the fitness industry. In this regard, the novel competitive landscape requires managers to redesign business models. To compete, fitness firms must rethink, reinvent, and reorganize the ways in which they create, deliver, and capture value through their business models. In this competitive landscape it is essential for companies to innovate business model. Prior literature show that business model innovation (BMI) is a key leverage for companies to gain and sustain their competitive advantage (Bashir and Verma, 2017). Although BMI has been analyzed from many perspectives (Wirtz et al. 2016), there is still uncertainty about the BMI components. The discussion around BM innovation, even respect to BM imitation, remains an open research area (Montemari et al., 2024). Among the multiple conceptual framework provided by prior literature, this research relies on the Triple Layered Business Model Canvas (Joyce and Paquin, 2016) to provide empirical evidence about how a business model is innovated toward sustainability in the aftermath of the Pandemic emergency.

Relying on a case study approach and using multiple semi-structured interviews, the paper offers empirical evidence about the changes implemented by a company operating in the OFE to innovate its business model toward sustainability. Empirical evidence shows how BMI widens value creation toward a sustainable path, generating social and environmental value. The paper provides theoretical conceptualizations of BMI that can be extended to different industries for future research. Practical and managerial implications are offered.

2. Literature Review and Research Questions

Research has shown that business model innovation (BMI) is a key leverage for companies to gain and sustain their competitive advantage (Bashir and Verma, 2017). BMI aims to create new pathways of value creation that are sufficiently radical to change the existing competitive landscape (Barnes et al., 2024).

BMI has been analyzed from many perspectives (Wirtz et al. 2016), including types of innovation (Taran, Boer, and Lindgren 2015), BM innovation processes (Holtström 2021; Taran, Boer, and Nielsen 2022), and enablers and barriers to BM innovation (Mateu and March-Chorda 2016). The BMI literature is recent, rapidly growing, and untheorized (Foss and Saebi, 2017; Montemari et al., 2024). The concept and the theoretical rationalization of BMI components still need more elaboration (Shakeel et al., 2020). This research is positioned in the BMI literature that classifies BMI, relying on the conceptual antecedents of BM (Foss and Saebi, 2017). BMI is clarified as a drastic transformation of existing BM (Adams et al., 2016). With respect to BM, BMI introduces the additional conceptual dimension of innovation thus raising additional theoretical and empirical questions to those already posed in the BM literature. Prior literature highlights that innovation might involve different levels of newness: new to the world, new to the industry, and new to the company (Garcia and Calantone, 2002; Montemari et al., 2024). This research explores the newness at the company level and aims to provide empirical evidence to answer the following research question:

RQ1. What changes are innovating the BM of a company operating in outdoor fitness equipment?

Sustainability is an ethical choice and a response to a specific market demand from customers requiring sustainability practices (Mannien et al., 2024; Kurek et al., 2023). Recently, the increasing focus on BM is due to sustainability issues (Rossignoli and Lionzo, 2018). Sustainable development occurs through new business ideas and BM innovations (Bocken et al., 2014; Hart and Milstein, 2003; Schaltegger et al., 2012; Stubbs and Cocklin, 2008) with the aim of combining sustainable value and value innovation while keeping the spirit of the business model (Shakeel et al., 2020). The business model for sustainability 'incorporates sustainability as an integral part of the company's value proposition and value creation logic' (Abdelkafi & Täuscher, 2016, p. 75). The literature offers different classifications of the available kinds of sustainable business models (Lüdeke-Freund et al., 2018). However, the research agenda remains wide, leaving room for further investigations (Najmaei and Sadeghinejad, 2023). Within sustainable business model literature, studies identifying sustainable value-creation elements is still fragmented (Mannien et al., 2024). The triple-bottom-line approach is a well-acknowledged framework the literature is referring to when studying sustainable business models (Dhir et al., 2023). Joyce and Paquin (2016) conceptualize sustainable business models (SBMs) according to the

Triple Layered Business Model Canvas (TLBMC), which illustrates an implementation of the Business Model Canvas (BMC) towards a sustainability perspective. The most widely used Osterwalder and Pigneur (2010) canvas adopts an economic approach, but it lacks a sustainability perspective. In this respect, the TLBMC helps to visualize how business model innovation can be developed toward a sustainable perspective. TLBMC enlarges the original BMC by adding two layers: environmental and social. The environmental layer is based on a lifecycle perspective, and the social layer is based on a stakeholder perspective. The TLBMC provides a holistic view of how the firm can generate value for itself and its stakeholders. Furthermore, it details the shift toward a circular model, which offers enormous opportunities, including cost saving through waste reduction, better supply chain management, lower sensitivity to resource price volatility, and longer, better customer relationships. Drawing on the TLBMC, I empirically explore how the pressure toward sustainability shapes the BMI, attempting to answer the following research question:

RQ2: What are the changes toward sustainability in BM of a company operating in outdoor fitness equipment?

3. Methodology

This paper is based on a case study design (Yin, 2009). Prior studies acknowledge lack of rigorous, theoretically guided and empirically based approaches in research on BM (Zott, Amit and Massa, 2011). I use an inductive methodology to enable the development of theory about BMI (Yin, 2009).

My evidence is drawn from the study of a company operating in the OFE industry: MyE. The name of the company is fictitious for the sake of anonymity. Three major sources of data were used. First, available sources such as the company websites, updated catalogs, annual report and correlated articles. Second, qualitative data was gathered during the “Move City Sport 2022” event, which was held in Bergamo in October 2022. Lastly, I collected information from multiple semi-structured interviews with MyE’s founder and the top managers. I coded and analysed the interviews, focusing on the components of Triple Layered Business Model Canvas (Joyce and Paquin, 2016). Second, a within-case analysis was developed to elucidate the drivers that led to BMI (Yin, 2009). Iterating between theory and the case analysis clarified the theoretical argumentation (Eisenhardt, 1989).

4. Findings

To address RQ1, it is helpful to understand the decision-making process followed by MyE's top management to innovate its business model (BM).

To address the proliferation of several new fitness trends that emerged with COVID-19, the company had to meet novel consumer needs and behaviors in the OFE. Even before the Pandemic, the market demand for OFE started focusing on realizing “wellness projects” rather than selecting a mix of single products. MyE’s top management formed a system containing “their mindsets related to the key business ideas, and their unique view of the business” (MyE’s CEO interview). As a result, in 2020, MyE started designing international projects to create “public wellness projects”. To achieve this, the company sought to enlarge its target customer end-user by embracing an inclusive approach. The choice to embrace inclusiveness was carried out with the awareness that the business strategy needs to be dynamic to follow the external environments. Unlike the competitors, MyE decided not to move indoor fitness equipment to outdoor spaces but instead to create a new environment of equipment that is essentially different from indoor tools. For example, the brand decided not to produce cardio equipment since the aim is to lead people to do cardio by exploiting outdoor areas. Consequently, the workout type was born to be instinctive and based on body weight rather than on moving outside indoor gym weights. In response to changes in the firm’s external environment, the CEO expanded its product lines and provided a 360-degree outdoor fitness experience.

Furthermore, MyE brought a new value proposition that prompt people to pursue an outdoor fitness lifestyle. In doing so, it developed the first artistic and design concept for outdoor fitness worldwide and introduced the concept of functional sculptures. According to it, the fitness products integrate into the outdoor context with a strong artistic sense that combines art, design, and fitness. The idea's implementation was made possible thanks to the industrial know-how of the main industrial partner, who has 30 years of urban design experience and MyE’s top management know-how, which gave the knowledge derived from 20 years of experience in the fitness industry.

The new customers’ needs were addressed in two ways: i) revisiting the customer segmentation, adding new categories of target customers, and ii) revising the products to combine functionality with beauty in both public and private spaces. MyE's business model employs radical innovation in the industry, including novelty

and differentiation. The innovation of the business model follows the "focused BMI" typology (Foss and Saebi, 2017). Innovation is "focused" for two main reasons. First, the new BM is a novelty to the OFE industry because it is one-of-a-kind in the overall OFE competitive landscape. Second, the innovation is "modular" because it changes only one component rather than the whole BM architecture. Specifically, MyE decided to serve new customer targets, extending its product to the public segment. MyE's focuses on extending the new outdoor fitness experience in the following segments: corporate, academic, hospitality, residential, mall, convention center, cruise, and private.

Consequently, introducing a novel target customer set has drastically changed how MyE does business. Furthermore, creating product lines dedicated to athletes and non-athletes has required much investment. The development of products required significant expenses in terms of R&D. The realization of those products was made possible thanks to a highly skilled workforce, design skills, and accurate designs. Moreover, the product development was done by external consultants who have contributed to the project. Additionally, all those products cannot be easily imitated thanks to the legal protection of patents.

To address RQ2, it must be pointed out that MyE sells luxury fitness equipment. Like other luxury brands, it aims to reshape its BM sustainably. A few decades ago, "luxury" was defined as a status symbol since it related to exclusivity. However, the approach has now changed toward a new value-creation perspective. Luxury embraces environmental and social issues to promote the community's well-being. Accordingly, MyE BM turned to sustainability generating superior customer value and contributing to the sustainable development of society.

The company decided to operate "to reduce adverse external effects and create new positive external effects for the environment and society" (MyE's CEO interview). MyE's products are considered durable and long-lasting and projected to be environmentally friendly.

Starting in 2020, MyE lays its foundation on three main values: inclusivity, which allows everyone to do outdoor workouts; aesthetics, which enhances the outdoor areas with art and design; and, finally, Italian craftsmanship, which translates into great technical work.

In the triple bottom line approach Joyce and Paquin (2016) used to conceptualize the sustainable business model, the environmental layer describes how the organization generates more environmental benefits than environmental impacts. The fitness-wellness industry is characterized by many emissions, especially from raw materials processing and transportation. MyE's set the goal to reduce carbon emissions in all value chain stages. MyE operates using an eco-friendly manufacturing process. Since 80% of total carbon emissions derive from raw materials, MyE has carefully evaluated the selection of its raw materials to be environmentally friendly. The selected materials are considered a fundamental component of its product lines, which can be defined as green or sustainable because of their long lifespan, but, most of all, because of the absence of plastic components. All products are eco-friendly since they are 100% plastic-free.

Further, they can be distinguished into two typologies, ranging from "born green" to "made green" materials. The former regards materials derived from nature, such as wood or marble. The latter is formed by materials that have been given a second life by mixing recycled materials. For instance, components are mostly made of recycled pieces. In so doing, MyE employs a recycling process for almost all its finishing. This specific manufacturing practice allows to reduce material waste significantly. Furthermore, the leading industrial partner has "always demonstrated a strong focus on corporate social responsibility through constant research in new technologies and materials and by making conscious design choices".

The company uses energy from 100% sustainable sources for the manufacturing process. Since 2009, it has engaged renewable energies using a technologically advanced processes plant. MyE started to create renewable energy, which allows it to cover most of its energy needs. The company provides clean energy thanks to its photovoltaic system, which has over 7500 solar panels installed on its plants' rooftops. The adoption of solar energy is translated into reducing more than 850 tons of CO_2 per year in the environment. In short, the company lowered its material waste and carbon footprint.

From a social perspective, all OFE firms deliver social sustainability because their core business is creating social value and promoting consumer health and well-being. The OFE can positively affect society by improving physical activity and public spaces (Chow et al., 2021). Outdoor fitness training benefits people's physical condition by improving blood pressure, physical fitness, and quality of life (Chow, 2013). In the public context (B2G), OFE creates a space where people can socialize while meeting their fitness goals. Meanwhile, in the private context (B2B and B2C), they can enhance the public health status of individuals. Although most OFE

firms mainly operate in the B2G market segment, MyE delivers social value in many customer segments. Indeed, it seeks to create social value by offering fitness solutions for a multi-target end-user. More specifically, the brand's functional and innovative fitness solutions are conceived to guide people to pursue a healthy lifestyle. Additionally, the business strategy aims to create an outdoor wellness community. Specifically, its mission focuses on improving "interactions between people and creating the right conditions for socializing, working, playing sports and having fun" (MyE's CEO interview).

MyE has always complied with national health and security laws for the sake of its workforce. Workplace accident prevention procedures are in place to ensure the safety and well-being of the employees. Recently, MyE has embraced a health policy, setting the standards for protecting and ensuring employees' and operations' well-being. The policy covers all the employees, and accountability lies with the Board of Directors.

MyE states it offers equal opportunities regardless of ethnic background, race, religion, age, gender, disability, sexual orientation, outlook, or social status. However, the male component of MyE's workers is much larger than the female one. This is due to the difference in the job assignments, which is driven by maximizing individual personal skills.

MyE has fostered charity groups. For instance, the community of people who train in Miami has felt obliged to give something back to the city by organizing solidarity activities every month around one of MyE's most iconic facilities. Furthermore, the company has recently addressed social inclusiveness in its projects. Given the goal of creating healthier communities, the brand offers parks to outdoor wellness experiences, allowing every kind of user to enjoy public spaces free of charge. Finally, it also creates value for the city itself. For instance, a study in Los Angeles outlines that "parks in Los Angeles installed with OFE attracted new visitors and stimulated increased physical activity". Thus, the company contributes to the requalification of urban areas by creating a place where people can work out and connect.

5. Conclusions

The theoretical rationalization of BMI components is still undefined (Shakeel et al., 2020) and attracts academic research and professional interest. With respect to BM, BMI introduces the additional conceptual dimension of innovation, thus raising additional theoretical and empirical questions to those already posed in the BM literature. This research moves from the BMI literature that classifies BMI relying on the conceptual antecedents of BM (Foss and Saebi, 2017) and relies on the Triple Layered Business Model Canvas (Joyce and Paquin, 2016) to provide empirical evidence about how a business model is innovated toward sustainability in the aftermath of the Pandemic emergency.

Relying on a case study approach and using multiple semi-structured interviews, the paper offers empirical evidence about the changes implemented by a company operating in the OFE to innovate its business model toward sustainability.

Empirical evidence shows that the innovation of the business model was triggered by the changes in the customers' needs and habits. The BMI took place in two directions: novelty and differentiation. Novelty refers to the new customer targets, as the company revolves towards additional customers, such as corporate, academic, hospitality, residential, mall, convention center, cruise, and private. Differentiation refers to the product's renewal to combine functionality and beauty.

The pressure toward sustainability resulted from changes in the customers' needs, which triggered a turn in the value proposition. It evolved from selling fitness equipment to providing equipment to achieve a well-being state that includes mental, spiritual, and physical health. The case shows how BMI widens value creation toward a sustainable path, generating social and environmental value.

The study has the potential for many contributions. First, the study contributes to the theoretical conceptualizations of BMI, showing that innovation may be triggered from only one BM component, generating a cascade of effects in the whole BM architecture. Furthermore, the study contributes to the literature investigating SMB, revealing that the value chain pressures and the company's ability to partner with its suppliers are pivotal in pursuing SBM. While the challenges generated by customer habits and needs changes triggered the company to rethink its offer, the suppliers' know-how and alignment with its value proposition drove the innovation. The product renewal was possible thanks to the partnership between the company and its suppliers, who share a common value proposition besides the contractual agreements.

Second, the paper contributes to the studies investigating OFE's benefits, showing that besides the physical well-being of many users (Chow et al., 2020; Chow, 2013), OFE constitutes a profitable business in the fitness

industry. The increasing demand for OFE feeds the evolution of extant businesses and generates incoming wealth for suppliers along the value chain.

The generalizability of the study is granted by the robust adherence to the case study (Yin, 2009) methods widely used in qualitative studies. However, the study is not exempt from limitations as it relies on a single case study. Further research might extend the evidence by comparing multiple studies in the same industry.

Practical and managerial implications are offered. The case shows that innovating a BM strongly depends on the top management's choices. Leaders' attitudes toward changes and firm flexibility represent favourable conditions for BM innovation. In this case, the CEO's attitude toward open innovation was pivotal in driving the decision-making inside and outside the company involving the supplier in a quasi-network partnership.

Future research shall explore further how these relationships emerge and evolve for the sake of the BMI.

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The Role of the Inclusive Leader in Driving Innovation: An Example of a Teal Organisation

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Abstract: The role of the leader is to create change and indicate the direction in which the organisation should go. Leader is the one who inspires, creates the organisational culture and builds emotional relationships that result in a much more effective company. His or her activity also influences the level of innovation in the company - the more inspired a co-worker perceives a leader and the greater his or her capabilities and freedom of action, the greater the chance of creating newer or even revolutionary solutions. The author's research has shown that the role of a leader in an innovative organisation cannot consist only in creating and promoting a vision, and then inspiring others to make it a reality. It can be concluded that the period of feisty and charismatic visionary leaders is slowly passing into oblivion, and their place is being taken by leaders who are able to discover and unleash the creative potential of the entire team in their talented colleagues. Amidst the evolving landscape of businesses, there is a growing focus on identifying key traits of leadership essential for effective organizational change. It is advocated that every organization should draw on these traits to innovate its employee resources. The presented results show the results of four years of research within the framework of the project entitled Teal Organisations: developing self-management and entrepreneurial culture in the age of Economy 4.0. The research shows how the understanding of innovation, the role of leadership has changed over several years and what research gaps are emerging. The research targeted micro and small enterprises in the family business sector. Insights from the third stage conducted in 2023 shed light on the qualities and competencies of leaders. The study's findings highlight that leadership fosters better team outcomes through enhanced decision-making and collaboration. Our research shows, that leaders are required to acquire, develop and refine the skills of facilitating the work of a team to effectively and continuously generate innovation. The leader must master several skills, i.e. knowing the tools of creative team work, allowing the free flow of information, the ability to integrate ideas in order to create a new, better idea, so that the valuable ones do not get diluted and are qualified for further innovative work through well-considered decisions.

Keywords: Leader, Innovation, Teal organisation

1. Introduction

1.1 Leader (Inclusive)

Leadership, as defined in literature, encompasses distinct features and competencies crucial for effective functioning within a specific environment (Pasieczny, 1981; Chmiel, 2003). Key traits outlined by authors such as Kirkpatrick, Locke, Zaccaro, Kemp, and Bader include determination, motivation, responsibility, self-confidence, cognitive abilities, extroversion, emotional and social intelligence, openness, self-control, problem-solving skills, and compliance. What is more, leaders play a pivotal role in change initiatives thanks to their ability to influence employee reactions and provide clarity, connection, and accountability (Kurtessis et al., 2017; Van Buren, Greenwood, & Sheehan, 2011). Establishing respect-based relationships where employees' needs are acknowledged and met (Travaglione et al., 2017) fosters managerial support, facilitating communication and strategic decision implementation (Dasgupta, 2015).

Inclusive leadership fosters collaboration and innovation by inviting employee participation in goal-setting and decision-making processes (Bilińska-Reformat, 2011). It creates an environment where individuals from diverse roles contribute to identifying sources of innovation and engage in trust-based, joint decision-making (Garita, Martinez, 2016).

1.2 Innovation

The issue of innovation has been present in the literature for a long time, but in recent years it has been increasingly considered in the context of the dynamic changes that are occurring in the organization's environment and the need to adapt to them. Despite the fact that since the time of Schumpeter, considered the founder of the concept of innovation and viewing it as the creation of new combinations of existing resources (Schumpeter, 1934), many new definitions have appeared (e.g. OECD/Eurostat, 2009; Mulgary & Albury, 2003; NAO, 2009; Damanpour & Schneider, 2009; Kogabayev & Maziliauskas, 2017), what is invariably emphasized is that their essential component is creativity (e.g., Seaden & Manseau, 2001; Cropley et al, 2011; Meutia et al., 2018). Currently, in its most basic form, innovation is defined as any change that results in a benefit. In practice, innovation is associated with a series of activities aimed at creating entirely new or significantly improved

products, processes, or systems. It is often assumed that innovation occurs when a particular solution has never been used before, at least in the context of a particular company. What is important when it comes to innovation is that, in recent years, a variety of conceptual frameworks have emerged to offer a better understanding of the factors that contribute to and promote innovation (Hosseini & Azizi, 2020).

Roy & Mohapatra (2023) see creativity as one of the components of the triad (along with culture and innovation) recognizing that rootedness and cultural grouping moderate the relationship between creativity and innovation. Ek Styv´en et al. (2022) conclude that the opportunity to be creative and innovative at work is an important driver for employees to stay with their current employer, similarly, Rzepka & Sabat (2022) find that creative behavior leads to innovation.

2. Methodology

The research used in this article is part of another research project under the name of "Teal organisations in Economy 4.0". The project involves conducting research in Poland and in selected countries of the world (USA, Georgia, Slovakia, Brazil, England, Romania, Czech Republic, Ukraine, Spain). The research is conducted in stages and includes a pilot study, core research and repeat research. The research has been and will be conducted using the principles and standards developed by the OECD - DAL (Development Assistance Committee - Networking on development evaluation). The research included a preliminary phase and three subsequent stages. It involved 622 respondents and employed CAWI and CAPI methods in accordance with OECD-DAL recommendations. Random sampling targeted Polish enterprise employees. Statistical analyses utilized the Cronbach alpha test, ANOVA method, and F test (Fisher-Snedecor) with SPSS STATISTICA software. The choice of countries is based on the availability of studies and is random.

The aim of the analysis was to record and specify those characteristic features of the surveyed companies that differentiate the level of subsequent indicators. For this purpose, a one-factor variance analysis was used as a method to verify the hypotheses. The null hypothesis with equal average values for the general population was verified by the F-test (Fisher-Snedecor). The application of this test was possible because the calculated indices could be considered as continuous variables with distributions close to normality (at the materiality level $\alpha = 0.05$) based on the results of the calculations performed with the Kolomogorov-Smirnov test. A Alpha Cronbach test was carried out to verify the reliability of the questions concerning the surveyed companies. The above tests made it possible to determine the variables for which there are statistically significant correlations.

Table 1: Scope of business activity

		Pilot	I stage	II stage	III stage
Predominant mode of the company's operation (%)	Commerce	19.7	10.3	16.6	13.4
	Production	17.6	13.9	28.0	21.8
	Services	62.7	75.8	55.4	64.8
Scope of the company's activity (%)	Local	19.3	22.1	9.4	19.2
	Regional	8.2	12.4	27.3	26.3
	National	30.0	23.0	22.0	23.0
	International	42.5	42.4	41.3	31.5
Number of employees (%)	0-9	13.7	9.1	3.3	5.1
	10-49	24.0	18.8	55.1	37.6
	50-249	15.5	28.2	16.6	21.6
	250 - 999	18.5	20.9	16.6	14.9
	1000 - more	28.3	23.0	8.4	20.8

Source: Own research

The research hypothesis posits that an inclusive leader, characterized by humility and vision, effectively unites and motivates employees. Humility lends credibility to their actions, while vision is crucial for long-term organizational success. The study focused on top-level employees from family businesses, with the majority

employing up to 50 individuals (68.3%) and operating nationally (42.5%). During the study period, 11.4% represented IT companies, and 39.6% were from the hotel industry.

3. Variables Adopted for Research

Table 2: Basic descriptive statistics of the characteristics selected for research

		Mean	Me	Mo	N_{Mo}	Min	Max	Standard deviation	IN_{With}
Although leadership skills help in this position, well-developed interpersonal skills are essential to properly carrying out group tasks	Y	4.27	4	4	112	2	5	0.75	17%
Knowledge	X_1	4.30	4	5	118	1	5	0.79	18%
Vision	X_2	4.26	4	4	115	1	5	0.78	18%
Humility	X_3	4.26	4	5	117	1	5	0.83	19%
Courage	X_4	4.27	4	4	112	1	5	0.77	18%
Honesty	X_5	4.44	5	5	141	1	5	0.74	16%

Source: Own research. Me – median, Mo – modal, dominant.

The respondents rated honesty (4.44) and knowledge (4.30) highest, while vision and humility scored the lowest (4.26). The Spearman rank correlation table reveals the relationships between the variables. The strongest correlations with the variable Y are found with courage (0.62) and humility (0.58), followed closely by knowledge (0.57).

Table 3: Spearman rank correlation matrix

	Y	Knowledge	Vision	Humility	Courage	Honesty
Y	1	0,57	0,54	0,58	0,62	0,47
Knowledge	0.57	1	0.62	0.60	0.61	0.64
Vision	0.54	0.62	1	0.56	0.63	0.56
Humility	0.58	0.60	0.56	1	0.61	0.58
Courage	0.62	0.61	0.63	0.61	1	0.52
Honesty	0.47	0.64	0.56	0.58	0.52	1

Source: Own research

Based on the selected set of potential explanatory variables, three models were constructed. The first is basic for all respondents, while the other two are for men and women separately.

4. General Model

The results of the regression analysis for the base model are presented in Table 4. The research reveals that two statistically significant variables entered the model: courage and humility. The model demonstrates a 36% fit to the data. The multiple correlation coefficient R is 60%, with a standard error of estimation of 0.60.

Table 4: Estimation results for the base model

	b*	Std. error with b*	b	Std. error with b	t(251)	p
Intercept			1.582	0.230	6.886	0.000
Courage	0.407	0.063	0.398	0.062	6.425	0.000
Humility	0.259	0.063	0.232	0.057	4.085	0.000

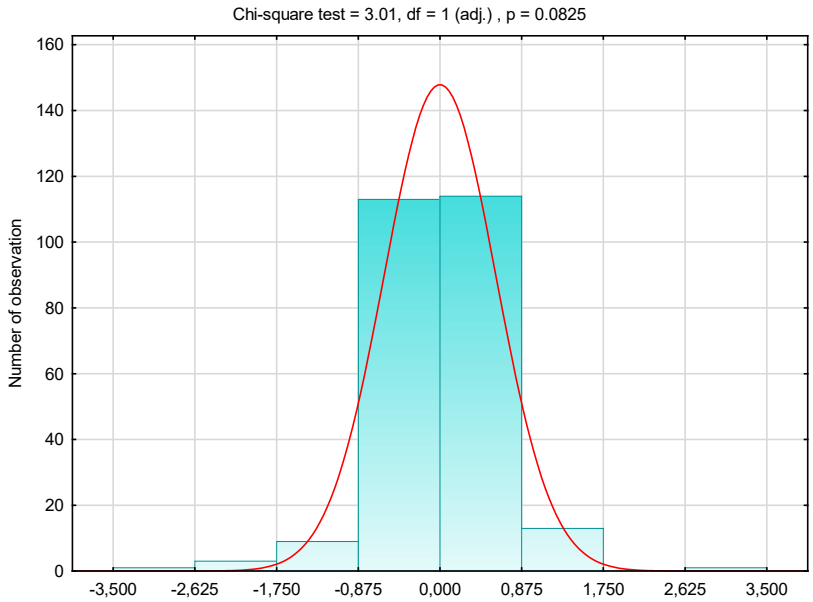
Source: Own research

The model can be expressed as:

$$Y = 1.582 + 0.398X_4 + 0.232X_3$$
$$(0{,}230) \qquad (0{,}062) \qquad (0{,}057)$$

If the courage rating increases by 1 point, the leadership ability rating increases by 0.898 points. For every 1-point increase in humility score, the leadership ability score increases by 0.232 points.

The normality of residuals, a fundamental condition for a properly constructed model, was assessed. The analysis reveals that p>α with p=0.0825, indicating no grounds to reject the null hypothesis of a normal distribution of residuals. Therefore, the model is constructed correctly. Figure 1 illustrates the examination of the normal distribution fit.



Source: Own research

Figure 1: Normal distribution fit – residuals of the base model

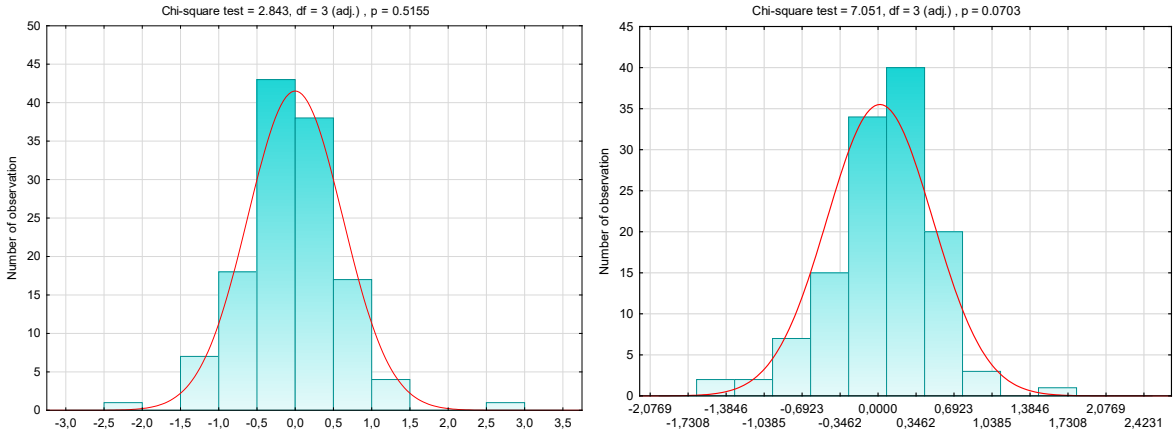
Table 5: Estimation results for the model for men and women

Men						
	b*	**Std. error**	**b**	**Std. error**	**t(126)**	**p**
		z b*		z b		
Intercept			1.921	0.299	6.421	0.000
Courage	0.322	0.095	0.290	0.086	3.389	0.001
Humility	0.308	0.095	0.261	0.080	3.244	0.002
Women						
	b*	**Std. error**	**b**	**Std. error**	**t(122)**	**p**
		z b*		z b		
Intercept			0.445	0.345	1.290	0.200
Courage	0.427	0.071	0.472	0.078	6.034	0.000
Knowledge	0.414	0.071	0.416	0.071	5.850	0.000

Source: Own research

Summarizing the regression results, leadership skills support men in their roles, yet strong interpersonal skills are essential for effective group performance (R=0.569, R^2=0.324, Corr.R2=0.313; F(2,126)=30.211, p<.00000, SE=0.625, v2=1). Similarly, for women, leadership skills aid in their roles, but developed interpersonal skills are

crucial for group tasks (R=0.718, R^2=0.516, Corr.R2=0.508; F(2,122)=65.025, p<0.0000, SE=0.519, v2=2). Figure 2 depicts the distribution fit for both groups.



Source: Own research

Figure 2: Normal distribution fit – model residuals for men and women

5. Findings

As mentioned before, leadership involves influencing individuals to achieve goals. While 44.2% somewhat agreed and 34.7% strongly agreed that "a good leader should foster independent thinking and accountability among subordinates," only 2.1% disagreed, with 18% undecided. Notably, 78.1% agreed that "in relations with subordinates, a leader should act as a mentor, providing guidance and advice without taking over." Additionally, over 70% (39.2% and 38.1%, respectively) agreed that "a leader should have the knowledge to manage teams, projects, and processes effectively."

The findings show strong support for key leadership traits: "vision" and "humility". Over 70% of respondents (38.9% and 37.9%, respectively) endorse vision's ability to inspire action, while over 76% advocate for humility's importance in admitting mistakes. Effective leaders value, support, and empower their employees, motivating them to work hard and supporting them in times of need. They possess all the necessary qualities to effectively manage a team. An inclusive leader possesses specialized skills, including knowledge, acquired qualifications, innovative abilities, creativity, and analytical thinking (Rzepka et al., 2023). Interpersonal skills are paramount for team cohesion; even with strong managerial qualifications, ineffective communication can hinder success. Effective guidance from a manager is vital for achieving team goals. Minimal standard deviations across responses in Table 1 (ranging from 4.05 through 4.09 to 4.11) indicate a high level of consensus.

Research also highlights that a leader's effectiveness hinges on learnable skills that can be continuously honed, irrespective of inherent traits. Leaders should excel in social competencies for effective team leadership, including communication, active listening, feedback provision, goal motivation, positive self-presentation, problem-solving, and assertive behavior. An effective, inclusive leader is visionary, entrepreneurial, and adaptable to change.

6. Discussion

The results of the conducted analyses confirm the formulated research hypothesis: an inclusive leader embodies humility and possesses a long-term vision. These qualities enable the leader to foster connections among employees and foster partnerships between them, particularly crucial in the context of diversity management within family businesses.

As demonstrated, an inclusive leader should embody humility and vision. However, inclusivity in leadership is not solely defined by specific personality traits; it also encompasses the characteristics of the task situation and behaviors that can be acquired through knowledge and observation of role models (Jawad and Ozbilgin, 2015). Nevertheless, not everyone possesses the inherent traits to become a leader. Individuals with attributes such as intelligence, courage, decisiveness, eloquence, and personal refinement are predisposed to assuming leadership roles within an organization. The personality traits, leadership style, experience, and organizational knowledge of leaders all have an impact on their effectiveness.

Team members may not know their roles and responsibilities and struggle to work together effectively without a leader. Rzepka's study has confirmed that the majority of respondents (90 percent) see a leader's organizational skills as the most desirable, as they help organize a team's work. Employees frequently experience confusion, according to Ind and Watt (2004), when there is no leader to provide direction. In such cases, projects can quickly fall behind schedule, and the quality of the work may suffer. It is safe to say that there is a consensus that leaders are responsible for setting goals, providing direction, and ensuring everyone works towards a common purpose (Levis & Mills, 2018). Good team leaders must also be able to listen to feedback from their team members (and provide it) openly and constructively (Weston-Smyth, 2023).

In today's world, a leader or manager is no longer seen as someone who simply issues orders from the top of a hierarchical structure. Instead, effective management involves working collaboratively with the team, often in a supportive role. This approach has been shown to be essential for positive performance, productivity, and motivation (Khan & Mashikhi, 2017). Research has found that activities to improve teamwork, such as team-building exercises, positively impact team effectiveness and success (Aga et al., 2016). Team leaders often play a critical role in guiding their teams to success, relying on intuition to accomplish an effective leadership style that is not just about hard facts but also about using one's instincts (Gopalakrishnan, 2007). A team leader sets the tone for the team, provides direction, and helps team members work together effectively. In 2021, a study examined the impact of having a leader on team performance. The study involved an escape-room challenge (as the group dynamics observed in such places are believed to be comparable to workplace dynamics (Depledge, 2019) in which several teams participated. Randomly selected teams were asked to choose a leader before starting the task, while others were not given this option. The study results showed that the teams with designated leaders performed significantly better. Specifically, 63 percent of these teams completed the challenge within an hour, compared to only 44 percent of teams without designated leaders (Coggan, 2022).

7. Conclusion

In the era of change management, "inclusiveness" emerges as a pivotal competency for contemporary, innovative leaders. Indeed, innovation stands as a cornerstone in the context of family businesses, impacting various outcomes and consequently, long-term competitiveness within their markets (Block et al., 2023; Casado-Belmonte et al., 2021; Dekker et al., 2013; Duran et al., 2016).

The idea of the Teal organization is used in practice to varying degrees depending on the circumstances. However, the more independent the employees are, the more creative they usually are. The manager of such a self-managing team assumes the role of coach and mentor for the employees. He inspires and motivates his team and supports them in achieving their goals.

The key attributes of inclusive leaders, including awareness, curiosity, commitment, cooperation, courage, and cultural intelligence, serve as primary drivers for organizational development success. Therefore, further research in this area should concentrate on delineating the influence of inclusive leadership on employee development. Additionally, fostering inclusivity facilitates the formation of employee teams, underscoring the importance of investigating the leader's role in catalyzing relationships among employees as another avenue for future research.

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Ecological Innovations in Hotel Companies: A Case Study of Poland

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Abstract: Entrepreneurship is one of the key pillars of the modern market economy. The most important attributes of entrepreneurship include innovation. According to many economists, most of the economic growth of developed countries should now be linked to the application and implementation of innovation. Among many types of innovations, ecological innovations (eco-innovations) deserve special attention. Ecological innovations contribute to the reduction of operating costs, increase in competitive advantage and facilitate entry into new markets. At the same time, they have a positive impact on the natural environment. The examples of eco-innovations are also increasingly often found in hotel companies. The aim of the publication is to discuss the current examples of the most significant ecological innovations in hotel enterprises. The article considers the significant impact of ecological innovations on the activities of this type of enterprises. In order to achieve the objectives of the publication, the Polish hotel market was taken into account. The article presents the following research thesis: Environmental innovations are an increasingly important element influencing the operation of hotel enterprises in Poland. However, there is still little awareness of them among guests. The article was written on the basis of books studies, monographs, magazines and netographic information. Methodology of research carried out for the needs of the work. To identify and analyze ecological innovations in hotels in Poland, as well as for the purposes of achieving the goals of the work, two methods of collecting primary research material were used. The first one is based on the analysis of existing data, including the analysis of guest opinions on the booking portal and literary criticism. The second one consisted of a diagnostic survey in which a non-standardized interview was used as a research technique on a deliberately selected group of hotel owners and managers from all over Poland, who have decided to introduce ecological innovations on the premises of their facilities. Interviews were conducted in January-February 2024. The interview did not take into account objects that temporarily suspended their activity. The results of the research positively verify theses.

Keywords: Economy, Hotel, Client, Creativity, Environmental protection, Entrepreneurship

1. Introduction

Entrepreneurship is one of the key pillars of the modern market economy. The most important attributes of entrepreneurship include innovation. According to many economists, most of the economic growth of developed countries should now be linked to the application and implementation of innovation. Among many types of innovations, ecological innovations (eco-innovations) deserve special attention. Ecological innovations contribute to the reduction of operating costs, increase in competitive advantage and facilitate entry into new markets. At the same time, they have a positive impact on the natural environment. The examples of eco-innovations are also increasingly often found in hotel companies.

The aim of the publication is to discuss current examples of the most significant ecological innovations in hotel enterprises. The article considers the significant impact of ecological innovations on the activities of this type of enterprises. This article focused on the Polish hotel market to meet the objectives of the publication.

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2. The Concept of Innovation and Ecological Innovation

Many academics have contributed to the topic of innovation. Austrian economist J. Schumpeter believed that companies must be innovative in order to remain competitive on the market (Schumpeter, 1947). Another

authority in this area, P. Drucker, believed that a non-innovation company inevitably would grow old and deteriorate. (Drucker 2003).

Inovativeness can be understood as the introduction to the market of a new or significantly improved product, good or service or the implementation in the enterprise of a new or significantly improved process. Innovations are the result of technological development, new combinations of existing technologies and the use of modern knowledge desired by the company (Wozniak, 2006). For the purposes of research and comparative analysis, it is recommended to use the classification of innovations proposed by OECD specialists, contained in the so-called Oslo Manual. The Oslo Manual distinguishes innovation (OECD, 2008):

- product,
- process,
- organizational,
- marketing.

In addition to the types of innovation mentioned by the Oslo Manual, the concept of ecological innovation (eco-innovation) is increasingly found in literature. Ecological innovation can be defined as "innovations, which consist of new or changed processes, practices, systems and products that use environmental resources, at the same time, they contribute to its protection" (Jarża, 2013). According to the classic definition, eco-innovation is a "new product that provides value for the customer and for business, while significantly reducing the negative impact on the environment'' (James, 2001). According to another definition, eco-innovation should be understood as "intentional conduct characterized by entrepreneurship, including the stage of product design and integrated management of it during its life cycle, which contributes to the pro-ecological modernisation of industrial-age societies by taking environmental concerns into account when developing products and related processes. Eco-innovation leads to integrated solutions to reduce resource and energy inputs while improving product and service quality. Technological innovation is one of the ways of eco-innovation" (Carley, Spapens ,2000). For some authors, innovation means "any new forms of action aimed at significant and visible progress towards the goal of sustainable development, by reducing environmental impact or achieving greater efficiency and responsibility in the use of resources, including energy" (Prystrom, 2013). In turn, according to the authors of another definition, eco-innovations consist of new or modified processes, techniques, practices, systems and products that eliminate or reduce harmful effects on the environment (Kemp, Andersen, Butter, 2004).

In Poland, eco-innovation was defined comprehensively only in 2009 by the Central Statistical Office (GUS). This definition defines eco-innovations as "innovations that bring environmental benefits, as a new or significantly improved product (article or service), process, marketing or organizational method, or, which bring environmental benefits compared to alternatives" (GUS, 2010).

At the European level, defining the concept of eco-innovation has also been addressed by, inter alia, the European Commission (EC), the Organisation for Economic Co-operation and Development (OECD) and Eurostat. The European Commission defines eco-innovation as "a form of innovation, the purpose of which is to make significant and demonstrable progress towards achieving the sustainable development goals by reducing environmental impact or achieving a more efficient and responsible use of natural resources including energy" (https://commission.europa.eu/research-and-innovation_pl)

The theories of eco-innovation can and even should be considered in a narrow and broad perspective. The broad approach to eco-innovation concerns, on the one hand, solutions from the company's activities and institutional and social solutions; on the other hand, it is a prerequisite for sustainable development, increased social welfare and improved quality of life. The aim of eco-innovation, in a broad perspective, is to provide a sustainable competitive advantage for the enterprise in economic terms without harming the quality of the natural environment or in economic terms with minimal damage to this environment with full responsibility to society. They are narrowed down and are not integrated into the entire activity of the enterprise (Przychodzień, 2015).

The primary objective of eco-innovation should therefore be considered as environmental benefits, i.e., reduction of the negative impact of economic activity on the natural environment by reducing energy intensity, reduction in the use of natural resources or the emission of harmful substances (Ottman, Stafford, Hartman, 2006). Therefore, eco-innovation is such an innovation that seeks, on the one hand, to reduce the burden on the environment; and on the other, to achieve a certain environmental performance. Ecological innovations implement a policy of reducing pressure on the environment, using pro-ecological solutions. An eco-innovative solution is one that is innovative in relation to the most modern solution. Therefore, the paper assumes that eco-innovations include the production and application of new products, services, processes, and, systems and

procedures to meet human needs and ensure a better quality of life while minimising the consumption of natural resources and the emission of pollutants into the environment per unit of product or service over the entire life cycle compared to with alternative solutions (Kemp, Pearson, 2007).

Ecological innovation depends on many different factors and should be considered in a multi-faceted dimentions. The main factor contributing to their development are legal regulations, while other factors related to market conditions as well as technological capabilities of companies also play an important role. In addition, savings achieved through the implementation of environmental innovations are important factors. Eco-innovations are also strongly correlated with product and process innovations, and their implementation is influenced by the functioning environmental management systems, as well as their level and quality.

3. Ecological Innovation in Global Hospitality

Due to its size, the hotel industry is one of the most environmentally friendly sectors of tourism. On average, per 1 hotel room, between 160 kg and 200 kg of carbon dioxide are produced per year. However, the water consumption is from 170 to 400 liters per guest per 1 day for a 5-star hotel. Hotels generate an average of 1 kg of waste per 1 guest per 1 hotel day (Fatoki, 2019). Considering these facts, pro-environmental behaviour should be regarded as necessary to be implemented at various levels of the facility's operation (Firlej, Spychalska, 2015).

Pro-ecological measures in the global hotel industry, especially in the context of contemporary environmental issues, are not only a necessity, but an important tool for increasing the competitiveness of a facility and its offer in an increasingly competitive market. Analysing a variety of sources, both academic articles and promotional material from a number of hotels, it is possible to identify many interesting and often original initiatives or ideas. (Bugdol, Puciato, Boris, 2019).

Noteworthy is the fact that progress in eco-innovation is largely a natural consequence of fungible trends in the global economy, including the escalating popularity of ecotourism. In addition to the changes in the means by which tourists travel, their mindset has also evolved. UNWTO research indicates that 87% of tourists in the world want to travel sustainably. Additionally, 33% revealed that ecotourism consists in rational selection of the place of their stay, including primarily the right hotel (https://www.national-geographic.pl/traveler/artykul/7-najbardziej-ekologicznych-hoteli-na-ziemi-mamy-zdjecia).

As in the case of other areas of the economy, here too, the supply side responds to changes from the demand side, modifying its activities in the field of ecological innovation. Individual activities that are part of ecological innovation have been used in the hotel industry for years. The most important of them can be:

- Perlators mounted in taps (water saving up to several dozen percent),
- Minibars with high energy class without freon release,
- LED lighting that uses 75% less energy and emits the same amount of heat,,
- Energy-efficient household and rtv equipment throughout the facility,
- Encouraging not to change towels or bed linen without the express wishes of the guests.

In addition to these activities, which in their own way fit into ecological innovation, many more sublime examples of activities around the world can be also found. Nowadays, more and more hotels are built in accordance with the principles of ecology or apply very advanced ecological innovations (Baker, Davis, Weaver 2014).

For the purposes of this article, it is worth giving a few examples. The advanced eco-innovation Brooklyn Bridge Hotel in the USA is LEED Gold certified and is equipped with state-of-the-art, energy-saving heating and cooling systems, LED lighting control thermostats, and, HVAC systems with energy recovery and advanced monitoring. Approximately 25% of the hotel's roof is occupied by green areas with garden beds overgrown with trees and shrubs that work diligently to produce oxygen, absorb carbon dioxide from the atmosphere and reduce the urban heat island effect. The hotel is distinguished by having a water recovery system that collects rainwater and practically uses it to irrigate the park. Additionally, the facility actively conducts educational campaigns for the implementation of pro-ecological activities, such as public transport, promotion of plant diet, the principles of good recycling, and restrictions on the use of plastic in everyday life and environmental education of others (https://www.1hotels.com/brooklyn-bridge/sustainability).

Another example is the Butiquehotel Stadthalle in Vienna. The facility offers its guests a rest on the lavender roof and tasting of organic honey produced on the site. The hotel promotes ecological transport by rewarding the guests arriving at the hotel by train or bicycle with a discount of 10% on renting a room. By not placing minibars in rooms, the hotel saves 21,024 kg of CO2 per room. The object segregates 100% garbage. Photovoltaic

panels used in the hotel allow to produce own, clean electricity throughout the year. Solar panels provide the hotel with hot water. Eco-friendly shower heads, LED lighting and standby devices greatly reduce water and energy consumption. (https://www.hotelstadthalle.at/en/boutiquehotel/green-heart-vienna.html).

Another example is the Hotel Soneva Fushi, located on Kunfunadhoo Island Baa Atoll in the Maldives. The hotel uses renewable energy sources such as solar energy and has its own ecological gardens that supply restaurants with fresh products. The resort has its own glass factory, where recycled glass is processed into handmade items, and even a recycling center where guests can learn how to manage their own waste. The hotel has established its own Soneva Foundation, which supports the development of the projects that have a positive impact on the environment, society and the economy. Wherever possible, the Soneva Foundation applies the principles of impact investing in an effort to recoup its investments by financing carbon dioxide emissions, which in turn will be used in the projects, to help extend the reach and benefits for more families. (https://soneva.com/foundation/). Examples of other hotels that are most advanced in implementing eco-innovation are shown in Table 1.

Table 1: Examples of hotels that most advanced implement ecological innovations in 2024

Hotel name	Location	Characteristics
Hi Hotel Eco Spa & Beach ****	Nice, France	Using recycled paper, organic paints, safe cleaners and organic food
Campi ya Kanzi ****	Mtito Andei, Kenya	Using solar panels, solar boilers, promoting eco-tourism with respect for the Maasai culture
Hoshinoya Karuizawa ****	Karuizawa, Japan	Own hydroelectric power plant operating for the needs of the hotel, the use of renewable energy
Crosby Street Hotel *****	New York, USA	Eco-friendly building materials brick, stone, glass. The vegetable garden providing ingredients for the menu of the local restaurant
Magdas Hotel ****	Vienna, Austria	Using recycled furniture, offering beer from local breweries
Ritz Cartlon *****	Charlotte, USA	Using a green roof with garden and hives. Production of own herbs and honey used in the hotel kitchen. Hotel staff wearing clothes made from recycled plastic bottles

https://sznyt.pl/2019/08/12/8-ekologicznych-hoteli-ktore-wskazuja-kierunek-rozwoju-turystyki/.

https://www.national-geographic.pl/traveler/artykul/7-najbardziej-ekologicznych-hoteli-na-ziemi-mamy-zdjecia.

4. Ecological Innovation in Hotels in Poland

Polish hospitality industry strives to keep up with global trends in innovation, including ecological innovation. However, the use of eco-innovation is not yet common among Polish hotels. This is evidenced by the limited amount of compact and netographic data describing ecological innovations in the domestic hotel industry. The analysis of the domestic hotel industry in terms of ecological innovation allows to identify approximately 20 facilities (for a total number of over 2,600 hotels), which are described in the media and widely considered by experts to be ecological. Only half of this group clearly informs on their websites about the eco-innovations used, and only three such facilities have ecological certificates. The same group consists of the properties entirely constructed in accordance with ecological principles. Only two facilities have the word eco in their name. Analysing the opinions of the guests of these hotels posted on the booking portal since the beginning of 2024, the environmental novelties and innovations used were not subject to wider feedback.

The most common cases are these in which individual eco-innovation solutions are used on a different scale in hotels of different categorisation and character (historic hotels, chain hotels). (Sala, 2021).

One of the most outstanding ecological facilities in Poland is the Arlamow Hotel. Extensive information on this can be found on the hotel's website itself. The hotel prides itself on its comprehensive approach to environmental measures, notable among which are its own CHP plant with trigeneration technology, the use of

a food waste composting machine that transforms food waste by heat into pre-compost used in the CHP plant to generate energy, available water dispensers helping to save around 3,000 plastic bottles per year, the replacement of disposable paper towels in the toilets with reusable cotton towels in rolls. In addition, the hotel conducts educational activities of an ecological nature addressed to guests. As part of it, tree planting, cleaning of the land, ecological games for children take place, and as part of the Holistic Mice package, the promotion of a healthy and active lifestyle takes place (https://www.arlamow.pl/hotel-ekologiczny).

Located in Kolobrzeg, the Aquarius Hotel Spa & Wellness makes high use of ecological innovations, branding itself on its website as eco-friendly. The design of the individual elements facilitated ecological operations right from the building phase. The facility uses glass, returnable water bottles and biodegradable beverage tubes. The hotel consistently replaces paper flyers with electronic informants on hotel television. In addition, the facility encourages drinking tap water and actively participates in ecological campaigns, including recycling campaigns (https://www.aquariusspa.pl/pl/hotel-spa-nad-morzem/hotel-przyjazny-srodowisku/).

The Eco Tatry Hotel already in its name suggests ecological solutions, which is confirmed on the site of the facility and its slow life philosophy. The hotel is based on 4 pillars: Nature, Ecology, Silence, Health. The hotel stands out from the others with its own eco-initiatives, the use of solar collectors, environmentally friendly heating, the implementgation of recycling. The property also prides itself on using natural materials for the construction of the cottages (https://www.ecotatry-hotel.pl/hotel-koscielisko-o-nas/).

Opened in 2017, Radisson Blu Resort in Swinoujscie is the first 5-star hotel in Poland designed and built from scratch in accordance with the guidelines of the ecological LEED certificate. During the LEED certification process, all the elements of sustainable construction are taken into account, such as: location and type of land intended for investment, energy and water consumption, quality of the internal environment, type of materials used, and, innovativeness. One of the many solutions used in this hotel is the use of rainwater to power parts of the toilet (https://enjoyyourstay.pl/hotele-ekologiczne/). The examples of other hotels in Poland that show eco-innovation are presented in Table 2.

Table 2: Examples of ecological innovators among hotels in Poland in 2024

Hotel name	Location	Characteristics
Hotel St Bruno ****	Giżycko	Elimination of the use of typical plastic products. Encouraging the use of tap water instead of bottled water for guests to drink. Use for heating the building of heat pumps, reducing water consumption and the use of LED lighting. Application of the zero waste principle
Uroczysko 7 Stawów ****	Gola Dzierżoniowska	Own heat pumps and biological treatment plant. A grey water system that eliminates drinking water for activities that do not require it. Growing our own herbs and vegetables, used in the dishes of the local restaurant
Herbarium Hotel & Spa ****	Chomiąża Szlachecka	Own heat pumps, the use of natural herbs in gastronomy, limiting the use of paper in the area of marketing, the use of QR codes, offering ionized water in glass bottles
Hotel Dębowy Biowellness & SPA ***	Bielawa	The use of organic products - honey from local apiary, herbs, wines, milk, chocolate, as well as coffee grounds. Use of fruits, vegetables and herbs from the hotel garden and products purchased from local suppliers
Klekotki Spa & Resort ***	Klekotki, Skowrony	Use of own sewage treatment plant, hydroelectric power plant, solar collectors, heat pumps and water treatment plants. Used organic laundry detergents, serving food-based products from

Hotel name	Location	Characteristics
		local suppliers and the nearby organic vegetable and herb garden
Hotel Bast ***	Inowrocław	Using glass packaging and withdrawing from plastic. Using own vegetables for hotel gastronomy. Having own wildlife rehabilitation center
Trystian Hotel & Spa ****	Kąty Rybackie	Air conditioning based on chilled water unit, the use of water foaming caps in taps and shower heads and high-quality dishwashers. Use of intelligent electricity management
Bukowy Park Hotel Medical Spa ****	Polanica Zdrój	Roof gardens, which reduce the need for heating energy, and are also used to install solar collectors, from which renewable energy is used to heat water. The use of intelligent energy management systems, including, inter alia, a heat recovery system from mechanical ventilation or energy-saving bulbs

Source: Own elaboration.

The most popular ecological innovations used in hotels in Poland include:

- Solutions for saving electricity, water and heating,
- Promoting organic food based on the production of own, ecological products,
- Removing plastic items from the hotel space.

In the context of the above theoretical considerations, as well as the case study analysis of various hotel facilities from the world and Poland, an examination of the approach to green operations on the Polish hotel market was thought to be appropriate. In March 2024, in-depth interviews were conducted with a deliberately selected group of hotel owners and managers, which are recognized in the media as hotels implementing ecological innovations.

E. Blazejczak, marketing and public relations manager of Herbarium Hotel & Spa believes that "*the ecological innovations used in the hotel today are its important asset and significant added value. Modern energy solutions in particular can bring significant savings in an era of rising inflation. However, ecological innovations themselves are not yet the main reason for choosing a hotel as a destination, and guests learn about them during their stay. The task of the hotel is therefore to educate guests about the valorization of ecological innovations. There are also no guest reviews for eco-innovations on the booking portal after the stay''*. J. Szczyglowska, the owner of the Bast Hotel, is of the opinion "*that ecological innovations are an element of building a competitive advantage of the hotel and a way to reduce the costs of its operation. The guests themselves are consumers and are not guided by the environmental rationale of the facility when choosing it. They become acquainted with it during their stay. They also do not comment on this fact on the booking portal.''* And in turn. K. Michalowska, the manager at Klekotki Spa & Resort is of the opinion that "*the applied ecological innovations in her hotel are an important criterion for choosing a hotel for some guests. However, guests rarely comment on eco-innovations after their stay."* The manager of the guests' experience of the St. Bruno K. Świderski Hotel argues that "*some types of eco-innovation, such as electric vehicle charging stations, are particularly important in the hotel's operations, especially for businessmen. In general, however, guests rarely show interest in pro-ecological attitudes. Encouraging to reduce the use of towels or paper raises resistance. Paper straws are considered impractical."* A. Polomska from Trystian Hotel & Spa believes that "*eco-innovations are a showcase of a given hotel, proving its progressiveness. However, hotel guests are not yet ecologically aware. The process of changing the awareness will gradually progress. Hotel guests benefit from ecological novelties available on site and familiarise themselves with them. This is especially true for older people. The youngest guests, in turn, are already much more aware of the valorization of ecological solutions."* K. Sochaj, the director of the Hotel Debowy Biowellness & SPA , "*appreciates the importance of eco-innovation in a modern hotel, whose aim is to increase the well-being of guests."* At the same time, however, he believes that hotel guests do not pay attention to ecological innovation. *"We should also not exaggerate the introduction of too radical pro-ecological solutions in hotels, eliminating (as it already happens in Austria) televisions from rooms and access to wi-fi. Hotel guests are*

still used to the services of smart tv." J. Wilczynska, the manager of Bukowy Park Hotel Medical Spa, claims that "*environmental innovation contributes both to the benefits of reducing costs, as well as has a positive impact on marketing and visitor interest."* The guests of her hotel pay more and more attention to the ecological aspects of the hotel, without commenting on them on the booking portals. According to E. Nadolska, general manager of the Uroczysko Siedmiu Stawów Hotel, "*ecological innovation is playing a growing role in the hotel industry in Poland. Guests more and more often pay attention to eco-innovations used in the places of their stays. This hotel tries to educate its guests by placing information in rooms about its environmental policy, including in particular the practice of cleaning rooms every third day. The hotel intends to continue to introduce new ecological innovations in order to meet market trends. The introduction of photovoltaic panels is planned. Among the already functioning ecological innovations, guests pay the most attention to chargering stations for electric cars. Shaping the approach of guests to ecological issues facilitates the use of the booking portal, which selects objects in terms of sustainable travel or access to charging stations for electric vehicles''*.

5. Conclusion

Ecological innovations are an increasingly important element affecting the functioning of hotel enterprises in Poland, although they are not yet widely used. Not all owners or managers are convinced of its valorization for their hotels. The number of eco-friendly inowators among the total number of domestic hotels is still small. A characteristic element is the fact that ecological innovation in Poland is not the domain of only luxury chain hotels, but also independent facilities. Ecological innovation in Polish hotels has its own specificity. The use of ecological innovations in the field of heating (heat pumps, photovoltaic panels, solar collectors, modern air conditioning), lighting (LED technology) dominates, water management (water saving and purification equipment) or thermal insulation (green roofs). Such solutions can bring significant savings in operating costs of facilities and the level of prices of stays, which affects the profitability of the operation. Many hotels in Poland equate ecological innovation with promoting the principles of healthy eating based on the production and promotion of their own vegetables, fruits, herbs and honeys. Moreover, such activities contribute to the increase in profits of individual facilities from the sale of these products. A smaller number of hotels publish information about their pro-ecological activity on the websites. Only in isolated cases do hotels use the term eco in the parts of their names. These facts prove that ecological innovation is not yet of colossal importance in the field of marketing. Additionally, it is important to realise that hotel guests are not sufficiently aware of the benefits of eco-innovations, which translates into their pro-environmental behaviour and post-stay opinions. Relatively few guests attach importance to the environmental performance of a facility when making a booking. Nor do all customers see the point of using it. Thus, hotels can act as educators in this regard for their guests, especially the older generation.

Considering the changing economic conditions, the seeking modernity, the emergence of new hotels and the ongoing evolution in ecological attitudes, it seems appropriate to undertake further research into ecological innovations in the national and global hotel industry.

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Use of e-Wallets and Their Impact on SME Business Transactions

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Abstract: Currently, worldwide there is an accelerated digital transformation, which will continue in time with the same trend, becoming an everyday part of human life. The appearance of covid-19 has had a strong impact on several aspects of life, especially in the way of acquiring products and/or services, which, due to the fear of receiving money from a person infected with the virus, led people to look for other options to carry out their economic transactions without physical contact, such as the use of electronic wallets. However, many entrepreneurs still do not use this type of technology in their businesses. The purpose of this research is to determine the impact of the use of electronic wallets in the commercial transactions of SMEs. To this end, we worked with entrepreneurs in the town of Otuzco in the La Libertad Region of Peru. It was observed that they only carried out transactions using the cash collection and payment method and did not use technological tools such as electronic wallets. This is applied research with a quasi-experimental design, cross-sectional and quantitative approach, with a sample of 88 SMEs divided into a control group (23 SMEs) and an experimental group (65 SMEs). The survey was used as a data collection technique, and a program was developed to promote the use of electronic wallets in the entrepreneurs of the city of Otuzco, obtaining as a result a positive impact on the commercial transactions of these SMEs. The results show that 96% of the merchants were reluctant to use electronic wallets for fear of being affected by computer crimes. After the training, 98% of the merchants monitored recognized the importance of their use in their regular commercial transactions. In conclusion, it was found that training on the use of electronic wallets and continuous monitoring have a positive impact on the level of commercial transactions, boosting the competitiveness of businesses by increasing sales, streamlining operations, and reducing financial costs. The research is of interest because it shows the importance of disseminating programs in the use of technological tools such as digital wallets in small businesses to achieve a positive impact on the improvement of their economic activities.

Keywords: Technology, SMEs, Commerce, Development, Digital applications

1. Introduction

Currently, worldwide there is an accelerated digital transformation, which will continue in time with the same trend, becoming an everyday part of human life, in addition, the emergence of covid-19, strongly affected various aspects of life, especially in the way of acquiring products and / or services, The fear of receiving money from a person infected with the virus led people to look for other options to carry out their economic transactions without physical contact, such as the use of electronic wallets, which are the world's favorite because of their simplicity and minimal cost (Hoang and Nguyen, 2022).

According to McKinsey (2020), this global virus pushed people to learn to use the electronic means of payment that were already available, being adopted quickly in countries that had the necessary digital channels, but complicated for those where the equipment was insufficient, so that the migration to digital would take longer. That is why there are small groups that have not yet managed to adapt and are unaware of the use and benefits of digital tools for their businesses, meaning this is a barrier to globalized economic growth.

Worldpay (2020) points out that the way in which people carry out economic transactions daily has a lot to do with their culture, habits and the level of technology available to them; therefore, in places where people lack all of the above, there will continue to be a negative tendency to always use cash as a means of payment.

While it is true that there are internal factors such as the culture and habits of each individual that affect the way of making economic transactions, other highly external factors also have a significant impact, so Aparna et al. (2015) emphasize that merchants are somehow prevented from efficiently taking advantage of electronic payment tools, due to the lack of internet in some rural areas, in addition to the lack of technical knowledge of its correct use.

Muhtasim (2022) mentions that another factor that makes merchants distrustful of using digital wallets is the issue of privacy and cybercrime, which have a negative impact on the decision to adopt these electronic tools, since due to this fear they prefer to use cash for their transactions in their stores. This situation is detrimental to businesses because it does not allow them to increase sales and this affects profits (Ajimon and Prajod, 2021).

In Peru, due to state initiatives, there is a regulatory standard that encourages the growth of electronic payment methods, as Abad et al. (2016) report that Peru has a legal framework that encourages access to electronic payments, which is essential for the expansion and growth of mobile payments today. According to El Comercio (2022), in response to the pandemic, 61% of Peruvians abandoned the use of cash, and 79% of Peruvians are open to the possibility of trying new digital payment options.

However, there are many entrepreneurs who do not use or are unaware of the use of digital wallets, in the case of Peru more than 60% of the total population is unaware and does not take advantage of the benefits, nor trust in these electronic tools, so to promote their proper use, it is necessary to promote internet connection in remote areas and especially provide programs that educate on financial issues, giving them greater confidence for the implementation of electronic wallets in their businesses (Gubbins, 2023).

Such is the specific case of SMEs in the district of Otuzco, La Libertad. Most of these small entrepreneurs are unaware of the benefits they would get with the use of electronic wallets in their businesses, although it is true that they have a smartphone and internet connection, they are still wary of the security of using these digital tools for their daily transactions, affecting their level of sales to the general public, since millennials represent a large part of their clientele and they normally use and prefer to use digital payments to make their purchases. For this reason, it is of utmost importance to train them on the efficient use of digital wallets to efficiently take advantage of the benefits of technology. As explained, this article aims to determine the impact of the use of e-wallets in the commercial transactions of SMEs.

2. Literature Review

According to Páez (2020) digital wallets also called digital purses are mobile or web applications that have the functionality to store and send money for transactions at any time of the day. They are used to perform online economic transactions using a cell phone, computer, tablet or any electronic device with internet connection (Le et al., 2019).

Through mobile payment, money is transferred to a person through a mobile device which enhances the functionality of smartphones because they become virtual debit cards. It is currently the most popular mobile banking service, especially in newly developing regions where the rate of transactions through these e-wallets has increased (Taufan and Yuwono, 2019).

Due to the simplicity of their use, e-wallets have managed to consolidate their position as the world's favorite for making payments and collections, since they only need to top up the balance through the delivery of cash at a recharge point or ATM, contributing to financial inclusion (Aunurrochim and Bin, 2021, Cotrina and Pumarrumi, 2020). Customers see this option as very versatile as they can use them through mobile applications downloaded on their cell phones (Wang et al. 2016).

For some time now, technological innovations on electronic wallets have been trying to improve the coexistence of businesses so that transactions flow with greater continuity and strengthen commercial operations (Bellido and Bartolo, 2023). An important aspect is the short transit time of money and low distribution charges provide a guarantee of a higher level of sales, boosting business growth (Wei et al., 2023).

Several researchers approach the topic of digital wallets from different contexts and realities. The use of these tools is becoming widespread and is spreading faster and faster because their use increases the level of transactions, as they become easier, faster and more efficient to conduct business on a daily basis (Putri and Sumitra 2020), however, a certain part of the population has problems adapting to these new technologies (Manrai et al., 2021).

In order to identify elements that influence their adoption, Ramos (2022) proposes several alternative solutions for the use of these tools, taking into account that security and risk mechanisms influence the decision to adopt or not digital wallets, and that the correct use of these tools in businesses could be promoted.

The use of these wallets promotes financial inclusion, and it can be determined that the new electronic platforms have had a positive impact on businesses (Llamocca and Huaylla, 2020; Cotrina and Pumarrumi, 2020), which is why it is important to promote their use and publicize the minimal costs and benefits they offer. Taking into account that it helps to reduce costs and implies greater speed in commercial exchanges (Márquez, 2016). In addition, it avoids carrying cash, thus reducing assaults, promotes competitiveness and becomes a differentiator from traditional businesses (Encalada et al., 2020).

On the customer side, factors such as ease of use, credibility and security are established, which make digital wallets a preferred option for consumers (Soervanto and Sumantri, 2020). The key factors driving the adoption of these wallets were also analyzed by Ilieva et al. (2023), identifying ease of use, social influence, compatibility with lifestyle and perceived trust. Sharma (2022) determines a positive relationship between customer intentions and the factors of ease of use, trust and experience through the use of e-wallets. Despite the ease of use and greater security compared to the use of credit and debit cards, as well as the absence of transaction costs, there are gaps that represent a challenge for their sustainability over time (Bagla and Sancheti, 2018; Kapoor, 2020, Chawla and Joshi, 2019).

Determining factors with respect to generating greater trust in the use of e-wallets were analyzed by Kinis and Tanova (2022) who determined that the behavioral intention to use e-wallets increases if a reimbursement condition is shown in case of fraud.

There is still a significant gap for e-wallets to be used to their full extent. Alam et al. (2021) conducted a SWOT analysis where they point out important strengths such as easy access, security, adequate management of products and services, as well as speed. However, they identify some weaknesses such as lack of infrastructure and exploitation by the mobile telephony market.

Studies reveal that users, regardless of age, prefer to use digital wallets for their simplicity. They use them for online shopping, transportation, restaurants, purchase of necessities, avoiding carrying money or going to ATMs to withdraw cash (Mavale et al., 2020). However, financial security, cybercrime and level of trust influence the use of digital wallets (Muhtasim et al., 2022).

No quasi-experimental studies on training programs on the use of e-wallets were found to be able to measure the effect they have on the economic transactions of merchants who increase the use of these technological tools.

3. Methodology

The research has a quantitative approach because it focuses on the collection of numerical data. It is applied. The design is quasi-experimental because it reveals the impact of manipulating one or more independent variables on the dependent variable. The objective of the research is to determine the impact of the use of electronic wallets on SME business transactions.

The hypothesis of the research is that the implementation of an e-wallet training program does have a positive impact on SME business transactions.

The population of this research is represented by 88 SMEs in the province of Otuzco; this number was identified personally, observing and counting them at the time of applying the surveys. SMEs from all economic sectors in the city of Otuzco were included, without distinguishing any socio-demographic aspect. The sample is considered a census sample; this type of sampling is used when the sample represents 100% of the population and when the number of individuals is manageable.

A survey was applied to obtain information on various aspects related to the knowledge and use of the electronic purse for their businesses. To measure the reliability of the instrument (questionnaire) with dichotomous measures, the Kuder Richarson coefficient was used, yielding a result of 0.898, which means that the reliability is adequate.

kr20 = (k/(k -1))(1-(Σ pq)/σ^2) = (8/(8 -1))(1-(1.11)/〖5.16〗^2) = 0.898

4. Results

The characteristics of the 88 businesses that do not yet use electronic wallets during their economic transactions are disclosed.

Table 1: Socioeconomic characteristics of SMEs

Age	18 to 35 years old	10%
	36 to 53 years old	57%
	Over 53 years old	33%
Gender	Male	88%
	Female	13%

Academic level	primary	8%
	secondary	74%
	technical studies	18%
Item	Commerce	97%
	Services	3%
Monthly sales	0 - <1000	8%
	>1000 - <5000	76%
	>5000 - <10000	13%
	>10000	3%

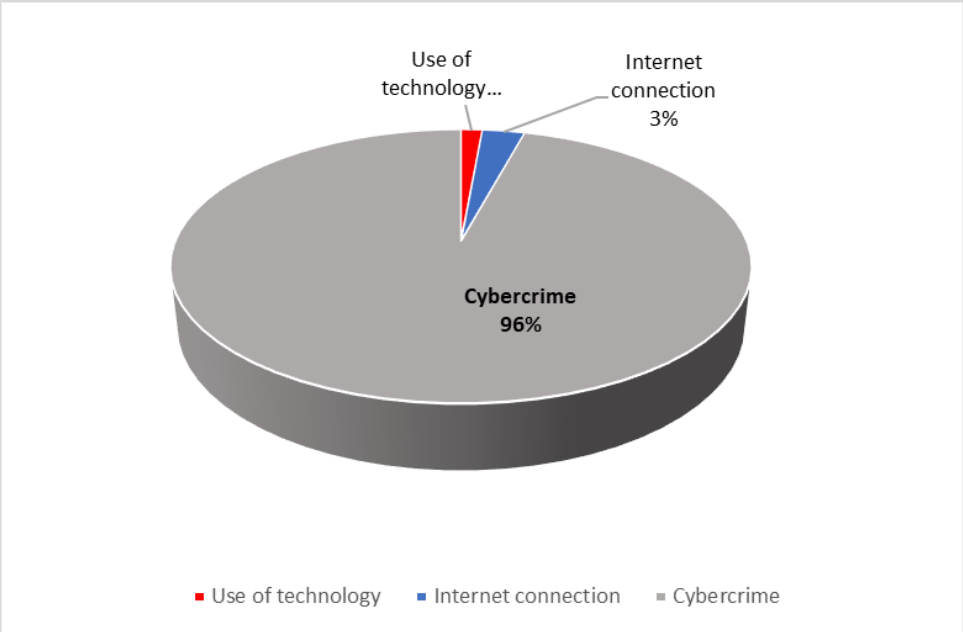


Figure 1: Factors impeding the use of digital wallets

The factor that predominates widely in comparison with the others is the fear of cybercrime, since traders believe that if they ever lose their cell phone, they run the risk of unscrupulous people using their money and emptying their accounts leaving them bankrupt; secondly, internet connection represents a minimum percentage, some businesses do not have a stable internet connection, and finally, the technological issue is a factor that affects to a lesser extent since the vast majority of businesses have a cell phone.

Table 2: Development of the Training Program on the use of Digital Wallets

Objective	To encourage merchants to use and take advantage of the benefits offered by electronic wallets.
Place	Auditorium of the Provincial Municipality of Otuzco, in front of the main square.
Date	July 21, 2023

Agenda:

Introduction and Welcome	5 minutes
Definition and Importance of Electronic Wallets	20 minutes
Advantages, benefits, and precautionary measures	25 minutes
Examples, practical demonstration	40 minutes
Questions from the audience	30 minutes

After the training on the use of electronic wallets and the accompaniment for a period of approximately 2 weeks, the survey was applied to measure the impact on commercial transactions in SME merchants.

The following shows the evolution of the responses of the questionnaire applied to the 88 merchants, comparing the impact on the responses of the 65 people who attended the training and allowed continuous follow-up, with the 23 people who did not attend, therefore, this research divides the sample into two groups, the control group, made up of those SMEs that were surveyed pre and post training, but without having participated in the training; and the experimental group, made up of the SMEs surveyed pre and post the scheduled training.

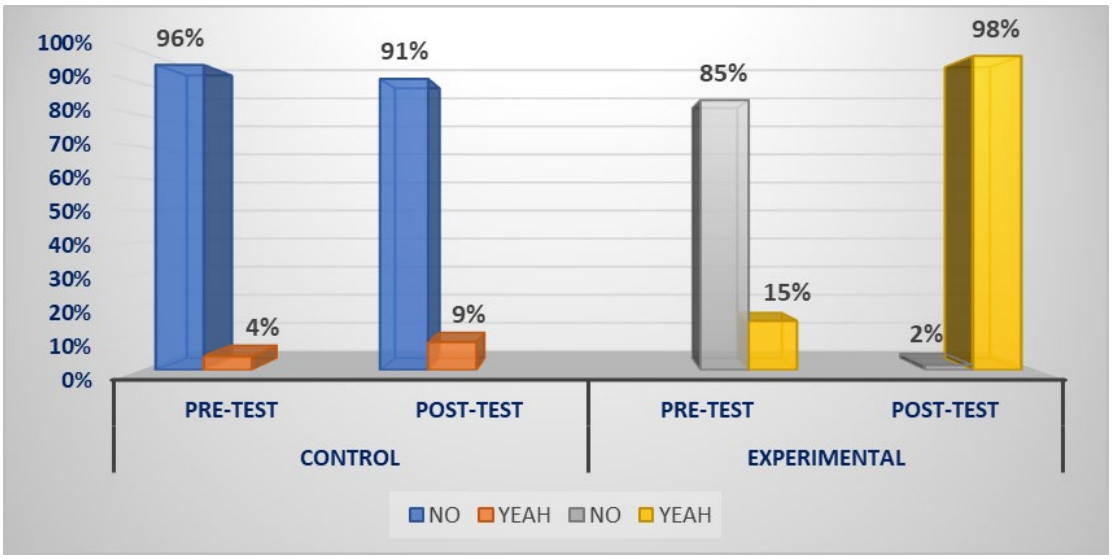


Figure 2: Importance of the use of electronic wallets for business operations

The control group shows little acceptance of the importance of the use of electronic wallets in their businesses. The results in the experimental group show a significant impact, because after the training 98% of the respondents value the importance of the use of these wallets as an important impulse in their business operations.

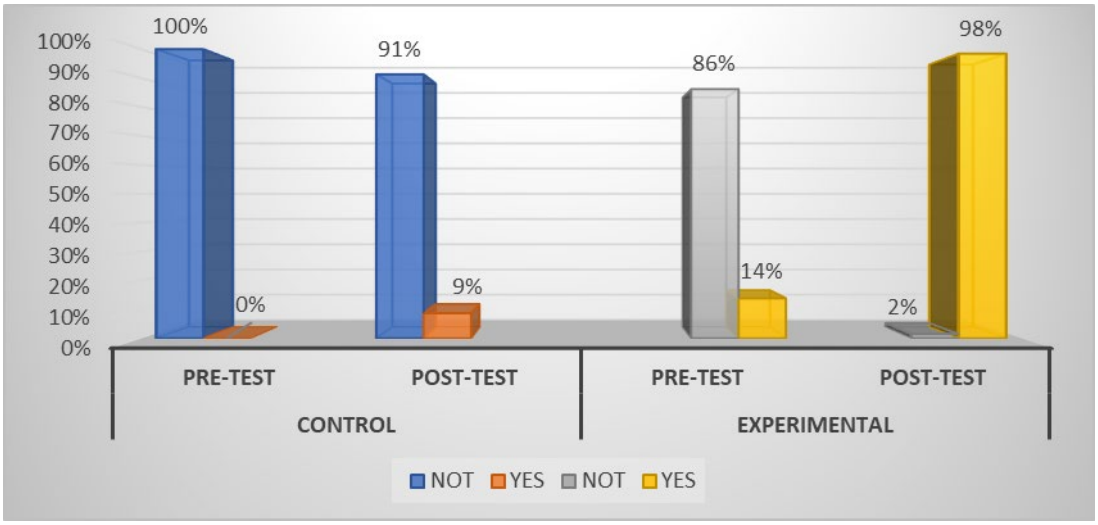


Figure 3: Electronic wallets facilitate cash change management

The control group is still reluctant to use electronic wallets, some respondents changed their minds in the post-test, due to comments from friends or relatives. The results in the experimental group show a significant impact, since after the training 98% of the respondents testified that they found it much easier to make change when making sales, improving the flow of customer service.

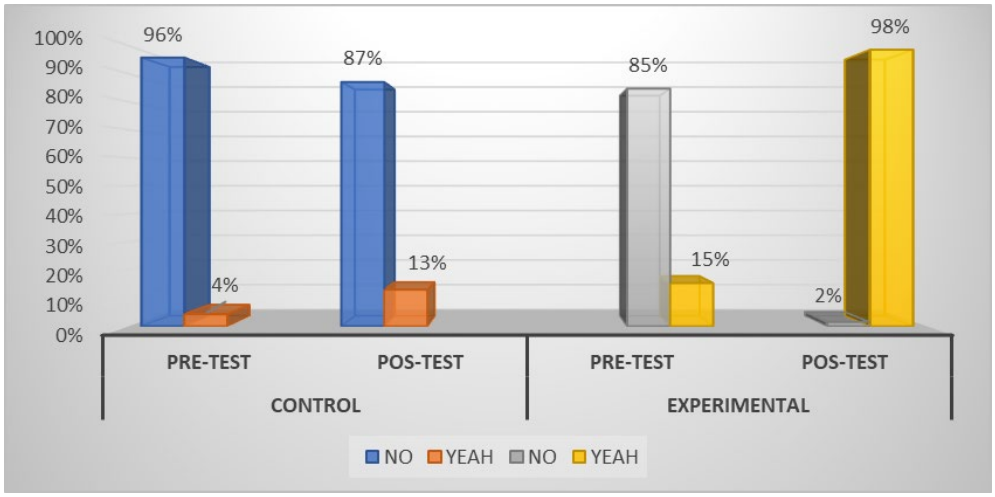


Figure 4: Use of electronic wallets facilitates payment to suppliers

The same trend in the consultation regarding payments to suppliers, which is often presented as a difficulty since they come from different remote areas of the city and with this mechanism it is much more feasible to comply with payments on time and thus make purchases more easily.

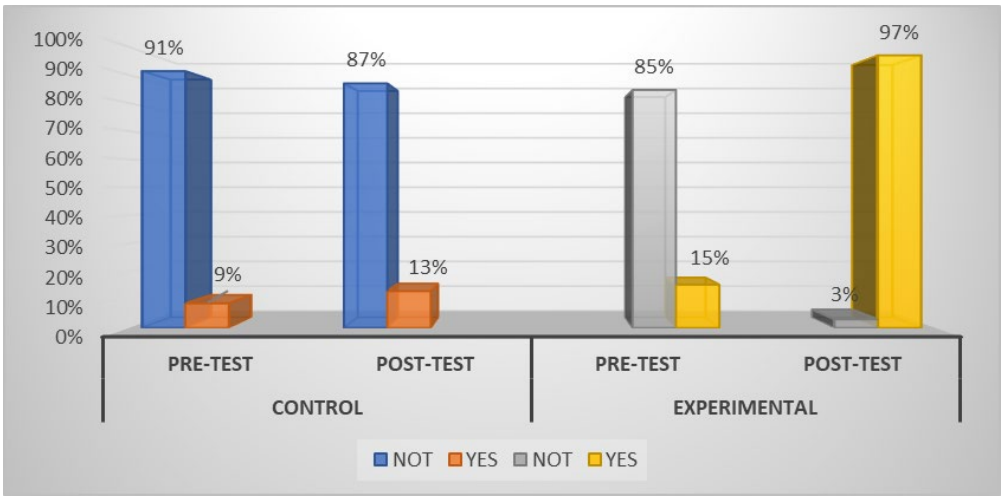


Figure 5: Use of electronic wallets facilitates service payments

The control group, made up of those merchants who did not attend the training, did not present relevant changes in the pre- and post-test, while in the experimental group, approximately all the merchants have changed their way of thinking, this being the result of the dissemination of the benefits that electronic wallets bring to businesses, such as, Improving sales by capturing the largest number of customers, since the use of these electronic tools avoids several day-to-day sales problems, such as not having a single payment for the returns, traveling to another location to pay suppliers, or making deposits to pay for various services necessary for the operation of the business where commissions are charged, etc.

Table 3: Normality test

	Group	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistical	gl	Sig.	Statistical	gl	Sig.
Measurement Pre-Test	Control	.402	23	.000	.562	23	.000
	Experimental	.350	65	.000	.712	65	.000
Measurement Post-Test	Control	.422	23	.000	.641	23	.000
	Experimental	.527	65	.000	.134	65	.000

It is identified that the significant probability of the pre-test and post-test measurement is less than 0.05, therefore, it is concluded that the data do not tend to a normal distribution.

Based on this, non-parametric tests were performed for related samples, so the Wilcoxon test was applied in two parts, the first for the control group:

Table 4: Incidence between the pre-test and post-test of the Control group

Test Statistic[s]	
	Post-Test Measurement Pre-Test Measurement
Z	-1.342[b]
Asymptotic sig. (bilateral)	.180

It is observed that the asymptotic significance is greater than 0.05; therefore, it is concluded that the results of the questionnaire applied to the control group in the pre-test and post-test moments did not produce relevant changes; in summary, the merchants in this group continue with the fear and uncertainty that prevents them from using electronic wallets.

On the other hand, different results were obtained in the experimental group, as shown in the following table:

Table 5: Incidence between the pre-test and post-test of the Control group

Test Statistics	
	Post-Test Measurement Pre-Test Measurement
Z	-6.771[b]
Asymptotic sig. (bilateral)	.000

In this case the asymptotic significance is much lower than 0.05, that is to say that in this group there is a very noticeable incidence between before and after the programmed training, in other words, the merchants who attended and accepted the continuous follow-up, already use at least one electronic wallet for their respective businesses, thus achieving greater efficiency in their commercial transactions, allowing them to increase their sales gradually, since generally, tourists use electronic tools for their purchases.

5. Discussion

According to the results obtained, the hypothesis is validated, since the implementation of a training program on the use of electronic wallets does have a positive impact on the commercial transactions of SMEs. After the training and continuous follow-up, it was noted that the level of commercial transactions gradually increased, since more clients are being attracted every day.

The results show that the sales income regularly received by the businesses is relatively low, and that women represent most of the salespeople who do not know how to use an electronic wallet according to the survey, due to their low level of education. Likewise, the age of the merchants is not a differentiating criterion in the level of knowledge of electronic wallets, since according to results the ages of the respondents vary between 18 and 53 years old. This is in line with the research of Manrai et al. (2021), which found that semi-rural women present problems in adopting new technologies related to finance, since if they do not have facilities and training available, they will not be able to learn to use digital payments. It is also aligned with Mavale et al. (2020), who mention that regardless of the age of the users, their behavior and preferences are the same due to their simplicity of use.

It is observed that, after some time of their use, the level of commercial transactions gradually improved according to the result obtained by applying the Wilcoxon test, since thanks to the various benefits such as their simplicity of use, the zero commissions charged by these electronic tools for their use, the speed of the transactions as they are immediate, avoiding loss of time, they allow merchants to adapt quickly. It is identified with the study by Wie et al. (2023), where they mention that thanks to the short transit time of money and the minimum distribution costs, it helps to ensure that a higher percentage of customers are captured. In the same

line, Márquez (2016) says that, as there is greater confidence in the use of digital payments, being faster and safer, it allows to reach a greater number of customers, achieving customer loyalty. It is also supported by the research of Putri and Sumitra (2020), where they found that the use of electronic wallets has a positive impact on sales, because of which sales become easier, faster and more efficient.

This allows them to grow economically and develop in line with the emergence of new technologies in the world.

6. Conclusions and Recommendations

It was determined that the use of electronic wallets has a positive impact on the commercial transactions of SMEs, considering that sales revenues gradually increased as it allowed merchants to capture a greater number of customers for all the benefits that their use brings, therefore, it is absolutely necessary that all large and small businesses learn to use at least one electronic wallet with the help of training and monitoring, so that in this way they continue to capture more local and international clientele.

It was found that the level of knowledge about the use of electronic wallets by SMEs in the city of Otuzco is almost nil, since, although it is true that more than half of those surveyed have heard of these tools at some point, almost all of them are unaware of their use and benefits. Therefore, it is concluded that there are businesses that do not use electronic wallets in their operations due to lack of knowledge.

It was identified that there are several factors that affect the adoption of electronic wallets, but the main one is the fear of cybercrime and distrust in the use of these tools; therefore, it is concluded that as long as they are not made aware of their correct use, they will continue with this fear, being unable to use them.

The impact of the training on the use of electronic wallets for SMEs in Otuzco is positive, since after the merchants who attended the training (experimental group) put into practice what they learned in their businesses, they noticed that the use of these tools helps to increase their sales, to make it easier to manage money for collections and payments, which allows them to enhance their economic activities, so it is considered essential to train entrepreneurs on these technological issues that help the sustainable development of their businesses.

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From Potential to Action: Strategies for Supporting Female Founders in the Pre-Start-Up Phase

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Abstract: In today's global economy, the role of start-ups is recognized as crucial for a country's competitiveness. Creating a supportive entrepreneurial ecosystem is therefore essential to enable founders to realize their potential optimally. Notably, there is a significant gender disparity in start-ups, suggesting a vast untapped entrepreneurial potential among women. This research aims to enhance the utilization of female start-up potential by providing actionable recommendations, based on an empirical analysis of the pre-start-up process of (potential) female founders. Through a qualitative research methodology, this study investigates the factors influencing women's journey towards entrepreneurship, considering diverse biographies and life situations. Interviews with ten women showed the complexity of the pre-start-up phase and the necessity for a broad support system. The study identifies several key areas for action to foster female entrepreneurship. Firstly, increasing awareness and visibility of self-employment as a viable career path for women is crucial, requiring more female role models and media representation to challenge traditional gender roles and stereotypes. This could cultivate a natural inclination towards entrepreneurship and sectors with high start-up activity. Moreover, lessening the disproportionate burden of family responsibilities on women is essential, suggesting enhancements in childcare facilities and encouraging shared domestic duties. The research further suggests the implementation of support programs to reduce barriers and provide a realistic view of entrepreneurship, alongside the potential benefits of mentorship in both pre- and post-start-up phases. Women's risk-averse, cautious approach in the pre-start-up process often leads to hesitance in developing innovative projects. Encouraging a focus on market needs and early engagement with potential customers, alongside proactive network building, seeking co-founders, or outsourcing, can address knowledge gaps and reduce uncertainties, making self-employment a more attractive option. This study emphasizes the importance of a collaborative effort among various stakeholders in the entrepreneurial ecosystem to unlock the entrepreneurial potential among women.

Keywords: Female entrepreneurship, Gender disparity, Pre-start-up process, Entrepreneurship ecosystem, Start-up support, Entrepreneurial tendency

1. Introduction

Entrepreneurs play a pivotal role in creating new jobs, driving structural change, and fostering economic drivers for innovation and technological progress, especially in growth and technology sectors (Danko, 2018). Despite the recognised potential of female entrepreneurship, women consistently account for only one third of entrepreneurial activity in Switzerland (Baldegger et al., 2020). And the share of entrepreneurs in the overall female working-age population has remained stable at 6-7% for the past 30 years, while the share of men is significantly higher (Bundesamt für Statistik, 2020). This suggests a significant untapped potential among women, where targeted investments and initiatives could lead to substantial economic benefits (Allen et al., 2008). Furthermore, there are also societal reasons to address the gender gap in self-employment, given the legal anchorage of gender equality in Swiss law since 1981 (Bundesamt für Statistik, 2013). Nevertheless, women continue to face greater constraints on their career development opportunities, as evidenced by their under-representation in managerial positions and lower rates of self-employment (Leicht & Welter, 2004).

The gender gap in entrepreneurship is particularly pronounced in Switzerland, indicating a need for further exploration and intervention (Elam et al., 2019). This study aims to bridge the gender gap in entrepreneurship by exploring how Switzerland can better leverage female entrepreneurial potential. It seeks to offer actionable recommendations based on an empirical investigation of the pre-founding process among women. The research will explore various paths to self-employment, identify obstacles women face before starting a company, and analyse these challenges in a contextual framework. The main research question is: *How can the entrepreneurial potential of women in the pre-startup phase in Switzerland be unlocked?* Based on this, the following sub-questions were included:

- What triggers the *inclination* towards entrepreneurship among women?
- Which *goals and motives* do women pursue in becoming self-employed?
- What *obstacles* do women encounter in the pre-startup process?

- What is the impact of different (gender-specific) life situations and environments?
- Under what *conditions* do women become entrepreneurs?
- What potential for action and *support* are there in the pre-start-up process?

This research does not aim to explain why fewer women than men embark on entrepreneurship. It focuses on the female pre-founding process to better understand and harness women's entrepreneurial potential.

The research is structured int seven sections. The literature review explores the determinants of the lower rate of female founders. The methodology starts with the developed theoretical framework and introduces the qualitative approach chosen. In the results section the research questions are answered and discussed. The last two sections close the paper with recommendations and directions for future research.

2. Literature Review

Entrepreneurship has historically been seen as male-dominated (Brush, 2008, S. 611), while the field of female entrepreneurship, which has only developed in recent decades, still requires considerable research. Previous studies have mainly focused on descriptive, quantitative comparisons based on statistical indicators. For this reason, the need for qualitative research approaches that consider personal circumstances, social and professional conditions as well as individual intentions for success and motives for starting a business is increasingly being emphasized (Ettl, 2010; Henry & Foss, 2016; Paoloni & Serafini, 2018).

Many studies examine the "outcome" of start-up activities and often highlight differences between male and female founders. Even if this study does not aim to make a direct comparison on a gender basis, such studies offer valuable insights. Shinnar et al. (2018) found that gender influences the relationship between entrepreneurial intentions and actions, and that lower social expectations and environmental support contribute to women being less likely to start businesses despite their intentions. When self-employed, women are often solo entrepreneurs, employ fewer staff than men and concentrate on smaller businesses, which is partly attributed to the demands of childcare and leads to higher levels of part-time self-employment (Bergmann et al., 2014; Leicht et al., 2004). Despite similar survival rates of businesses founded by women, these businesses tend to have lower turnover, lower growth and fewer investments than those founded by men (Brush, 2008; Du Rietz & Henrektson, 2000).

There are several determinants of the lower female start-up activity. One is the entrepreneurial tendency and the motivation. All studies show a higher propensity and motivation among men than women (e.g. Sieger et al. 2019; Engels, 2020). Another factor is the recognition and development of business opportunities. The literature shows that men more often identify these opportunities and that they are more innovative (Gonzalez-Alvarez & Solis-Rodriguez, 2011; Baldegger et al., 2020). This is reflected in the number of women in scalable and highly innovative start-ups, where only 12.8% of founders are women (Schatt, 2024). Also, the background of a person plays a role. One the one hand, university graduates found more often than people without university degree. By now women have more university degrees then men (Bundesamt für Statistik, 2016). Therefore, this should not play a significant role going forward. However, men are over-represented in technical subjects at university, which is where many of the innovative start-ups come from. The second pillar when looking at the background is management and leadership experience. Founders have in average a high level of experience. As women are still under-represented in management roles, they have less opportunities to gain skills that are also valuable for self-employment (Bergmann et al., 2014; OECD, 2016).

Also, a determinant is the personality traits and the self-perception. It is consistently shown that women rate their abilities significantly lower than men. (SECO, 2008; OECD, 2016; Baldegger et al., 2020). In Switzerland, around 20 per cent more women than men consider their entrepreneurial skills to be insufficient for self-employment (Baldegger et al., 2020). Regarding the female start-up rate, this is aggravated by the fact that women have a slightly higher fear of failure (SECO, 2008; OECD, 2016). A main thrust that is also reflected in the statements of the qualitative study by Tchouvakhina (2004), in which women are generally described as more anxious and insecure.

As the main burden of household and family work is still borne by women, it can be assumed that self-employment among women is significantly more influenced by family circumstances than among men. Family-related factors - limited to the pure probability of starting a business - can have both an inhibiting and a promoting effect. On the one hand, a considerable proportion of self-employed women strive to achieve a better work-life balance through greater flexibility in terms of location and time. On the other hand, family obligations represent an obstacle to starting a business, especially in resource-intensive business models (Lauxen-Ulbrich et

al., 2004). Female founders without kids work in average six hours more than mothers, while there is no difference among male founders with and without kids (Hirschfeld et al., 2019).

3. Theoretical Framework

This study takes the gender gap in business start-ups as an opportunity to analyse the pre-start-up process in more detail from a female perspective. Based on two equally large gender groups of working age, there is a disparity of around one third at the end of the pre-start-up process. Accordingly, this period needs to be analysed more closely to promote female start-up activity.

The pre-foundation process is to be understood as part of the foundation process, which is itself part of the overall company life cycle and ends with the formal founding act (Welter & Bergmann, 2002). As only a fraction realises their intentions, the start-up process is presented as a funnel. The large number of influencing factors and the high level of complexity within the pre-start-up process make it more difficult to identify the main start-up obstacles that can result in the start-up project being cancelled. Therefore, a theoretical framework was developed specifically for this study, which is shown in Figure 1. The pre-foundation phase was modelled as a serial, multi-stage process. The aim of the theoretical framework is to theoretically illustrate various stages in the pre-foundation-process that can be differentiated from one another to better categorise the various influencing factors and their interdependencies. It should be noted that the developed pre-startup process is a theoretical, ideal-type model, which is unlikely to be linear or continuous in practice.

Pre-start-up-process as theoretical framework

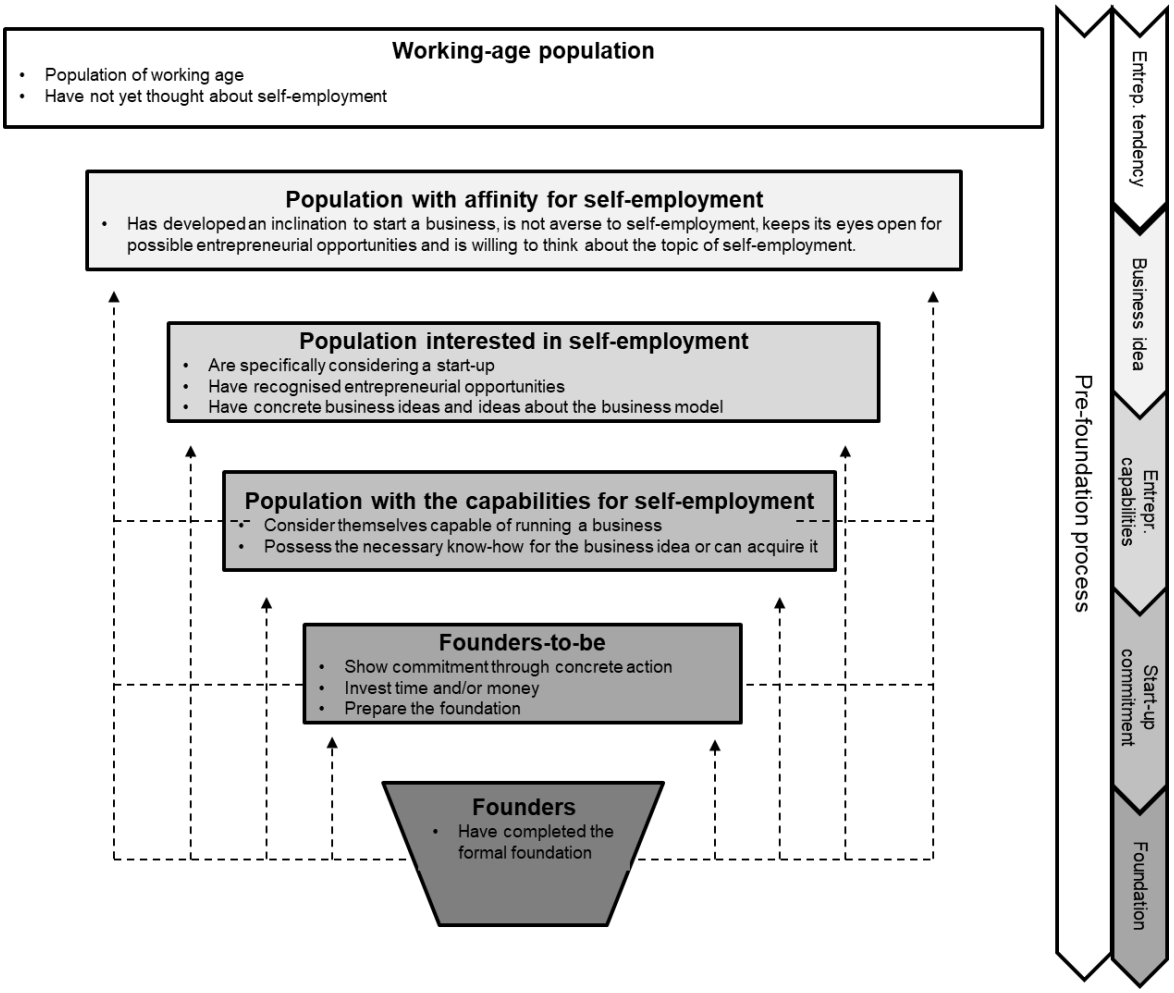


Figure 1: Pre-start-up process (own figure)

4. Methodology

This study adopts a qualitative methodology to investigate the pre-founding process from a female perspective, which enables an in-depth exploration beyond mere statistical differences, focusing on personal, biographical, and contextual factors.

Research Design. A qualitative framework is chosen to closely examine the difficulties of the pre-founding process, prioritizing a contextual and case-specific analysis. This method is well-suited for addressing the multifaceted and under-researched aspects of female entrepreneurship, allowing for a detailed understanding of individual experiences and societal influences.

Sampling and Field Access. The study targets women of working age in the German-speaking part of Switzerland who are at the different stages of the pre-founding process. The selection process aimed for diversity among participants, including founders, aspiring founders, and those who discontinued their projects, while considering socio-demographic characteristics.

Data Collection. Data was collected through ten interviews, employing a semi-structured interview guide that allows flexibility for participants to express their views while ensuring focused exploration of the research themes. This method facilitates a comprehensive understanding of the pre-founding process from multiple perspectives, emphasizing openness and reflexivity in the interview process.

Data Analysis. Interviews were transcribed and analysed using Atlas.ti9 software. This involved a categorization, starting with main categories derived from the theoretical framework and refining through sub-categories emerged from the data. The analysis aimed to maintain a balance between a detailed examination of individual cases and the identification of broader patterns and themes.

5. Results and Discussion

Based on the results from the interviews the research questions were answered.

What triggers the inclination towards entrepreneurship among women?

Among the women surveyed, the inclination to start their own business was triggered in various ways. Two of the women stated that they had a lifelong affinity for self-employment and always considered it as a normal career option. In one case, the inclination to start a business was triggered by an innovative professional environment. One woman made a personal and professional assessment when her children reached school age. The remaining six women stated that their inclination to set up their own business was only triggered when they identified the idea of setting up their own business.

From the other statements made in the interviews, two other factors could be identified, which may have additionally influenced the inclination to start a business. On the one hand, seven of the women interviewed have a self-employed father. Although a large proportion of the women denied a parental effect on the propensity to start a business, a look at the literature suggests an influence, although unconscious. On the other hand, seven of the women also report that they were dissatisfied with their previous professional situation and in some cases relate this directly to the interest in starting a business. Although the motives mentioned were almost exclusively pull motives, there is an obvious connection between dissatisfaction with the job and the emergence of an inclination to start a business. The findings from the interviews show that it is difficult in many cases - even for the women surveyed themselves - to make a clear statement as to whether and since when they have had an inclination to start their own business. Influencing factors such as parental role models and dissatisfaction with the professional work situation can trigger a latent and unnoticed entrepreneurial interest without this being perceived as a clear entrepreneurial inclination by the women themselves. A clear distinction between push and pull start-ups, as is sometimes made in the literature, does not apply to the majority of the samples analysed. Rather, entrepreneurial interest seems to stem from a combination of factors, with job dissatisfaction playing a central role.

The participants themselves see the main reasons for the lower propensity to start a business among women in the societal role models for women, the lack of entrepreneurial role models, and in the media, where successful women are portrayed as deviant from the norm and associated with masculine attributes.

Which goals and motives do women pursue in becoming self-employed?

When asked about the motives for self-employment, almost all women cite motives that can be subsumed under the terms self-determination and self-realisation. These include specific statements such as being their own

boss, being able to make their own decisions, being independent, having freedom and realising their own ideas. In many cases, these are goals and wishes that remained unfulfilled at the previous job.

For three women, social considerations also played a role in their start-up plans, while none of the women mentioned financial motives or a high income. Some of the women also see certain advantages in self-employment in terms of flexible working methods in connection with childcare. Others hope for a greater variety of topics and a faster realisation of ideas. All of the seven women with self-employed parents decided against taking over their parents' company or never even considered it.

How were the entrepreneurial opportunities identified?

The identification of entrepreneurial opportunities was also very case-specific. In principle, two different development patterns can be recognised as to how the business ideas were identified. These range from unexpected revelations and increased awareness to the active and targeted search for entrepreneurial opportunities.

An existing entrepreneurial tendency, which can itself be caused by various factors as described, is primarily responsible for whether entrepreneurial opportunities are sought or pursued at all. The intensity, duration and scope of the search influence how, where and for how long the search is conducted and therefore have a positive effect on the probability of finding an opportunity. The intensity of the search is determined by the degree of job dissatisfaction and the lack of career alternatives. The duration of the search depends on when the entrepreneurial inclination was triggered.

However, individual statements from the interviewees also show that start-up ideas can also be found quite unexpectedly, without prior searching. The start-up idea can be brought to the attention of potential female founders both by chance and by third parties from the network. Whether and for how long the start-up idea is pursued depends on the one hand on the career alternatives and on the other hand on further obstacles and impediments in the further course of the pre-start-up process.

What obstacles do women encounter in the pre-startup process?

A majority of the participants are very self-critical of their abilities and that this represents a certain uncertainty in the pre-start-up process, especially with regard to future sales. The women identify sales as an important success factor for self-employment but are unsure whether they will be able to confidently market their services. Self-confidence, in-depth knowledge, and positive feedback appear to be very important to gain the necessary security and self-confidence.

In this context, other women point out that they were able to reduce and overcome their uncertainties through early customer surveys, extensive market and competitor analyses or by contacting potential business partners. Positive feedback from specialists or doing well in competitions was also described as a motivational boost in the pre-start-up process.

A large workload, doubts about setting boundaries, and the financial risks were often seen as barriers in the pre-start-up phase. Predominantly, these inhibiting factors are personality traits. Skill and knowledge gaps, particularly in administration, law, or accounting, are also cited as barriers, but as ones that can be overcome. Starting a business as a team is seen as beneficial, as the complementing skills can be crucial for covering knowledge gaps. All surveyed women favoured founding in a team than solo, with many viewing a co-founder as vital for success. Additionally, solo founders often use freelancers to fill knowledge gaps, manage order fluctuations, and offload undesirable tasks, which allows them to concentrate on core competencies.

Several women consider the transition phase from employment to self-employment to be a critical phase. Some women do not want to take any financial risks and prepare their start-up on the side, which exposes them to a lack of time. Others consider it more important to have enough time during the preparation phase and quit their job, which exposes them to a financial risk. Having a professional alternative, their family situation, the possibility of reducing their workload, a supportive environment and financial savings or their partner's income are relevant decision criteria for bridging the transition period.

What is the impact of different (gender-specific) life situations and environments?

The compatibility of work and family was often mentioned as an important influencing factor in relation to self-employment. Reports on this topic were very ambivalent. Some see self-employment as an opportunity to better harmonise work and family life through a flexible form of work. Others see the described uncertainties during the preparation and early phase as an inhibiting factor, which can intensify in combination with children in need

of care. This seems to be particularly the case with resource-intensive start-up projects. For this reason, individual female respondents tried to start a business before starting a family or only started after their children reached school age. It can therefore be assumed that a high workload in the family can have an inhibiting effect on resource-intensive start-up plans, especially if these occur at the same time.

Particularly in connection with children, but also otherwise, the importance of support from the partner or family environment was highlighted, which can take on childcare and household tasks and also provide mental and financial support. The importance of networks, which serve as a source of information for the women and can help them solve problems, was also mentioned.

Under what conditions do women become entrepreneurs?

There is no universally valid formula that sets out the conditions; however, various influencing factors and conditions can be recognised from the interviews. The professional alternatives in existing employment are to a certain extent in competition with self-employment. The decisive factor seems to be which form of employment is better suited to both professional and private goals and motives. Accordingly, this decision is based on an individualised weighing up of interests, which can cause the start-up project to be abandoned at all stages of the pre-start-up process.

If the decision is made in favour of self-employment, it is very important to have a functioning business model and to know who the paying customers are. In addition, there must be confidence that the challenges ahead can be mastered with one's own skills. If this is not the case, it must be possible to compensate for deficits and gaps in knowledge either through potential co-founders or by outsourcing work. It must be possible to either bridge the income gap or solve the problem of the double time burden and to reconcile the start-up project with any family requirements in terms of time and finances. The support of the partner and family also appears to be an important prerequisite for the start-up project to be realised.

What potential for action and support are there in the pre-start-up process?

Most respondents were positive about the existing services, although some potential for improvement was pointed out. Attention was drawn to the lack of role models, which could encourage women to set up their own business and support in the pre-start-up process. Also, the underrepresentation of self-employed and successful women in media coverage and the fact that, in the event of coverage, they are often connoted as deviating from the female norm and with male attributes.

The attended support programmes and courses were mostly rated positively. However, many women would like further support, for example in the form of a mentor as independent advisor in the pre- and post-start-up phase. In some cases, it was pointed out that the focus of counselling in the private sector is on selling the service, which led to doubts about the objectivity of the advice. An open and honest discussion about entrepreneurship is desired that does not unrealistically glorify it and allows talks about the downsides. Reports on failed start-up projects are also seen as useful to learn from mistakes and gain a realistic insight into self-employment.

Many women see potential in the search for suitable co-founders. The majority looked for co-founders in their known professional, school or private environment. However, it was also pointed out that knowing the co-founder was not a mandatory requirement. Various women therefore see potential in digital search options for co-founders.

5.1 Adapted Theoretical Framework

Based on the literature and the findings from the empirical data, the theoretical framework presented in section 3 was supplemented with the influencing factors for each stage of the pre-foundation process, shown in figure 2. Influencing factors with a plus sign have a positive effect on progress in the pre-start-up process, while factors with a minus sign have an inhibiting effect. The professional alternative was assigned to the start-up idea stage, as its influence is greatest at this stage. However, as shown, this factor has an impact on the entire pre-start-up process, where the two forms of employment are constantly weighed up against each other.

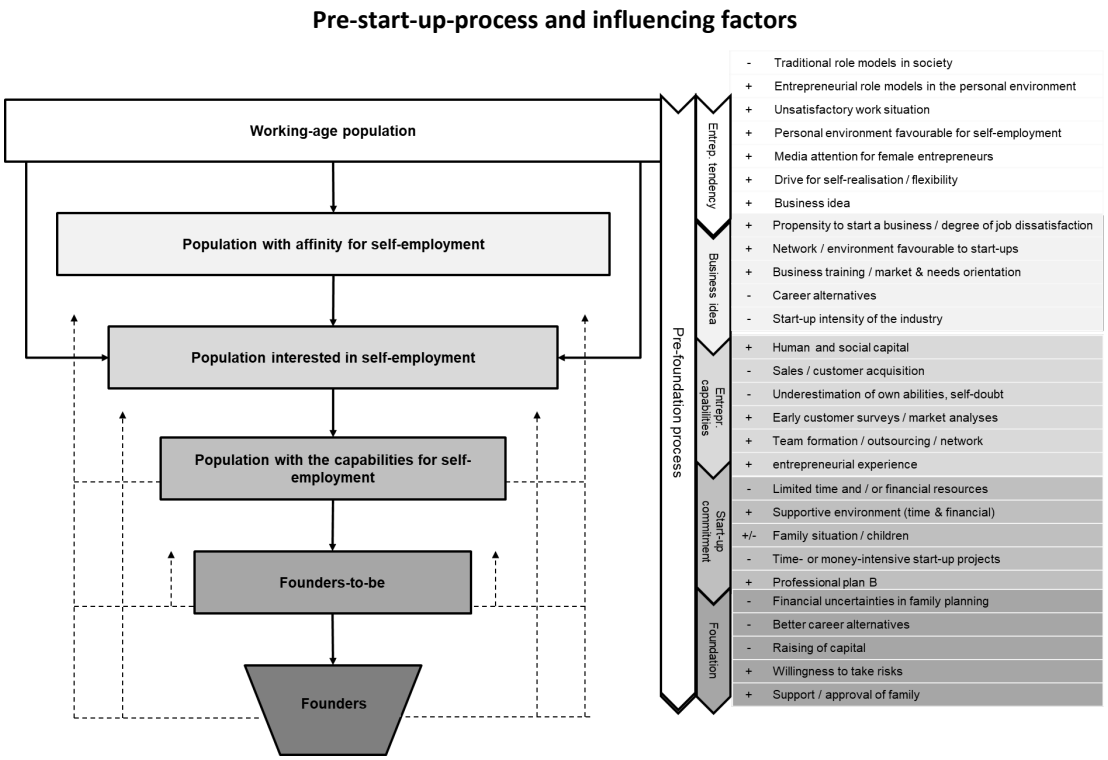


Figure 2: Pre-start-up process and its influencing factors (own figure)

6. Recommendations

Based on these findings, the following opportunities were identified to better support female founders-to-be. The measures and strategies for raising the proportion of female founders targeted at the pre-founding phase are addressed towards potential founders, entrepreneurs, educational institutions, start-up support institutions, governmental bodies as well as society.

For potential female founders

- Establish and maintain professional contacts early on. Think ahead about topics relevant to your founding project and how to acquire necessary knowledge, e.g. through leveraging women's networks.
- Confident decision-making: Acknowledge that men may market their services more confidently than women. Consider this when making decisions and do not restrict your own potential.
- While seeking entrepreneurial opportunities, do not focus solely on your qualifications and experiences. Pay attention to unmet market needs from the perspective of potential customers and consider how you can fulfil these needs.
- Reflect on your business model early in the process. Identify your paying customers and engage with them and partners as soon as possible.
- View missing knowledge or skills not as overwhelming barriers. Explore partnering with co-founders, tapping into your network, or outsourcing certain tasks, for example to freelancers.
- Insist on active involvement from your partner in household and childcare responsibilities. Strive to create conditions that allow both partners to thrive professionally and personally.
- Think about starting a business with your partner. Mutual support, understanding, and the combination of professional and personal synergies have been highlighted as beneficial.
- Be confident in your abilities. View any unsuccessful venture not as a failure but as a valuable experience that will aid your professional and personal growth.

For Female Entrepreneurs

- Share your journey as a female entrepreneur, highlighting your successes and experiences. Support other women in the pre-founding phase by sharing the advantages and challenges of entrepreneurship transparently and how you overcame these challenges.

- Serve as role model as an inspiration for future generations, especially girls and young women. Discuss why you chose self-employment and highlight aspects of your entrepreneurial journey that differentiate from male stereotypes.

For Educational Institutions, Start-up Support Initiatives, and Governmental Bodies

- Offer training and support programs with a practical focus to build entrepreneurial skills and reduce uncertainties regarding self-employment.
- Actively create opportunities for female role models in education, including professorships, teaching materials, case studies, and guest lectures.
- Use current or former entrepreneurs to serve as mentors to guide female founders through process.
- Promote team founding for women and develop (virtual) platforms for finding co-founders. Enhance physical and virtual spaces for entrepreneurs and innovative companies to meet and benefit from mutual support and synergy.
- Implement measures to attract more women to fields and studies traditionally dominated by men, thereby increasing female entrepreneurial activity.
- Introduce more awards and competitions specifically designed to support innovative and resource-intensive ventures by women, offering not only financial support but also networking opportunities and feedback from experts.
- Incorporate the concept of self-employment into compulsory education to normalize it as a career option from an early age. This could help foster intrinsic entrepreneurial inclinations among all children, not just those with entrepreneurial family backgrounds.
- Include entrepreneurial competencies, negotiation, sales, and strategic thinking in the curriculum to promote entrepreneurship and ensure the acquisition of skills traditionally associated with male entrepreneurs.

For Society and Policy

- Expand part-time and flexible working models in leadership positions to enable women to acquire entrepreneurial skills while managing family commitments.
- Ensure balanced media coverage of entrepreneurship that portrays successful women entrepreneurs without reinforcing stereotypes.
- Address traditional gender roles and stereotypes by creating opportunities for female role models in male-dominated professions and promoting equal sharing of employment and family responsibilities.
- Consider subsidies for childcare or tax policies favouring dual earners to support women's professional careers.
- Encourage men to contribute to family responsibilities, enabling women to pursue their professional aspirations. Advocate for gender-neutral parental leave policies to facilitate equal sharing of professional and familial duties.

7. Conclusion

This research focused on the under-researched pre-start-up process of women in Switzerland and aimed to develop recommendations for action to better utilise the start-up potential of women. The literature highlights the need to consider various influencing factors not in isolation, but as part of an integrated whole in order to understand their complex interactions. Therefore, a qualitative research approach was chosen that makes it possible to analyse the pre-start-up process. A theoretical framework was developed that divides the pre-foundation process into different phases and helps to systematically structure the influencing factors. Despite certain limitations, this framework has proven useful for systematically collecting and analysing the data. The research identifies a variety of influencing factors and barriers affecting women in the different stages of starting a business.

Future research could focus on women that have abandoned their entrepreneurial ventures. The primary data collection highlighted the challenge of these women. Exploring the reasons behind these decisions could offer valuable insights for supporting potential female entrepreneurs. Also, the number of interviews was rather small. A broader, quantitative study based on the recognized factors could deepen the understanding.

There are several limitations to this study. Firstly, as mentioned above, the number of interviews was limited. Secondly, most of the founders had an academic degree, which may lead to different findings than for women without a degree. Thirdly, participation was voluntary. The study may therefore be subject to selection bias, as

only people who were willing to talk about their experiences were included. Finally, the study has a narrow geographical and therefore cultural focus. This does not allow for generalization in other contexts.

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Towards Health 4.0: Blockchain-Based Electronic Health Record for Care Coordination

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Abstract: Inter-organizational data sharing in healthcare is fraught with challenges, including diverse healthcare terminologies, incompatible data structures, and issues with data consistency and security. Establishing a unified patient record across a data-sharing network is problematic, and centralized data stores and authority providers are prime targets for cyberattacks. This study proposes a blockchain-based patient data-sharing strategy that relies on network consensus rather than a single, centralized source of trust. The consensus is based on evidence of both structural and semantic interoperability. The primary objective is to develop secure and controlled data-sharing mechanisms that enhance care coordination. The research utilized Kanban as the software development methodology to manage the project effectively. The study found that blockchain-based electronic health record (EHR) systems significantly enhance care coordination by enabling seamless data transfer and fostering trust and collaboration among healthcare providers. Key findings include improved data consistency, enhanced security, and increased interoperability across diverse healthcare systems. These results suggest that blockchain technology can play a crucial role in transforming healthcare delivery and improving patient outcomes in the context of Health 4.0. This work contributes to the ongoing discussion on leveraging blockchain technology to revolutionize healthcare systems, offering a robust framework for secure and efficient data sharing that can lead to better healthcare delivery and patient care outcomes.

Keywords: Blockchain, Distributed ledger, Permissioned, Electronic health record, Health 4.0, Care coordination

1. Introduction

The integration of digital technologies into healthcare systems, often referred to as Health 4.0 (Radanliev et al, 2020), has the potential to revolutionize patient care, clinical outcomes, and operational efficiencies. Among the emerging technologies, blockchain stands out as a promising solution for transforming electronic health record (EHR) systems and enhancing care coordination Blockchain technology presents a viable way around the drawbacks of the existing EHR systems. Blockchain is a decentralized distributed ledger system that uses multiple computers to keep track of transactions in a way that prevents tampering and makes the data recorded unchangeable (Ncube et al, 2022). Blockchain technology can protect private medical data from breaches and illegal changes by generating a tamper-proof and secure ledger. By giving people authority over their health information, this promotes trust. Additionally, by bridging the gap between incompatible EHR systems and enabling seamless data transmission between providers, blockchain can enhance care coordination. Ultimately, blockchain can transform EHRs into a more secure, patient-centered, and efficient health information management system (Careline and Godhavari, 2022). The majority of medical data is stored in silos, each having a unique storage architecture and descriptive interpretation (Gupta et al, 2020). Due to this reality, it is challenging to create an interoperable electronic health record exchange or archives or even to easily and securely transmit clinical data to patients, providers, and other stakeholders. Within the same health system, various providers may keep separate sets of patient demographic data. There are redundant tests. There is little prescription data, which raises the possibility of adverse drug reactions. Doctors cannot make treatment suggestions in light of historical circumstances. Data from multiple sources must be manually compiled by population health and case managers to create an accurate picture of a patient's overall health. Since modern technology has advanced so quickly, health institutions have realized how important it is to use and share data. This emphasizes how crucial data privacy is. With the use of blockchain technology, each participant is guaranteed to have a copy of the digital ledger, which is updated instantly as transactions take place. The absence of a centralized server makes hacking all but impossible. The ledger is an unchangeable source of truth since, in theory, a recorded transaction cannot be undone (Careline and Godhavari, 2022). In light of these problems, this research paper proposes a blockchain-based electronic health record (EHR) system aimed at improving care coordination by providing secure and interoperable platforms for sharing patient information among healthcare providers. The objectives of this study are to develop a controlled private data management system using a distributed ledger for capturing patient medical records securely and efficiently. The objectives

of the proposed system are to capture patient medical records, to book appointments for patients, and to view and manage those appointments.

2. Literature Review

Health 4.0 has immense potential to enhance clinical results, patient care, and operational effectiveness. Blockchain is one of the cutting-edge technologies that could completely transform care coordination and electronic health records (EHRs). To improve care coordination, this literature review examines the opportunities and problems associated with deploying blockchain-based EHR systems.

2.1 Challenges of Traditional Electronic Health Records

While there are many benefits to using Electronic Health Records (EHR) in healthcare, there are also specific challenges that must be resolved such as interoperability, data security and privacy, and data quality and integrity. The smooth transfer of health information between various systems is still hampered by interoperability problems (Afza et al, 2021); (Gupta et al, 2020). The communication between various EHR systems is hampered by the lack of defined formats and protocols, which might compromise patient care by causing patient data to become fragmented (Afza et al, 2021). (Afza et al, 2021) raised concerns over the protection of sensitive patient data held in electronic health record (EHR) systems due to persistent security and privacy issues. The reliability of EHR systems is further impacted by the problem of preserving data correctness and integrity. There may be anomalies, errors, and discrepancies in the data.

2.2 Blockchain Technology in Healthcare

Blockchain technology has emerged as a promising solution to addressing the challenges of traditional EHR systems (Afza et al, 2021). Blockchain offers a secured and decentralized system for managing health data, ensuring transparency, integrity, and accessibility while preserving patient privacy. This paper proposed an electronic health record-based which used a distributed ledger to store and manage medical records, records access logs, and access permissions.

2.3 Blockchain-Based Electronic Health Records for Care Coordination

Blockchain technology has demonstrated the potential to address the issues with conventional EHR systems. Blockchain provides a safe, decentralized framework for managing health-related information and protecting patient privacy while guaranteeing accessibility, integrity, and openness. Multiple studies have examined the possible uses of blockchain in the medical field. In their comprehensive assessment of blockchain technology in healthcare, (Durneva et al, 2020)(Jhamba et al., 2024) emphasized how it might improve patient-centered care, interoperability, and data security. Likewise, systematic reviews by and (Hunt et al, 2022) have shown how blockchain technology may be used to secure health data and advance health informatics. Blockchain-based EHR system implementation can significantly enhance care coordination by giving medical professionals access to a safe and reliable environment for exchanging patient data. Through the utilization of blockchain technology, healthcare institutions can ensure the integrity, security, and accessibility of patient data, thereby enhancing care quality and patient outcomes. (Gupta et al, 2020) proposed an interoperable healthcare system using blockchain technology, emphasizing its potential to improve data sharing and care coordination among healthcare providers. Similarly, (Molde et al, 2020) explored the use of blockchain for EHRs, highlighting its ability to enhance data security, integrity, and patient privacy.

While blockchain technology offers significant potential for transforming EHR systems and care coordination, several

challenges and opportunities need to be addressed. (Kiania et al, 2023) conducted a comprehensive investigation of blockchain technology in healthcare, identifying challenges such as scalability, interoperability, and regulatory compliance. However, they also highlighted the opportunities for leveraging blockchain technology to enhance data security, integrity, and patient engagement. (Taherdoost, 2023) carried out a comprehensive examination regarding blockchain technology in healthcare, identifying emerging trends, challenges, and future directions. They emphasized the need for further research and innovation to address the scalability, interoperability, and regulatory challenges associated with blockchain-based EHR systems.

2.4 Existing Blockchain Implementations in EHR

In this section, we discuss various blockchain-based EHR systems, their features, and their weaknesses.

2.4.1 Medrec

Medrec is an EHR developed by researchers at the Massachusetts Institute of Technology (MIT) for managing Electronic Health Records (EHR). It was designed to address the challenges of data fragmentation, security, and interoperability in healthcare systems (Kiania et al, 2023). Using blockchain technology, MedRec, specifically Ethereum, creates a decentralized and encrypted collection and sharing system for patient health records. Since Medrec is built using Ethereum as the underlying blockchain it takes all the challenges of Ethereum which are the cost of processing transactions and scalability

2.4.2 Medibloc

MediBloc is a public blockchain platform that has been used to develop an EHR system called MediBloc. MediBloc uses a consortium blockchain architecture and offers features such as data sharing, security, and privacy (Hort et al, 2021). The challenges of Medibloc are scalability and performance. As the number of participants and volume of data on the MediBloc platform increase, scalability, and performance become critical factors. Blockchain systems may face challenges in handling a large number of transactions and maintaining high throughput. Ensuring that the platform can scale effectively to accommodate growing user bases and data volumes is essential for its success (Hort et al, 2021).

2.4.3 GemOS

GemOS is a blockchain-based operating system designed for healthcare. It allows healthcare providers to securely access and share patient health-related data while ensuring patient privacy and data integrity. GemOS, like other blockchain-based systems, faces scalability challenges (Zhang et al, 2016). As the number of transactions increases, the blockchain becomes slower and more cumbersome to manage.

2.4.4 Patientory

Patientory is an EHR platform utilizing a distributed ledger that allows patients to manage their health records securely and access them from anywhere. It also permits safe patient information access for medical professionals and communication with patients in real time. Patientory and similar platforms face privacy concerns due to the visibility of all transactions on the blockchain. Protecting patients' sensitive health information becomes challenging (Xia et al, 2017).

2.4.5 Medicalchain

Medicalchain is a platform that allows patients to store and manage their medical data securely using blockchain technology. It provides patients with full control over who can access their health records and allows for easy sharing of data with healthcare providers. Medicalchain faces scalability challenges (Zhang et al, 2016). As the number of transactions increases, the blockchain becomes slower and more cumbersome to manage. In response to the scalability and privacy challenges identified in existing blockchain-based electronic health record (EHR) systems, this paper proposes a novel solution aimed at addressing these issues and enhancing care coordination in healthcare settings. Building upon the limitations of current blockchain systems, the proposed system presents an innovative approach to securely manage patient data while ensuring scalability, data privacy, and user control. Our solution leverages a private blockchain network to address privacy concerns, ensuring that sensitive health data is securely

stored and accessed only by authorized parties. By using a private blockchain, we can guarantee the confidentiality and integrity of patient information while maintaining transparency and auditability. In addition, our system utilizes multiple chains on the same network and a Proof of Authority (PoA) consensus mechanism to address scalability challenges. By distributing the information across multiple chains and using a more efficient consensus mechanism, we can significantly improve the speed and scalability of the blockchain network, ensuring that it can handle a large number of transactions efficiently.

3. Methodology

This section outlines the process and strategies utilized to achieve the project's goal of creating an electronic health record system using blockchain technology.

3.1 Research Methodology

Document analysis was the research methodology used in this study. It is a methodical way of going over and assessing different types of documents, both digital and physical formats. Document analysis is a qualitative

research method that entails carefully reviewing and interpreting data to derive understanding, extract meaning, and produce empirical knowledge (Corbin et al, 2008).

3.2 Software Development Methodology

For this research project, we adopted the Kanban methodology as our software development framework. Kanban is a visual and iterative software development approach that emphasizes continuous delivery and workflow optimization. It is based on the principles of visualizing work, limiting work in progress, focusing on flow, and continuous improvement (Anderson, 2010)

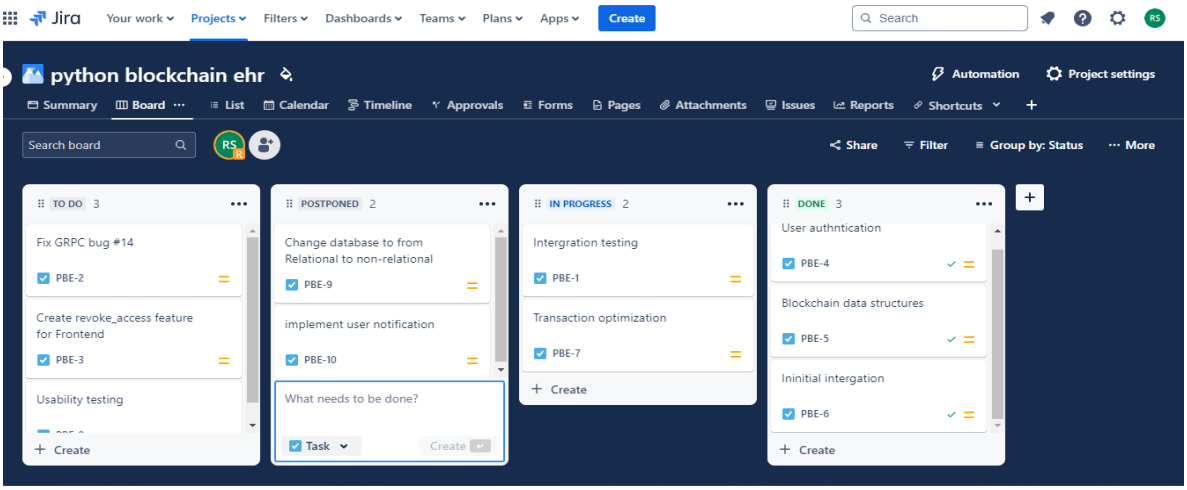


Figure 1: Kanban Board

In applying the Kanban methodology to our project, we utilized a Kanban board in Figure 1 to visualize our software development workflow. The board consisted of distinct columns denoting the waiting list, work in progress, completed, and testing phases of the development process. Tasks were represented as cards on the Kanban board, and team members were responsible for moving cards across the board as work progressed through different stages. Work-in-progress (WIP) limits were imposed on every step of the process to avoid excessive workload on team members and keep up a continuous workflow. Regular retrospectives were conducted to review the team's performance and identify areas for improvement. Using the Kanban methodology provided several benefits to our project. It improved visibility and transparency into the development process, enabling team members to monitor progress with ease of tasks and identify any bottlenecks or inefficiencies. The visual nature of the Kanban board also facilitated better workflow management and task prioritization, ensuring that the most important tasks were completed first. Overall, the Kanban methodology contributed to increased productivity and efficiency through continuous improvement.

Java was used to create the Android client of the blockchain electronic health record system, while Python was used to develop the distributed ledger and the RPC service that communicates with the Android client. Java is a widely used programming language known for its portability across platforms (Horstmann and Cornell, 2013). Python is a recommended language for blockchain development because of its recognition for readability and simplicity (Lutz, 2013).

3.3 Proposed Blockchain-Based EHR

Our proposed blockchain-based Electronic Health Record (EHR) system is intended to address the challenges of existing EHR systems while also using the benefits of blockchain technology to improve care coordination and patient outcomes. Key features include secure and private storage of patient medical records on a distributed ledger; scalable architecture utilizing a private blockchain network and a Proof of Authority (PoA) consensus mechanism; user-friendly interfaces for both healthcare providers and patients; and advanced security measures such as role-based access control and encryption.

3.3.1 System architecture

As part of the development process, a System Architecture Design is necessary to ensure a well-structured and organized system. Figure 2 shows the private and permissioned blockchain-based electronic health record system architecture, which uses a Proof of Authority (PoA) consensus mechanism.

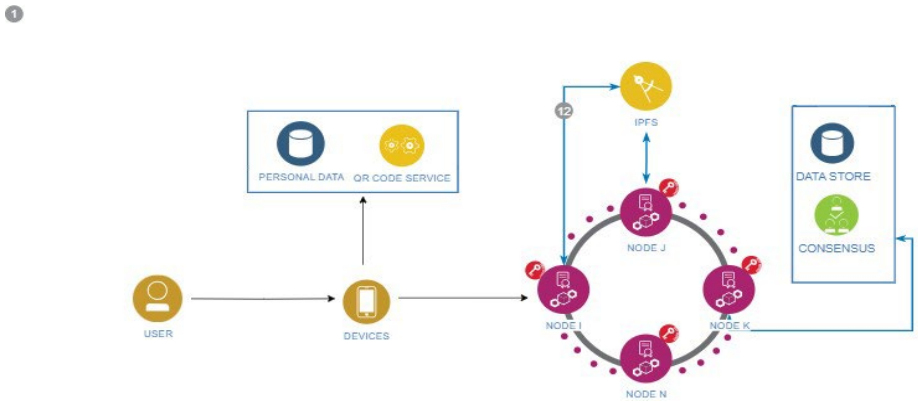


Figure 2: System architecture

The blockchain is private, ensuring that data is exclusively accessed by authorized entities within the network. This confidentiality is fortified by robust encryption mechanisms, notably RSA-SHA256, which provides data integrity and security. This encryption standard, widely recognized for its strength, safeguards sensitive health-related information. The system boasts a direct communication channel between the blockchain and mobile clients, facilitated by remote procedure calls (RPC). Personally Identifiable Information (PII) remains securely stored on mobile devices and off-chain databases, enhancing privacy and confidentiality. Patient-controlled access permissions further empower individuals, granting them control over their health data.

3.3.2 Functionality

Figure 2 depicts a blockchain-based system architecture for managing personal and health-related data, emphasizing security and distributed consensus. The user interacts with the system through devices that interface with a central data service. A key feature is the QR code service, which allows one person to scan a QR code on the owner's device, granting access to the owner's records. This service ensures secure and convenient access control. The Android application on the user device communicates with a decentralized network of nodes (Node I, Node J, Node K, Node N) that collectively maintain the blockchain. Each node participates in consensus algorithms to validate transactions, ensuring data integrity and consistency across the network. The system leverages the InterPlanetary File System (IPFS) for efficient, distributed data storage, connecting to the blockchain network. The InterPlanetary File System (IPFS) is a peer-to-peer hypermedia protocol designed to make the web faster, safer, and more open (Benet, 2014) Validated data is then securely stored in a dedicated data store, safeguarded by consensus mechanisms. This architecture ensures robust security, decentralized control, and high availability of personal and health data, providing a reliable framework for blockchain applications. Patients get to share their medical information with their care providers therefore, facilitating care coordination. Medical history is permanently recorded in the data store allowing for continued care even after switching care providers or hospital centers.

4. Results

This study investigates the development and deployment of a blockchain-based Electronic Health Record (EHR) system as a potential cornerstone for achieving Health 4.0 in healthcare delivery. We present the findings of our research, focusing on the system's performance, functionalities, and its capacity to address limitations inherent to traditional EHR systems. This section delves into the achieved milestones, optimizations implemented, and insights gleaned, emphasizing the transformative potential of blockchain technology within the domain of healthcare informatics.

4.1 Transaction Structure Snippet

Figure 3 shows the structure of the transaction that will be stored on the blocks of the blockchain. Each transaction type is stored on a separate chain, for example, permissions and records are stored on different chains on the same or different nodes enabling faster access to information by maintaining smaller spate chains. This makes the network faster in writing and reading transactions from the distributed ledger.

```python
@dataclass
class Transaction:
    """
    transaction_type : represents the node-type
    Not all transactions are stored on all nodes
    access logs - Node Type 1, access permissions - Node Type 2
    medical records - Node Type 3
    """
    transaction_type: str
    data: str
    metadata: str
    hash: str

    def __post_init__(self):
        self.hash = create_hash_default(self.data)

    def _from_dict(self, data: dict):
        self.type = data['type']
        self.data = data['data']
        self.metadata = data['metadata']
        self.hash = create_hash_default(self.data)
```

Figure 3: Code snipper showing transaction structure

4.2 HashChain Structure

Figure 4 shows that HashChain which will be stored in memory. The actual blockchain data can reach very large sizes which cannot be stored in memory. Storing references of the actual data in memory allows for faster searching and faster data access. The HashChain is also used to verify chains from different nodes to assess if they agree with each other without necessarily copying the whole blockchain and its data.

```python
@dataclass
class HashChain:
    chain: set()

    def add_block(self, block: HashBlock):
        self.chain.add(block)

    def find_block(self, block: str):
        return self.chain.count(block)

    def get_subset(self, o_chain) -> bool:
        return set(o_chain.chain).issubset(set(self.chain))

    def __le__(self, other):
        if isinstance(other, self.__class__):
            return len(self.chain) <= len(other.chain)

    def __lt__(self, other):
        if isinstance(other, self.__class__):
            return len(self.chain) < len(other.chain)
```

Figure 4: Showing Hashchain structure

4.3 User Interface

The electronic health record system has a user interface for doctors and patients. The doctor gets to update and view the patient`s records and the patient gets to view their records and give or revoke doctors` access to their records. The doctor and the patient share the same login screen where they enter their account details to access the electronic health record application on their mobile phone or tablet.

4.3.1 The doctor home screen

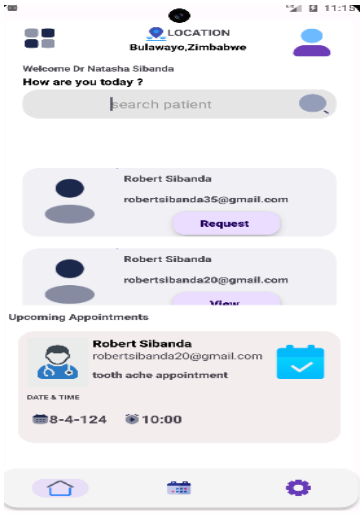


Figure 5: Doctor home screen

The home screen for the doctor is shown in Figure 5 where he/she searches for patients and gets to view or edit their records if he is permissioned. The doctor can also view his/her messages and notifications on the home screen. The doctors use the home screen to search for patients. The doctor can also submit a request for accessing patient records. The doctor can also accept or deny appointments from the home interface. All the upcoming appointments will be displayed at the bottom of the interface.

4.3.2 The patient home screen



Figure 6: Patient Home screen

Figure 6 shows the patient home screen where patients can view their doctors, and grant doctors access to their electronic records. The patient by checking or unchecking the View and Update button on a doctor`s card can add or remove permissions to a doctor to either view or update their medical records. Appointments will be shown at the bottom of the screen.

4.3.3 Health information screen

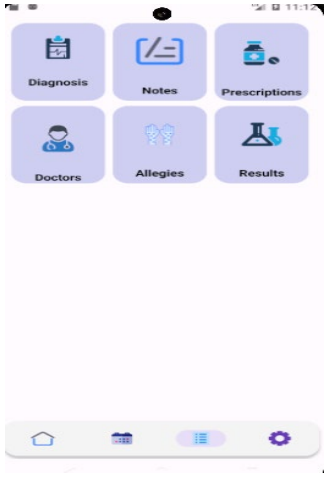


Figure 7: Health information screen

The health information screen in Figure 7 is used to view and update information on the selected patient. The doctor can add prescriptions, notes, alleges, laboratory results interpretations, and diagnoses. This screen can also be used to set an appointment for a patient.

The doctor has less functionality on their health information screen since they cannot add and update their records. They can be able to view their doctors, prescriptions, laboratory results, alleges, diagnoses, and notes from their doctors. Patients can give doctors permission to view and update their records by having them scan a QR code on their device. Doctors that have received permissions through scanning are given temporary permissions and those permissions can be revoked by the patient at any time. The Settings screen is also used to manage privacy and security settings such as changing passwords and enabling password protection of electronic health records.

5. Discussion

The results of this study demonstrate that our blockchain-based EHR system successfully addresses the scalability and privacy challenges faced by existing systems. By utilizing a private blockchain architecture and implementing advanced consensus mechanisms, we were able to achieve higher scalability and lower latency, while also ensuring data privacy and security. These findings have significant implications for the future of healthcare informatics and pave the way for the widespread adoption of blockchain technology in healthcare settings.

5.1 Performance Optimization Results

Several optimizations were made to improve the scalability and efficiency of the system. By implementing load balancing between nodes and utilizing the PoA consensus mechanism, we were able to significantly improve system performance. These optimizations resulted in higher transaction throughput and lower latency, enhancing the overall scalability of the system. Our proposed system addresses this scalability challenge by implementing shading and an off-chain storage mechanism. In our system, patient data stored on the blockchain includes only basic patient information along with an IPFS hash. This off-chain scaling solution reduces the volume of patient medical records stored directly on the blockchain.

5.2 Proposed Blockchain EHR System Latency

By storing less data directly on the blockchain, our system improves transaction speed as shown in Figure 8, the proposed system can process twice as many transactions per second as other blockchain EHR systems. Additionally, by utilizing IPFS, which stores data in a decentralized manner using a peer-to-peer network, we ensure that our system's security is not compromised while addressing the scalability problem.

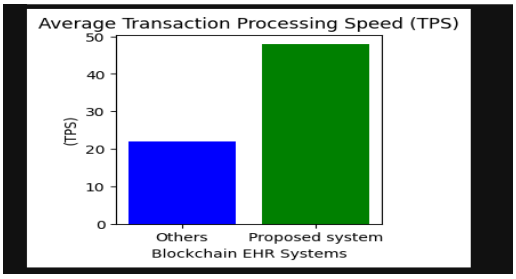


Figure 8: Proposed Blockchain EHR system latency

5.3 Challenges

Many Challenges were during the development of the blockchain-based EHR, among these was the imperative to implement robust security measures while concurrently ensuring scalability and speed. Balancing these requirements posed a significant hurdle, as stringent security protocols often impose computational overheads that can potentially hinder system performance. Additionally, maintaining data integrity and privacy amidst the system's expansion presented ongoing challenges. Scalability was crucial to accommodate the increasing volume of transactions and data, requiring careful architectural considerations to prevent bottlenecks and ensure seamless operation.

6. Conclusion

In conclusion, implementing an Electronic Health Record (EHR) system using a distributed ledger is a big step toward realizing Health 4.0 and improving care coordination in the healthcare sector. We have dealt with several of the issues associated with standard EHR systems, including data security, interoperability, and data integrity, by utilizing blockchain technology. We can raise patient outcomes, lower costs, and improve treatment quality by offering a decentralized, transparent, and secure platform for exchanging and storing health information. The delivery and management of healthcare will continue to be revolutionized in the future by more research and the use of blockchain-based EHR systems, which will ultimately result in a system that is more effective, efficient, and patient-centred.

7. Future Work

Future improvements for the blockchain-based Electronic Health Record (EHR) system outlined in this paper include enhancing the User Experience (UX) and User Interface (UI) design to improve adoption rates among

healthcare professionals and patients. Additionally, integrating the system with innovations such as AI (artificial intelligence) and the Internet of Things (IoT) have the potential to increase its usefulness. Continuously optimizing scalability and performance, establishing interoperability standards, and strengthening data privacy and security measures are essential steps. Real-world implementation and validation studies across diverse healthcare settings, along with cost-effectiveness and sustainability assessments, will provide valuable insights for broader adoption and long-term success. By addressing these improvements, the blockchain-based EHR system can evolve into a more robust, user-friendly, and widely adopted solution for enhancing care coordination and improving patient outcomes in the era of Health 4.0.

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Empowering Future Entrepreneurs: Developing an Online Entrepreneurial Mentoring Program Across Diverse EU Regions

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Abstract: The 2023 European Innovation Scoreboard reveals that there is an innovation asymmetry between different EU regions which is leading to an innovation gap. In particular southern and eastern EU countries showcase a lower level of innovation compared to their northern and western counterparts. Addressing this disparity, the ENTRPRENEDU project, funded by the European Union, pioneers a unique approach tailored for emerging and moderate innovation regions. This paper presents the development process of the curriculum for the ENTRPRENEDU online mentoring program, detailing the demand analysis, curriculum development, and implementation phases. This paper contributes to the discourse on entrepreneurial online education and mentoring program development by showcasing a tailored approach to curriculum design. The findings offer practical insights for educators, policymakers, and practitioners seeking to nurture entrepreneurship and innovation in diverse regional contexts.

Keywords: Innovation, Entrepreneurship, Hackathon, Mentoring, Curriculum, Demand analysis

1. Introduction

The European innovation landscape is currently at a critical juncture, marked by increasing global competition (Abels and Bieling, 2023). The European Union (2023) states in the European Innovation Scoreboard (EIS) that despite notable progress, there remains a pressing need to bridge the innovation gap between European countries and regions. In particular southern and eastern European countries perform lower innovation activities compared to their western and northern counterparts. The EIS offers a comparative evaluation of the research and innovation performance among EU member states, as well as other European countries and regional neighbours. It clusters countries based on their innovation activities into four performance groups which are namely: Innovation Leaders, Strong Innovators, Moderate Innovators and Emerging Innovators. Countries that fall into the last two categories have an innovation score that is lower than the European Union average score. Hereby, Croatia, Slovakia, Poland, Latvia, Bulgaria and Romania are Emerging Innovators while Estonia, Slovenia, Czechia, Italy, Spain, Malta, Portugal, Lithuania, Greece and Hungary are Moderate Innovators.

The urgency to close the innovation gap extends to the development of educational programs and support mechanisms aimed at fostering the ambitions of young individuals and bolstering start-up growth. However, challenges such as knowledge disparities, available human resources, financial constraints, and the accurate use of information technologies are present in this dynamic environment (European Union, 2023). In this context, innovators, educational institutions, and entrepreneurs emerge as pivotal drivers of technological progress, economic prosperity and job creation (Blackwell, Cobb and Weinberg, 2002; Fritsch and Wyrwich, 2017). To fully leverage this potential, educational institutions should forge close partnerships with the industry, equipping students with the entrepreneurial skills necessary to navigate the rapidly evolving innovation landscape.

The ENTREPRENEDU project (Enhancing Entrepreneurial Ecosystems for Education), involving a consortium of eight European partners including Fondazione E. Amaldi, Fraunhofer IPK, EBAN, Corallia, Cleantech Bulgaria, F6S Network Limited, Luiss University, and the University of Thessaly, aims to enhance entrepreneurial ecosystems in education. This initiative focuses on reducing the innovation and educational gaps across Europe. It features hackathons in Italy, Greece, and Bulgaria, where individuals aged 18 to 40 and new start-ups generate about 90 business ideas related to deep tech and sustainability. The top four teams from each hackathon join the ENTREPRENEDU online mentoring program.

2. Development of Online Mentoring Programs for Early-Stage Entrepreneurs

Mentoring programs for entrepreneurs provide a structured framework in which novice entrepreneurs, or mentees, receive guidance from seasoned business practitioners, known as mentors. These programs are pivotal in developing vital entrepreneurial skills and advancing business growth. Assenova (2020) showed that mentoring for early-stage entrepreneurs lead to an increase in revenue, profit and employment growth for underprivileged entrepreneurs. Further, research by Cope and Watts (2000) underscores the significance of

these programs in offering personalized support that is critically aligned with the mentees' specific business development stages. Such individualized support not only addresses the immediate needs of the entrepreneurs but also profoundly impacts their self-efficacy, enhancing their belief in their capabilities to succeed (St-Jean et al., 2018). Furthermore, mentoring influences the culture within start-ups, promoting adherence to foundational principles and cultivating an environment conducive to constructive problem-solving (Brodie et al., 2017).

Despite the benefits, the shift towards online mentoring programs introduces new challenges, particularly in establishing the depth of connection that face-to-face interactions facilitate. Online platforms, while providing wide-reaching access, lack the non-verbal communication cues such as body language and eye contact, which are essential in building trust and rapport between mentors and mentees (Lall et al., 2022). The asynchronous nature of many online interactions also impedes the flow of real-time feedback, which is important for the timely guidance and adjustment in the learning process (Hooley et al., 2016; Walsh, 2016).

In contrast, Kakouris (2017) introduces a transformative pedagogical approach in Greek entrepreneurship education through the TeleCC online platform. This constructivist model emphasizes cognitive development through interactive and reflective learning experiences. By fostering critical thinking and meta-learning, it represents a substantial shift from traditional mentoring to a dynamic, participant-driven educational practice, potentially enriching lifelong and inclusive learning in entrepreneurship. Kakouris (2009) further emphasizes the importance of specialized online platforms to support experiential entrepreneurial learning effectively in European higher education. These platforms are crucial for facilitating action learning and supporting working groups beyond traditional classroom settings.

The global spread of COVID-19 has further accelerated the transition to online education, as highlighted by Liguori and Winkler (2020). The pandemic has forced a swift and substantial shift to online delivery across educational institutions worldwide, necessitating a rethink of how entrepreneurship is taught. This situation underscores the urgency to enhance online learning capacities and develop more effective methods for imparting entrepreneurial competencies and mindsets online, adapting to new realities and market conditions as they evolve.

Addressing these challenges necessitates a hybrid approach that combines the strengths of both asynchronous and synchronous learning methods. Asynchronous learning allows participants the flexibility to engage with the material at their own pace, which can make the mentoring more accessible and inclusive, accommodating various learning styles and personal schedules (Chang et al., 2014). On the contrary, synchronous learning, through real-time interactions such as video conferences, mimics the immediacy and engagement of traditional classroom settings. This method enhances the engagement and allows for dynamic discussions and immediate feedback, which are vital for an effective learning experience (Mullen, 2021). By incorporating both asynchronous and synchronous learning formats into the curriculum, participants can benefit from a blended approach that combines the advantages of self-paced learning with real-time engagement. This hybrid model can offer a comprehensive learning experience, cater to different learning preferences, and maximize the effectiveness of the mentoring program (Dada et al., 2019).

Moreover, the structure of mentoring programs should embrace progressive learning, which involves designing a curriculum that gradually transitions from basic to more complex entrepreneurial concepts and practices. This approach allows participants to build on their knowledge base and skills systematically, ensuring a solid foundation of understanding before advancing to more challenging topics (DuBois et al., 2011).

To effectively support mentees through these progressive stages of learning, mentoring support should be adaptable and responsive to the changing needs of the participants as they advance through the program. This support includes tailored guidance and feedback that align with the mentees' evolving levels of expertise and challenges (Rigg and O'Dwyer, 2012; Russell, 2007). Additionally, fostering autonomy and self-efficacy is crucial in these programs. As mentees progress, they should be encouraged to gradually take on more responsibility in decision-making and problem-solving, thus empowering them to take ownership of their learning journey and business development (Sarri, 2011; Seet et al., 2018). Incorporating opportunities for reflection and self-assessment at each stage of the program can further aid mentees in consolidating their learning, identifying areas for improvement, and setting realistic goals for future development (Garcia-Molsosa et al., 2021).

Finally, conducting a demand analysis for entrepreneurial mentoring is critical in understanding the specific needs and psychological resources of entrepreneurs, such as self-efficacy and optimism. Such an analysis can guide the development of mentoring programs that effectively address these needs, enhancing entrepreneurial intentions and outcomes (Ayodele et al., 2022; Baluku et al., 2020; Nabi et al., 2021).

3. Development of an Online Mentoring Program in the ENTREPRENEDU Project

In the following, the methodology for developing the ENTREPRENEDU online mentoring program is presented.

3.1 Methodology for Demand Analysis

The first step to develop the curriculum for the ENTREPRENEDU online mentoring program was the execution of a demand analysis. Employing a qualitative research design for the demand analysis, semi-structured interviews were conducted to delve into the nuanced needs and experiences of the participating teams. These hour-long sessions followed a pre-defined guideline and aimed to determine the specific entrepreneurial needs of the participating teams. For the analysis of interview data, a thematic approach was utilized revealing clusters of predominant needs among the teams, serving as the cornerstone for deriving six overarching mentoring topics.

The data collection took place on 30th June 2023. The process comprised online interviews with representatives from each of the four selected teams that constitute the first cohort of the program. Each interview session lasted one hour, aiming to capture an understanding of the participant's experiences and needs. The interviews were conducted and protocolled by two Fraunhofer researchers and one research assistant to ensure consistency in data collection and interpretation. Prior to data collection, an interview guide was prepared to establish a clear direction and framework for the interview. The guideline was structured around eight key dimensions, namely: (1) Business Objectives and Goals, (2) Resources and Support, (3) Product or Service Evaluation, (4) Target Group, (5) Challenges and Problems, (6) Trends and Innovation relevant for business idea, (7), Knowledge, Know-How and Attitude, (8) Learning Objectives.

All interviews were conducted with respect to ethical considerations, including voluntary participation, confidentiality, and privacy of the participants. The data gathered from the interviews were analysed using thematic analysis. This method was employed as it provides a flexible and useful research tool for identifying, analysing, and interpreting patterns of meaning ('themes') within qualitative data. Based on the protocols of the interviews, we carried out a process known as 'open coding'. This is the first step in qualitative data analysis, and it involves identifying and defining themes that emerged from the interviews. In this process, we read through the protocols and labelled segments of the text that encapsulated key thoughts or concepts. After coding the protocols, the codes were examined for patterns and sorted into broader categories. This stage of 'axial coding' involved the clustering of related codes to identify the main themes. These themes were then compared across all teams to identify shared or unique demands. The themes derived from this analysis process served as a basis for the derivation of the mentoring topics, thereby ensuring that the curriculum is tailored to meet the specific needs and learning objectives of the teams.

Based on the results from the demand analysis presented above, the modules described in Table 1 have been derived. The mentoring partners were responsible for the creation and execution of one of the six mentoring modules. Fraunhofer IPK was responsible for coordination of the creation and execution of the mentoring program.

Table 1: Mentoring Modules

Module	Description	Mentoring Partner
Business Model Development	Enables participants to understand the importance of a well-defined business model, equipping them with necessary tools and knowledge for its development.	Fraunhofer IPK
Crafting a Unique and Competitive Value Proposition	Teaches participants how to define, develop, and communicate compelling value propositions for market differentiation and competitive advantage.	Luiss University
Idea Pitch: from Tech Feasibility to Product Development	Guides participants in connecting technological feasibility with product development and creating persuasive technology pitches.	Fondazione. E. Amaldi
Investment Pitch and Quantifying Funding Needs	Equips participants with skills to create effective investment pitches and accurately determine financial needs.	EBAN

Module	Description	Mentoring Partner
Entrepreneurial Business Planning	Provides participants with a comprehensive understanding of business planning, including market analysis, operational planning, and financial forecasting.	Corallia
Access to Finance and Related Funding	Offers knowledge on navigating the financial landscape and developing skills to present compelling business cases to participants.	Cleantech Bulgaria

3.2 The Mentoring Program Development

The results derived from the demand analysis were tailored to address the identified needs and laid the foundation for the program's curriculum development. The results indicated that the teams and start-ups possess varying skill levels and experiences. Hence, a blended learning approach entailing asynchronous and synchronous elements that increase in their complexity was chosen for the curriculum development. This allows the participants to benefit from both approaches and focus on the content of their respective skill levels. Further, the online setting enables participants to join the program from their respective geographical regions. Figure 1 provides a comprehensive overview of the mentoring program's three distinctive phases, detailing their respective mentoring units, content structure and learning depth.

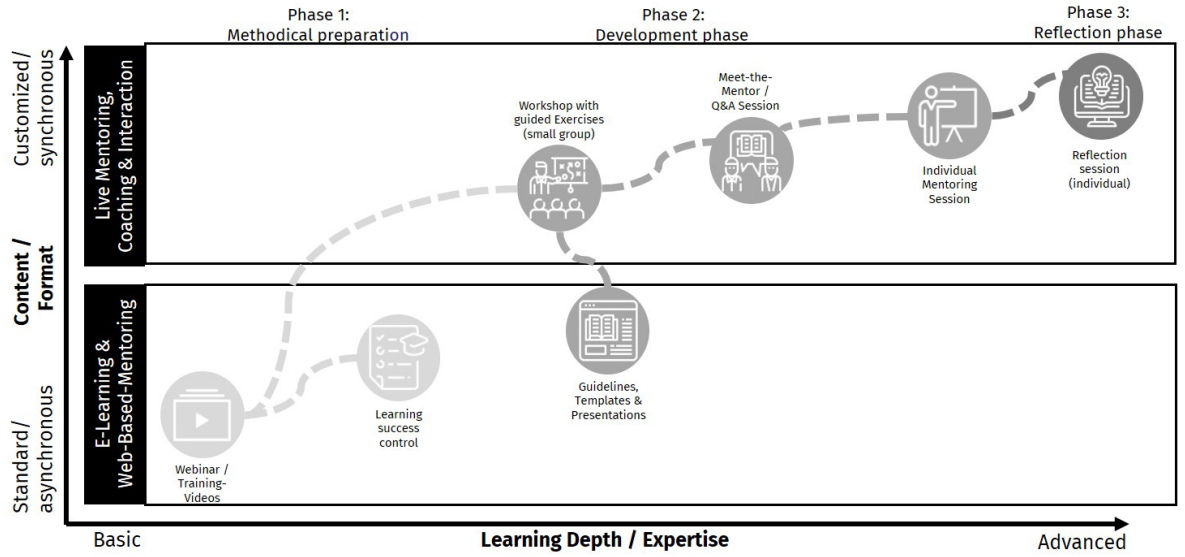


Figure 1: Mentoring program structure

The methodical preparation constitutes phase one where the content is standardized, aiming to transfer basic knowledge via online-based formats such as webinars and training videos. This content is identical for all participants of the first cohort and includes a one-hour learning success control which can be conducted using a quiz format. Here for each mentoring module three training videos have been facilitated by the mentoring partners. Each video has a length of approximately one hour and the complexity of the video content increases in unison with their numeration.

The second phase is focused on development and entails more advanced learning experiences that are customized to the participants' needs. This phase takes place in a live mentoring setting that entails interaction between the mentor and the participants. Therefore, workshops, Question & Answer (Q&A) sessions and individual mentoring are all viable formats for this phase. Each mentoring partner offers a two-hour workshop for all participants of a cohort. Thereby templates and tools such as Concept and Miro boards are utilized, and the participants have the opportunity to exchange feedback with their peers. Following the workshop, a 1-hour Question & Answer session is provided by each mentoring partner, in which participants can discuss the previously learned content. Further, each mentoring partner offers 2 hours of individual mentoring to each participant in which their needs and specific circumstance are prioritized.

Lastly, the reflection phase focuses on introspection and feedback. Each mentoring partner offers a one-hour reflection session. Here the participants come together with the mentor for one last time to evaluate their

progress, development and achievements of their goals. Further, future actions and goals that the participants should aim for are discussed.

Combining the durations of all three phases, the mentoring program will provide a total of ten hours of valuable mentorship to each participant. This extended support seeks to maximize the potential of the participating teams and contribute to their long-term success. Considering the participation of six mentoring organizations, each start-up within the first cohort is set to benefit from a total of 60 hours of mentoring.

4. Results: Application of the Mentoring Program

A comprehensive curriculum has been developed for all six mentoring modules. It begins with a clear outline of the goals and objectives for each module of the mentoring program. Moreover, based on the need's analysis and the expertise of each mentoring partner, the core subjects that the program aims to impart to the mentees have been defined. Each module has been designed to directly support the achievement of the program's objectives. For each module, the curriculum specifies the expected learning outcomes, which helps to clarify the contents of each mentoring module. Moreover, the content & resources, which include the materials, resources, and activities that will be used to deliver each module, as well as the different applied mentoring methods, were outlined in the curriculum. Additionally, the curriculum detailed the sequence in which the topics would be covered and the timeline for the entire mentoring program. It also defined how progress would be assessed and how feedback would be provided. In the following chapter, the curriculum is exemplified through Module 1: Business Model Development.

4.1 Exemplary Mentoring Module for Business Model Development

The module was strategically designed to equip participants with a comprehensive understanding of the elements of a robust business model. The module, facilitated by experts from Fraunhofer IPK, aims to provide the foundational tools and strategic insights necessary for the effective development and implementation of business models that are congruent with the entrepreneurial versions and market requirements of start-up teams.

The module commenced with the methodical preparation phase which comprised three learning videos aiming to establish a strong knowledge base for the participants, equipping them with the necessary theoretical concepts and tools needed to develop a robust business model.

The initial video serves as an introduction to the fundamental understanding of business model development. It is explained that it is not just about understanding one's product or service, but also about understanding the ecosystem in which the future business operates. The challenges faced by budding entrepreneurs and the importance of feedback and mentorship in defining a robust business model are highlighted. By the end of the video, viewers are said to be equipped with the knowledge to start, redefine, or pivot their current or future business model to better align with their business goals.

Progressing to a more advanced stage, the second video introduced participants to the business model canvas (BMC), aiming to offer an advanced understanding of its elements and application as a tool. It covers the definition and history of the BMC, introduces various adaptations, discusses its elements in detail, and provides examples of BMC applications.

In the third video, an overview is given of an approach to continuously adapt, develop, and change a business model according to external and internal drivers. For this purpose, a framework for strategic business development is introduced and filled with practical tools and techniques to analyse internal and external factors affecting the business model, as well as to derive relevant actions to systematically develop the business model in order to grow and survive as a successful company on the market.

Following the videos, a multiple-choice quiz was implemented to test the mentees understanding of mentoring videos to then focus in the following mentoring process on areas where the performance in the quiz was lacking. The quiz includes both theoretical and practical questions related to the content presented in the 3 videos of the module.

In the development phase participants actively refined and enhanced their business model under mentor guidance. A pivotal component of this phase is an interactive workshop designed to facilitate the application of learned concepts through the use of the business model canvas. During this workshop, participants are guided through a series of structured exercises that aid in the visualization and refinement of their business models. In this session, a whiteboard tool was used to let the mentees fill out their own business model canvas. Each team

had their individual virtual room in which the mentors provided support. Later on, the teams presented their status of the BMC and received feedback from the mentors and their peers.

Additionally, a meet-the-mentor Q&A session provided the teams with an opportunity to clarify questions and receive direct feedback on their business model development. This session offered strategic insights and practical advice, helping teams improve and tailor their business models to market demands.

Furthermore, individual mentoring sessions were conducted to provide bespoke guidance tailored to the unique needs of each team. These sessions focus on strategic aspects of business model refinement such as resource allocation, partnership development, and customer engagement. Mentors work closely with the teams to fine-tune each element of the business model, ensuring its alignment with strategic business objectives and market opportunities. In the individual session the business model canvas of the start-ups was reviewed and completed. The sessions began with a thorough review of the start-up's current BMC. Mentors and mentees collaboratively examined each component of the canvas, from the value proposition to customer segments, channels, revenue streams, and key activities. Further, the focus was placed on providing and discussing fitting business model partners that the start-up can apply to their BMC. Where gaps were identified, mentors provided targeted advice on how to address them, ensuring that by the end of the session, each start-up had a completed BMC that was both realistic and ambitious. A significant portion of these sessions was dedicated to exploring and selecting fitting business model patterns that start-ups could integrate into their BMC. This exploration was guided by the mentor's expertise in identifying patterns that have proven successful across various industries and how they could be tailored to the teams' specific context. Discussions revolved around a range of innovative business model patterns.

The module culminates in the reflection phase, which centres on reflection and strategic forward planning. A structured reflection session allowed the participants to assess their progress, recognize achievements and identify areas for future development.

4.2 Implementation and Validation of the Online Mentoring Program

To facilitate the mentoring program the online platform of the consortium partner F6S Network Limited was utilized. Here participants registered their teams on the platform to access the dedicated mentoring pages for each module. Each page featured private groups for sharing training videos, quizzes, and materials, and allowed mentors to post announcements and communicate with mentees. Further, the module descriptions and quizzes, to assess the mentees understanding of the mentoring modules, were also hosted on the F6S platform. The first four teams registered during the Italian hackathon formed cohort one. The mentors conducted workshops, Q&A sessions, individual mentoring and reflection sessions using their preferred online meeting tools.

The first initiation of the mentoring program took place from the middle of November 2023 to the beginning of March 2024. After the completion of the mentoring program the participants provided the consortium with feedback during a qualitative interview. The interview took place in guided online video calls and was facilitated by two researchers from Fraunhofer IPK. The methodology was structured around a semi-structured feedback guideline, exploring seven sections which are namely: (1) Reflection on the Mentoring Journey, (2) Overcoming Obstacles and Developing Skills, (3) Progress and Future Goals, (4) Learning from the Community, (5) Overall Satisfaction with the Mentoring Program and Modules, (6) Technical and Organisational Feedback and (7) Closing thoughts

The respondents reported significant development in their business ideas and models, attributing the program's effectiveness to steering their concepts towards feasibility and concrete planning. Mentors played a crucial role in this transformation, challenging assumptions and refining visions. Challenges faced by teams included scalability concerns and integrating learned modules effectively, but the program provided focused support to overcome these hurdles and cultivate essential skills. Through mentoring, teams clarified and strengthened value propositions and identified areas for business model improvement. Participants expressed appreciation for the program's assistance in establishing actionable goals and metrics for success, although an even stronger linkage between the different mentoring modules was desired. The overall, satisfaction with the program and modules was high, with constructive feedback provided for improvement in integration and scheduling. Derived from the feedback various enhancement actions were determined to improve the quality of the mentoring program for the second cohort. These include for example increasing the time between sessions without extending the program's duration to facilitate better absorption and reflection of the content. This approach would allow participants to apply their learnings more effectively during the intervals. Furthermore, it was

decided to facilitate the live mentoring session on one specific web application to streamline the process of scheduling and executing these sessions.

5. Conclusion

In conclusion, the ENTREPRENEDU project has demonstrated a proactive approach in addressing the innovation and educational gaps prevalent in the European Union, with a specific focus on emerging and moderate innovation regions. This initiative has successfully implemented a blended learning curriculum that combines traditional methods with asynchronous materials, enhancing its attractiveness and accessibility for diverse teams. This approach not only supports the scalability of the program across different regional contexts but also ensures it is replicable, allowing for broad adoption in various educational settings. These elements together make the ENTRPRENEDU mentoring program a valuable model for both academic research and practical application.

This research enhances the literature on online education and entrepreneurial training by demonstrating the effective use of blended learning strategies in emerging and moderate innovation regions. It highlights the effectiveness of asynchronous learning tools and structured mentoring on entrepreneurial skill development. For practitioners, the project offers a tested framework to foster innovation and skill growth. The participant feedback emphasizes the program's positive effects on business development and skill enhancement, while also suggesting areas for refinement such as better integration and scheduling. Overall, the ENTREPRENEDU online mentoring program exemplifies a concerted effort to foster entrepreneurial ecosystems, cultivate innovation, and bridge educational disparities, thus contributing to the long-term prosperity of the European Union.

Disclaimer

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Circular Economy Business Model in Cambodia: Drivers, Barriers and Impacts

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Abstract: The notion of the circular economy has garnered noteworthy interest as a viable substitute for the conventional linear economic framework. This paper investigates the emergence of circular economy business models in Cambodia, focusing on the drivers that are shaping this transition, the barriers that businesses encounter, and the potential impacts of circular economy initiatives on the Cambodian economy and society. By examining the Cambodian context, this study seeks to shed light on the opportunities and barriers associated with the adoption of circular economy practices in a least developed country setting. Even though Cambodia has made strides toward development, Gaudemar (2016) noted that it is improbable for the country to "graduate" from its Least Developed Country (LDC) classification until 2025 or later. Furthermore, the findings of this research can contribute to the gap in the literature related to policy interventions and strategic decision-making aimed at promoting sustainable economic development and environmental stewardship in Cambodia.

Keywords: Circular economy, Drivers, Challenges, Impact

1. Introduction

The traditional linear economic model, characterized by the take-make-dispose approach as pointed out by Jorgensen and Pedersen (2017), has led to resource depletion, environmental degradation, and social inequalities, particularly in developing countries such as Cambodia. In response to these challenges, the concept of the circular economy has emerged as a promising framework for achieving sustainable development by promoting the regenerative and efficient use of resources. As Cambodia continues to experience rapid economic growth and industrialization, there is a mounting requirement to transition towards more sustainable and resource-efficient business models. Industries, academics, and legislators recognize the circular economy as a promising strategy for collaboratively enhancing value chain sustainability and competitiveness because of its capacity to disentangle economic growth from resource consumption and waste production (Bressanelli, 2022). A production and consumption paradigm known as the "circular economy" emphasizes “sharing, leasing, reusing, repairing, refurbishing, and recycling current materials and products for as long as feasible” (European Parliament News, 2023). Through this approach, the “goods' life cycle is extended and waste is minimized to the bare least. Recycling ensures that resources from products that are nearing the end of their useful lives are kept within the economy” whenever possible. These could be regularly used in a prolific way, creating even additional value. This “deviates from the traditional, sequential economic take-make-consume-throw-away process” allowing the idea to hinge on a profusion of inexpensive, effortlessly available resources and an “energy paradigm (European Parliament News, 2023).

2. Circularity vs Sustainability

Primitive man survived with whatever resources were accessible and may possibly be utilized as, or converted into, lodging, provisions, foods, or equipment. Stahel (2020) identified that as “circular economy based on scarcity, as expressed in an old New England maxim: *use it up, wear it out, make it do or do without”*. The author opined that circularity was a requirement for most as only the affluent and influential resided in relative contentment and that this condition can still be found in less developed populations. The circular economy's reuse and repair strategies, however, have persisted throughout this time, silently and unnoticeably, across society. According to Stahel (2016), reducing the use of inputs for industrial production gave rise to the Circular Economy (CE) concept in the 1970s, however it turns out that circular economy may be applied to any resource. With the start of the 1973 oil price shock, the circular economy began to gain traction in the early 1970s. In 1976, Stahel and Ready delivered a study to the European Communities Commission in Brussels that examined an “economy in loops” and “its effects on society”. The "axiom of the smallest loop" was named after this

research, which demonstrated the “economic superiority of reusing objects over recycling materials”, (Awan et al., 2020).

According to Andrews (2015), the integration of circular economy into sustainability is a component of the holistic picture that circular economy delivers. This creates a parallel between the two concepts, with sustainability serving as the foundation and circular economy as the actual application. It is vital to take note that circular economy has been around long before sustainable businesses began stemming from Sustainable Development Goals (SDG). The Brundtland Commission explored sustainable development as a solution to environmental issues in their report in 1987. The concept of sustainable development received major international recognition for the first time at the 1972 United Nations Conference on the Human Environment in Stockholm, Sweden (United Nations, 2024). The idea that growth and the environment, which were once seen to be two different concerns, could be managed in a way that would benefit both was embraced by the international community, even though the phrase was not used specifically. Following the 1992 United Nations Conference on Environment and Development in Rio de Janeiro, the focus shifted to sustainable development. In 2015, the UN established the Sustainable Development Goals (SDGs), which emphasize interconnectedness and balance environmental, social, and economic sustainability. The SDGs are to "end poverty, protect the environment, and ensure peace and prosperity by 2030" (Hajian and Jangchi Kashani, 2021).

3. The History of Circular Economy and the Onset of Circular Economy Business Models

The history of circular economy is depicted by Tuladhar et al., (2022) as shown in Figure 1.

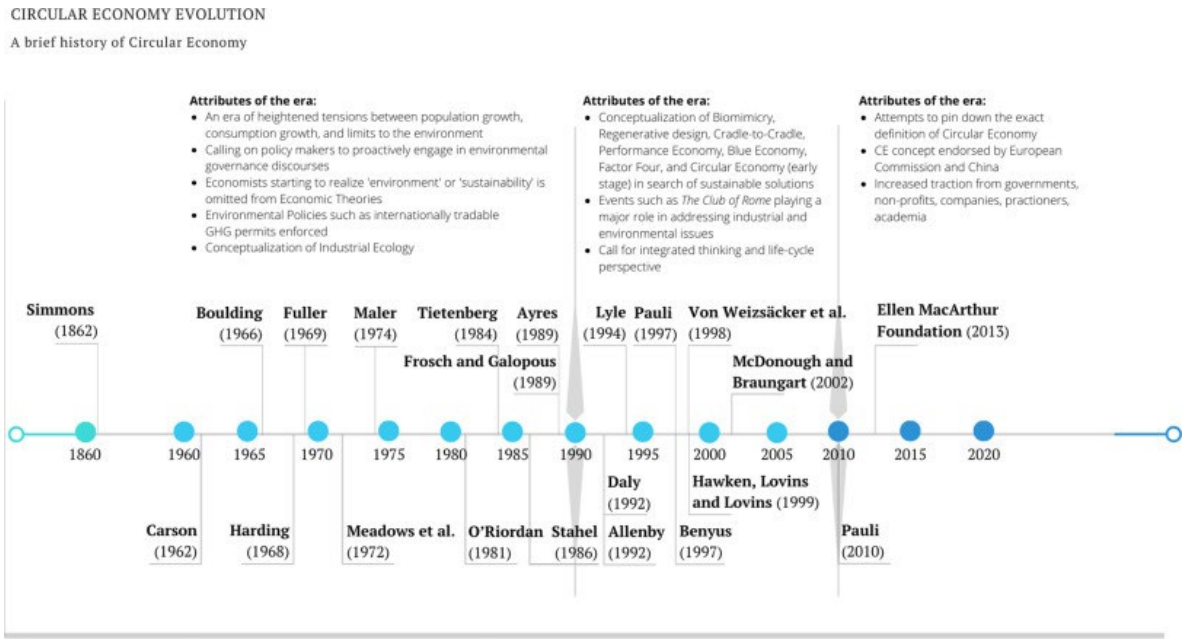


Figure 1: History of Circular Economy. Source: Circular Economy Evolution, (Tuladhar et al., 2022)

While environmental literature began to flourish in the 1960s, the first indications of circular economy may be found in the 1860s, when Simmonds proposed the necessity of symbiotic practices, those that benefit the environment and the economy equally in 1862, as mentioned in Thuladhar et al., (2022). The evolution of circular economy story over time is shown in the part that follows. Since 1860s till 1989, there were increasing tensions between population growth and increasing limits to the environment which resulted in policy makers to engage proactively in environmental governance discourses (Tuladhar et al., 2022). During this period, economists comprehended the omission of 1) environment and 2) sustainability from Economic Theories which subsequently resulted in the introduction of internationally tradable GHG permits and the conceptualization of Industrial Ecology by Frosch in1992.

In the next two decades, the world saw the conceptualization of 1) Biomimicry, 2) Regeneration Design, 3) Cradle to Cradle, 4) Performance Economy, 5) Blue Economy and 6) Factor Four, summarized in Table 1.

Table 1: Conceptualization of Environmental Governance

Theorist	Concept	Description
Benyus (1997)	Biomimicry	Drawing comparisons between companies and the natural ecosystem and offering "ten lessons" for an environmentally conscious business, society, or economy to learn from nature in order to find solutions to issues or just to breathe new life into existing goods and procedures
Lyle (1994)	Regeneration Design	Prioritizing the selection of materials, designing products for ease of disassembly, and applying systems thinking are essential to maximizing environmental efficiency prior to, during, and post-product usage.
McDonough and Braungart (1998)	Cradle-to-Cradle	Complies completely with nature, no harmful elements are produced, therefore laws are not necessary.
Stahel, 1986 theory mentioned as a solid building block of the CE by Sillanpää and Ncibi (2019)	Performance Economy	A method that "builds spiral-loops that minimizes the flow of matter and energy, and environmental degradation without impeding economic growth or the advancement of social and technical sciences"
Gunter Pauli (2010)	Blue Economy	Creative approaches that result in zero waste and claim that the formation of industry clusters, where the trash from one is used as an input for another, is the solution
von Weizacker (1997)	Factor Four	Provided examples of how our economies' resource productivity may rise fourfold, allowing us to live twice as well with half as much resources.

Source: History and evolution of the circular economy and circular economy business models (Tuladhar et al., 2022)

Subsequent decade witnessed the efforts to pin down the exact definition of Circular Economy (Kirchherr et al., 2017) which was endorsed by the European Commission and China resulting in increased traction for governments, non-profits, corporations, practioners and academia (Tuladhar et al., 2022).

4. Drivers

4.1 Government Initiatives

Cambodia, which is home to about 16 million people, lacks industrial diversification in terms of electronics and enhanced production and is mostly dependent on the garment sector. According to The World Bank (2023), Cambodia's GDP is expected to expand by 3.0%; yet, prominent ecological challenges and societal disparity are still present (BTI, 2022). USAID (2022) reported that deforestation, pollution, and environment corrosion are among the environmental problems that Cambodia faces. Between 2001 and the present, 2.6 million hectares of forest cover have been lost due to severe deforestation throughout the previous 20 years with logging and agricultural growth being the primary causes of deforestation (Pauly et al., 2022). Pheakdey et al. (2022) highlighted the significant issue of waste management, as landfilling and burial at disposal sites pose environmental dangers such as greenhouse gas emissions. Due to its reliance on resource extraction and export-oriented industries such as the textile industry, Cambodia's economy produces a lot of pollution and waste, primarily “Municipal Solid Waste” but also industrial, construction, and demolition waste (UNDP, 2022).

Given the situation, the circular economy holds great promise for addressing resource depletion, environmental degradation, and waste generation for a wide range of stakeholders, including businesses, governments, and society at large (Crome et al., 2023). An increase in the consumption of materials and energy has resulted from Cambodia's expanding population and economy. Like in other nations, this has led to new difficulties in managing waste, energy, the environment, and natural resources sustainably. The Circular Economy Strategy and Action Plan, in the words of H.E. Say Samal, Minister of the Environment and Chair of the National Council for Sustainable Development, "aim to create a win-win solution to the present challenges". The Strategy aims to close the loop of the entire value chain and preserve the value of resources for as long as feasible, as opposed to just extracting, using, and discarding them (UNDP, 2021).

"The circular economy has the ability to provide new economic values, a variety of job opportunities, and beneficial social and environmental change. It may direct the course of sustainable development for nations of all income levels, including Cambodia” said UNDP Cambodia Resident Representative Nick Beresford while the Swedish ambassador to Cambodia, H.E. Björn Häggmark, underlined further that in order to advance the idea of

a circular economy, the government must take the initiative, and all other stakeholders namely households, people, and others must also actively participate (UNDP, 2021).

Acknowledging the crucial role played by the business sector in expediting the shift towards a circular economy, a private sector platform was developed alongside the new plan to facilitate the exchange of information regarding feasible policies and initiatives. One of the most important first steps in developing a circular economy is the sharing of best business practices. According to H.E. Mikami Masahiro, Japan's Extraordinary and Plenipotentiary Ambassador to the Kingdom of Cambodia, "this knowledge will enable other industry players to use and replicate best circular economy measures and accelerate the industry-wide transitions", (UNDP, 2021).

Another initiative is the Circular Strategy on Environment 2023 – 2028 focusing on framework for Policy, Administration and Extension for a Clean, Green and Sustainable Cambodia as depicted in Figure 2. The Royal Government of Cambodia (RGC), through the 7th Legislature of the National Assembly, produced the Circular Strategy on Environment 2023-2028 in compliance with the Pentagon Strategy, Phase 1 - 2023-2028 (MOE, 2023). This strategy outlines the RGC's commitment to its mission in the environment to satisfy the economic needs in order to achieve sustainable development goals. Under this initiative, priority programs must be implemented in light of climate change as environmental and natural resource management, particularly in the areas of “land, water, minerals, and forestry”, continues to develop while simultaneously address the new issues brought on by climate change.



Figure 2: Circular Strategy on Environment 2023 – 2028. Source: Ministry of Environment, Royal Government of Cambodia

The two relevant programs that drive circularity under this initiative are presented in Table 2.

Table 2: Strategy and Programs Summary

Strategy 1 (Clean) Angle 1: Controlling Pollution **Priority 1: Improving the implementation and monitoring of solid waste, liquid, and hazardous waste management systems**
Create sub-decrees regarding the management of single-use plastics and plastic waste, the management of hazardous wastes, paint lead levels, electrical and electronic equipment types, reports on pollution releases and transfers into the environment, and other pertinent legal instruments;
Encourage the application of the 4R Principle (Refuse, Reduce, Reuse, and Recycle) in order to encourage a circular economy and solid waste management, especially with regard to plastic trash;
Promote the conversion of plants and agricultural products into packaging materials as an alternative to plastic;
Distribute legal documents to the public, especially the owners of pollution sources, about the management of solid, liquid, plastic, and hazardous wastes; bolster the application of laws pertaining to the handling of plastic, liquid, solid, and hazardous wastes; bolster the knowledge of Ministry and Provincial Department of Environment representatives regarding the handling of hazardous, liquid, and solid wastes;
Strengthen the ability of officials from the Ministry of Environment, Municipal or Provincial Department of Environment on the management and disposal of solid, liquid, plastic, and hazardous wastes;
Coordinate, cooperate, and mobilize support to encourage environmentally friendly schools, pagodas, and other religious institutions, legal entities, and individuals who have participated in the environmentally friendly activities.

Strategy 1 (Clean) Angle 1: Controlling Pollution **Priority 3: Promoting the implementation of waste management policy linked to the implementation of decentralization and deconcentrating policy and Safe Village, Commune-Sangkat policy** Examine and compile information regarding the kinds and intensities of risks and consequences associated with hazardous materials, hazardous waste, radioactive waste, and medical waste that are dumped into the environment; Publish information about the dangers and consequences associated with hazardous materials, hazardous wastes, radioactive wastes, and medical wastes;
Encourage the Department of Environment and Sub-National Administration to get training, information, and teaching on solid waste management techniques; collaborate to track and assess the 2020–2030 urban solid waste management policy's implementation;

Source: Ministry of Environment, Royal Government of Cambodia Website

4.2 Corporate Social Responsibilities (CSR)

Another key driver to circularity is the corporate social responsibility (CSR) that drive companies to embrace circular business models. Companies, Business Associations and Chambers of Commerce often synergize to educate small and medium businesses on circularity and sustainability measures. The Global Circular Fashion Forum's (GCFF) for example, initiated the "Circular Fashion Partnership Cambodia," that intends to assist countries that produce textiles in hastening and increasing the recycling of post-industrial textiles waste. Through this partnership, another event titled the "Textile Waste Opportunities for Circular Textiles, Garments, and Footwear in Cambodia" an initiative by GFA and GIZ, aims to establish circular systems in Cambodia. The initiative will support a pilot project focusing on sorting and recycling textile waste, diverting it from landfills and incineration. The event attracted representatives from manufacturers, brands, recyclers, and government officials (Khmer Times, 2023).

Similarly, the glass bottle return initiative, launched by HEINEKEN Cambodia, is a strong endorsement of the brewer's “Brew A Better Cambodia” aim, which lays out specific, bold goals to increase circularity and decarbonize the whole value chain by 2040, as well as its production by 2030. Since packaging plays a significant role in the brewer's whole value chain footprint, expediting returnable packaging is essential to fulfilling these long-term obligations. Since the food and beverage and hospitality sectors account for the majority of the market for glass bottle sales for brewers, collaborating with them is also a deliberate move (Anon, 2023).

In the same way, the first 4P's store abroad opened in Phnom Penh, Cambodia, in July 2021. In response to Cambodia's waste dilemma, the pizza restaurant adopted the daring idea of zero-waste. By following the 5Rs—reduce, reuse, repurpose, and recycle—they started the movement from the ground up and turned the food scraps from the restaurant into a brand-new zero-waste pizza. They created meaningful pieces of art out of the broken plates and used leftover lime peels to make tea that produces no trash. All garbage, from inside and outdoors, is moved to the recycling room for segregation and recycling (Pizza 4P’s, n.d.). During a panel discussion that took place in April 2024, the Sustainability Specialist of the company shared that food shells are powdered and mixed to animal feed as they are great source of calcium and further reiterated that much of their 5Rs are integrated into the company’s operations and are integral part of their business. The company firmly believes that they can confidently advance towards a waste-free future if they analyzed every action carefully and with resolve.

Likewise, a joint venture between the Siam City Cement Company (SCCC) of Thailand and the Chip Mong Group of Cambodia, called Chip Mong Insee Cement Corporation established the business unit Chip Mong Ecocycle in 2019 to offer sustainable industrial waste management solutions through cement kiln co processing for the first time in Cambodia. Through partnerships and collaborations to provide new technology for sustainable industrial waste management through circularity, Chip Mong Ecocycle is leading the charge for transformation in Cambodian industrial waste management (H&M Foundation, 2021). Although circular business models in Cambodia have proven to be a success, the number of such businesses are still relatively small in comparison to the majority of traditional business models both formal and informal in the country.

5. Barriers

The two main sectors of the waste economy in Cambodia are the solid waste management sector and the notional recyclable waste management industry. In some nations, state-owned or major corporations either entirely or partially "manage" the recycling trash systems. By contrast, Cambodia's garbage system is an authentic “grassroots recycling economy” that operates independently of the state until 2019 and adheres to its own laws and paths. Throughout the world, the so-called "informal" (recyclable) waste economies have been

progressively organized and commercialized during the last 20 years (Eitel, 2022). Meanwhile, waste reclaimers are still able to continue collecting recyclables in neighboring nations like Thailand and Vietnam, but the government provides financial and technical support to the industry in addition to capacity-building programs and incentives (Sasaki et al. 2014, Chua 2016, Jellinek 1993, Nguyen 2019 as cited in Eitel, 2022). Thus, Phnom Penh's recycling economy is unique, but its distinctiveness is threatened by heated political debates over formalizing the industry.

Given that Cambodia was engulfed in a genocide until the late 1970s, understanding circularity in the nation requires awareness of the surrounding context and the ability to connect to the intricacy of the culture and recent history of the nation. Despite the rapid growth and government initiatives, Cambodia lax enforcement and societal readiness are the immediate barriers to transformation from traditional business models to circularity.

According to Ghosh (2019), the adoption of circular economy has been restricted to industrialized countries with improved waste management techniques, technological advantages, wider access to resources, and requisite skills while emerging economies continue to lag in adopting circular practices due to the enormous complexity of this approach (Diaz, 2017). A recent study indicated that just 8.6–9.1% of the world's economies were circular in 2019–2020, underscoring the stark delay in the adoption of circular practices (Kirchherr and van Santen, 2019). Other barriers explored in multiple studies based on industries and size of enterprise are summarized in Table 3.

Table 3: Barriers to Circular Economy

Industry	**Barriers**	**Researcher**
Agriculture	Absence of knowledge and awareness, as well as lack of government assistance	Kumar et al. (2021)
Coffee	Localized perspective, absence of uniformity, and consistency of governmental directives	van Keulen and Kirchherr (2021)
Textile Market	Low consumer demand	Huang et al. (2021)
Global Textile	High production and sales costs for circular goods	Hartley et al. (2022)
Electronics and Electrical Equipment	1) Producer reluctance & cultural issues 2) Weak waste regulation, a lack of transparency throughout the production chain, and a lack of CE standards	1) Cole et al. (2019) 2) Rizos and Bryhn (2022)
Automotive	1) Absence of knowledge and experience with CE, 2) Ineffective environmental legislation, ownership difficulties, and a lack of government assistance	1) Agyemang et al. (2019) 2) Kayikci et al. (2021)
Furniture	Insufficient funds and unpredictability in the economy	Silvius et al. (2021)
Scale of Enterprise	**Barriers**	**Researcher**
	Insufficient expertise and significant expenses associated with adhering to rules and regulations	García-Quevedo et al. (2020); Mishra et al. (2022)
	Poor profitability, a lack of cooperation and awareness among stakeholders, and management's reluctance to change	Mangla et al. (2018)
	Inability to distinguish between profit-sharing and responsibility models, as well as ownership concerns	Tura et al. (2019)

Micro, Small and Medium Scale Industries	Lack of harmonization of the laws, lack of government enforcement and collaboration, and lack of uniformity	Stumpf et al. (2021
	Insufficient customer awareness and businesses' reluctance	Kirchherr et al. (2018)
	Age factor: older people reluctant to use products made of recycled materials as opposed to younger people	Neves and Marques (2022)
	Technical and economic impediments are connected to regulatory restrictions.	Bening et al. (2021)

Source: Circular economy adoption barriers in built environment- a case of emerging economy (Mhatre et al.,2023)

The barriers and the low percentage of circularity adaptation globally are indicative why it is even more challenging to foster circular business models in least developed economy such as Cambodia. As ideal as it seems, this requires enormous effort in terms of regulatory and socio-economic aspects. Chen et al. (2020) inferred that promoting environment-oriented development such as circular economy can be financially taxing for local governments, as it requires significant financial outlay and slows GDP growth. The author further indicated that transitioning from economy-oriented development to circular economy requires sacrificing economic growth, affecting early-stage local economic growth.

6. Impact

Despite the barriers, countries around the world including Cambodia have not ruled out the impact the circular economy has on environmental preservation. The positive impact of circular business models has proven to be effective in the garment industry. Under the International Finance Corporations' Cambodia Improvement Program, eleven suppliers that "operate cut-and-sew and garment-washing" businesses put resource efficiency measures in place in 2019 and 2020. These efforts reduced electricity and water use by 18% and 29%, respectively. This action supports the nation's climate goals while also increasing productivity. Producers implemented resource-efficiency initiatives over 22 months, reducing energy usage by 29%, water usage by 44%, and greenhouse gas emissions by 25%, with 60% of recommendations implemented, considering the epidemic (IFC Org, 2022). Similarly, the UNDP published the 'Handbook for Implementing Circular Economy Practices in Hotels and Restaurants' that offers Cambodian hotels and restaurants helpful advice on how to change their operations to become more sustainable (UNDP Org, 2021). Initiative such as this is crucial for Cambodia as the Minister of Tourism predicted that there would be about 28 million tourists by 2030, a fourfold increase from 2020 (IPS Commercial, 2020).

7. Conclusion

As Cambodia transitions towards a circular economy, the 'private sector will play a central role in achieving this change' (UNPD Org, 2021). Similarly, regional and world organizations support will expedite the transition through infrastructure provision and capacity building. The Economic Research Institute for ASEAN and East Asia (ERIA) Capacity Building Program and Policy Design Department organized a two-day training on Circular Economy Introduction for Cambodian officials, realizing the importance of strong and rigorous policymaking. In order to ensure the successful implementation of circular economy priorities and agenda under the ASEAN Framework on Circular Economy, the workshop's objectives were to assist Cambodian policymakers in mainstreaming circularity in routine work processes, comprehending circular economy concepts, identifying potential economic activities or sectors, establishing enablers, and putting in place suitable monitoring and evaluation mechanisms

In conclusion, the circular economy is neither a panacea for prosperity, sustainability, or employment. Businesses and governments need to make sure that these initiatives are taking us in the right direction and not toward a circular future that is even less sustainable by carefully assessing the expected and actual impact of these measures. Making the changes necessary to use the planet's resources sustainably can be accomplished through circularity. However, chasing circularity as a goal unto itself deceives us and might even have unfavorable effects. We need targets to make sure we stay inside the safe operating space and don't go beyond

the planet's capacity to maintain society, as well as metrics to help us stay focused on the impacts we seek. To maximize the benefits of circularity and assist society in realizing its advantages, industries and governments alike must adopt it carefully and thoughtfully. From a resource stance, recycling is only valuable if the resources required for "recovery and recycling are less than those needed for extraction and disposal", (Moss, 2019). There have even been suggestions that, if not executed with caution, the circular economy could lead to the depletion of resources. Maybe society shouldn't aim for zero waste in the end and should instead determine the ideal reprocessing rate for each material and understand the complete impact of circularity on businesses, countries, and even individuals' sustainability efforts. This requires further study and impact-based metrics to accurately measure the impact of circular activities on resources and the environment.

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Innovation and Entrepreneurship in Southeast Asia: The Role of Geographical Indications

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Abstract: The Southeast Asian economies have been highly proactive in developing Geographical Indicators (GIs) within their jurisdictions. For instance, Thailand developed its "One Tambon One Product" (OTOP) project to support community co-operatives in *tambons* (sub-districts) and villages throughout Thailand. The aim was to increase village incomes and preserve local wisdom. This followed Japan's One Village One Product (OVOP) program. This was followed by its "One Province, One GI" to encourage each of its 76 provinces and Bangkok to develop at least one GI product. The aim was to increase village incomes and preserve local wisdom. Subsequently, the Lao People's Democratic Republic (PDR) established its One District One Product (ODOP) program. In addition, local communities throughout most of the eleven Southeast Asian Nations, often with the support of external development agencies, have protected their products using GIs or Trademark legislation. The number of domestic GIs registered within the eleven Southeast Asian nations as of April 2024 was Cambodia with seven, Indonesia with 127, Lao PDR with six, Malaysia with 79, Thailand with 194, and Vietnam with 94. These cover both agricultural and non-agricultural products, with the majority in each jurisdiction being the agricultural sector. This paper outlines the legislative framework of GI protection of products from the above jurisdictions and how the legislation has provided a framework for local entrepreneurs and communities to develop and protect local products, thus improving the quality of life of those local communities, whether as producers or providers of labour. Cambodia and Lao PDR have also followed a different path to registering GIs as they are parties to the World Intellectual Property Organisation's Geneva Act, which provides a one-stop shop for registering GIs. Products protected by the relevant legislation include agricultural products, products derived from agricultural products, cooked food, handicrafts, and woven cloth, including associated designs and pottery methods and designs. Three examples are provided in detail: Kampot Pepper – Producers return to ancestral lands after 40 years of civil war and unrest; Bolaven Coffee – International development agencies support small landholders to form a co-operative to support the development of their community; and Mak Mao Berry Juice – One man's 30-year passion to commercialise a local product.

Keywords: Community development, Geographical indications,Iinnovation, Legislation, Traditional knowledge

1. Introduction

This paper focuses on implementing and promoting Geographical Indications (GIs) in Southeast Asia. Initially, it provides a strategic overview of the approach of the ten nations to adopting and promoting GIs. This is followed by an analysis of the types of products registered in each jurisdiction. As will be seen this also includes handicrafts. Three examples of successful commercialisation of GI products are provided.

One of the key innovation initiatives of the ten-member Association of Southeast Nations (ASEAN) has been the promotion of GIs to foster community development. For instance, Thailand's "One Tambon One Product" (OTOP) project, launched in 2001, to support community co-operatives in *tambons* (sub-districts) and villages throughout Thailand. The aim was to increase village incomes and preserve local wisdom. The inspiration was Japan's One Village One Product (OVOP) program (Food and Agriculture Organization, 2023). Subsequently, the Lao PDR established its One District One Product (ODOP) program (Khaosan Pathet Lao, 2014). Thailand followed up its OTOP program with its "One Province, One Geographical Indication" program to encourage each of its 76 provinces and Bangkok to develop at least one GI product (Department of Intellectual Property, 2013). With the registration of the "Ekkarat Drum" or "Klong Ekkarat" of An Thong province, on 22 June 2021, its goal was achieved (Nishimura & Asahi, 2021).

According to the World Trade Organisation (WTO), of which all ten members of ASEAN are members, geographical indications are "indications which identify a good as originating in the territory of a Member, or a region or locality in that territory, where a given quality, reputation or other characteristics of the good is essentially attributable to its geographical origin" (*TRIPS Agreement (as amended)*, art 22(1)). Member states are required to provide legal means for interested parties to prevent use of a designation or presentation of a good that "misleads the public as to the geographical origin of the good" (art 22(2)(a)).

The World Intellectual Property Organization (WIPO) has identified three primary modalities for the protection of GIs (World Intellectual Property Organization, 2024):

- *sui generis* systems which are established [by a country] to "apply specifically and exclusively to GIs";
- "collective marks and certification marks";
- "modalities focusing on business practices (such as laws relating to the repression of unfair competition or consumer protection)".

Most ASEAN economies use the *sui generis* system approach for registering domestic and foreign GIs. This may entail GI-specific legislation or specific requirements within broader intellectual property (IP) protection legislation. In addition, Cambodia and Lao PDR are parties to the *Geneva Act of the Lisbon Agreement on Appellations of Origin and Geographical Indications,* which allows for registration of GIs in its International Register, which allows for registration in the territory of the other parties to the *Geneva Act* provided it complies with the requirements of the foreign party (art 6). Countries not party to the Geneva Act must register their products in each of the desired foreign jurisdictions per the foreign jurisdiction's requirements.

Currently, Cambodia, Indonesia, Lao PDR, Malaysia, Thailand, Singapore and Vietnam offer protection under a *sui generis* law on GIs, with the law applicable to both agricultural and non-agricultural in all jurisdictions other than Singapore (ASEAN, 2020, p. 2). Singapore specifies the categories of goods it protects in its GI legislation. Brunei Darussalam, Myanmar and the Philippines protect GIs as "collective marks and/or certification marks under their trademark system" (ASEAN, 2020, p. 2). The Geographical Indication Legislation of the ASEAN member states is listed in Table 1.

Table 1: Geographical indication legislation of the ASEAN Member States

Country	Legislation
Brunei Darussalam	Trade Marks Act (rev ed 2000)
Cambodia	Law on Geographical Indications, 2014
Indonesia	Law on Trademarks and Geographical Indications
Lao PDR	Law on Intellectual Property (Amended), 2017
Malaysia	Geographical Indications Act 2002
Myanmar	Trademarks Law 2019
Philippines	Intellectual Property Code
Singapore	Geographical Indications Act
Thailand	Protection of Geographical Indications Act (2003)
	Ministerial Regulation of Geographical Indications (2003)
Vietnam	Law on Intellectual Property 2005
	Law amending the Law on Intellectual Property 2009

Source: The authors

Registration of a Geographical Indication requires the applicant to provide comprehensive information concerning the product. An example is Koerintji Cinnamon from Indonesia, which had been exported and traded internationally by the Dutch since 1895 (ARISE+ Indonesia, 2022). It is claimed that 85% of cinnamon in the global market is from Indonesia, with the most premium quality being Koerintji Cinnamon, which the communities have produced for generations with traditional knowledge on cultivating the product resulting in its unique qualities and taste (ARISE+ Indonesia, 2022). As an example, a summary of the details of its registration is provided in Table 2.

Table 2: Summary of registration details of Koerintji Cinnamon

Property	Description
Product	Koerintji Cinnamon is produced from the variety of *Cinnamomum burmannii* grown and cultivated by the local Kerinci community in the southern part of Sumatra, Indonesia.
Certificate Number	ID G 000 000 043

Property	Description
Geographical Coverage & Origin	Kabupaten Kerinci is located on a plateau area surrounded by hills and is connected to the Bukit Barisan mountain range. Koerintji Cinnamon trees grow on hills across 12 districts (named in the registration).
Official GI Lodger & Community	"The Masyarakat Perlindungan Indikasi Geografis Kayumanis Koerintji Jambi (MPIG-K2J) is the official GI lodger of Koerintji Cinnamon and represents farmers' groups and local co-operatives, consisting of artisans, collectors, individual farmers, members of co-operatives and traders" (ARISE+ Indonesia, 2022).
Unique Physical Specifications – Dried Hard Barks	Quality grades are classified as follows: • KM (thickness >5mm, age: 30 years and above) • KF (thickness 3-5mm, 20-30 years) • KS (thickness 2-3mm, 10-20 years) • KA (thickness 1-2mm, 6 years) • The more mature the tree, the higher the price.
Unique Physical Specifications – Cinnamon Sticks	Sticks or quills are obtained from 8-10-year-old bark of Koerintji Cinnamon. The bark is sun-dried for up to 4 days and then air-dried at room temperature of 26^0C. After the drying process is completed, bark is cut into specific lengths and/or ground into coarse or fine powder. Koerintji Cinnamon sticks or quills have a thickness between 1mm and 3mm and of 8-10 years of age, grouped into two grades: • **VAA** has a double roll at each end and a diameter of 6-10 mm • **VA** has a single roll at each end and a diameter of 10-15 mm
Protected Name & Reputation	Koerintji Cinnamon / Kayumanis Koerintji
Correct Labelling	"The protected name of "Koerintji Cinnamon" can only be strictly used for the authentic and pure composition of 100% Koerintji Cinnamon – cinnamon sourced, grown and produced exclusively in the geographical coverage and origin defined in the GI Book of Specification. Mixed cinnamon cannot be sold using this name. However, the name of Koerintji Cinnamon may appear on the ingredient list as part of recipes or mixtures whereby the percentage/content of Koerintji Cinnamon must be clearly stated on the labelling" (ARISE+ Indonesia, 2022).
Traceability & Origin	Product packaging containing the composition of authentic 100% Koerintji Cinnamon must, by law, include in the labelling: • Official Indonesian GI logo • Registered GI product logo • Correct GI name: Koerintji Cinnamon / Kayumanis Koerintji • GI Code of Origin: Product traceability or lot code with prior approval from MPIG-K2J

Source: ARISE+ Indonesia (2022) with editing by the authors.

The Geneva-based Organization for an International Geographical Indications Network (oriGIn) (2024) has identified what it considers to be the "benefits for producers and consumers":

- Protection of geographical names shows that GIs "can create wealth and add value in developing countries";
- GIs generally are based on minimum innovation, and developing countries have a rich history of traditional knowledge; they are well-placed to transfer such knowledge into marketable products with possible international market reach;
- Poor countries have a competitive labour advantage, particularly in agriculture and handicrafts;
- There can be spillover benefits to the economy;
- A GI can only be produced in its designated area, which provides its specific characteristics, restricting the ability of big corporations to exploit the GI holders;
- A GI provides "collective" rather than "individual" rights, meaning both the community and small producers can benefit;
- A collective approach generates economies of scale for small producers and
- "GIs are a light monopoly" in that it is a monopoly over a geographical name and not an exclusive right over a product.

2. Geographical Indications within Southeast Asia

2.1 Domestic GI Registrations

Unfortunately, details of the number of GIs in each jurisdiction depend on when the GI data is posted online. For instance, the ASEAN GI database is only updated periodically. To ensure that the data are as complete as

possible, the data source with the most domestic registrations for a particular country was used, as shown in Table 3 below. Data for registration of foreign products has been excluded.

As will be seen, 509 domestic GIs have been registered. As Brunei Darussalam and Singapore are very small nations, it is unsurprising that there are no registered domestic GIs. On the other hand, Singapore has registered a significant number of foreign GIs. Whilst Myanmar has the requisite legislation, the current political situation, which, to all intents and purposes, amounts to civil war, precludes any meaningful development.

Fresh fruit and vegetables are by far the most popular GIs. Even within one country, a generic fruit type, such as mangoes, may be granted a number of registrations as each particular geographical area produces a fruit with different identifiable characteristics. This means that the registration process must be rigorous, and the local growers' committee must be diligent in certifying the products in its area.

Thailand has the highest number of rice and sago registrations, with Indonesia having the highest number of coffee registrations by far. Surprisingly, Indonesia, once called the “Spice Islands”, is only just ahead of Vietnam for the number of spice and salt registrations.

It is important to note that GI registrations are not restricted to agricultural products, as they also include a significant number of fabric and handicraft registrations. Such products have particular traditional regional designs and use traditional processes.

Table 3: Domestic Geographical Indications registered in the ASEAN Members States

Member	Total Domestic GIs	Fruit & Vegetables	Rice & Sago	Coffee	Tea	Wine & Spirits	Juice & Honey	Spices & Salt	Cacao	Seafood	Processed Food & Meat	Palm & Rice Sugar	Fabrics	Handicrafts	Gems & Pearls	Tobacco	Miscellaneous
Brunei Darussalam	-	-															
Cambodia[1]	7	1					1	2		1	1	1					
Indonesia[2]	127	17	8	49	1		1	15	1	3	1	3	15	6	1	3	3
Lao PDR[1]	6	-	1	1	2								2				
Malaysia[1]	79	16	2	1	2	2	1	5	1	14	11		7	16			1
Myanmar	-	-															
Philippines[1]	2	1											1				
Singapore	-	-															
Thailand[3]	194	103	20	8	1	2	1	6		10	8	1	15	15	2		2
Vietnam[1]	94	38	10	3	3		2	13		8	7	1	1	4		2	2
Total	**509**	**176**	**41**	**62**	**9**	**4**	**6**	**41**	**2**	**36**	**28**	**6**	**41**	**41**	**3**	**5**	**8**

Source: [1]Organization for an International Geographical Indications Network (2024); [2] Directorate General of Intellectual Property (2024); [3]Department of Intellectual Property (2023). Compilation and grouping of GIs by the authors.

2.2 Examples of GI Products

This section details three GI products to show the different motivations behind the development of an industry and the registration of a GI.

2.2.1 Kampot Pepper – producers return to ancestral lands after 40 years of civil war and unrest

Cambodia recorded Kampot Pepper as the first GI registered via the Geneva Act of the Lisbon System of the World Intellectual Property Organization (WIPO, 2021). Pepper production in Cambodia commenced as early as

the 13th Century. Following the conflict in Indonesia between the Sultan of Aceh and the Dutch Army in 1873-1874, some production moved to Kampot (Kampot Pepper Promotion Association (KPPA), 2024). With the French colonialists arriving at the end of the 19th Century, production increased to 8,000 tonnes yearly. Then it stabilised at around 3,000 tonnes per year. It was considered to be of exceptional quality, particularly by the Chefs of France (KPPA, 2024).

From 1975, with the arrival of the Khmer Rouge and the subsequent civil war, production ceased, and the poles of pepper essentially disappeared. At the end of the 20th Century, families returned to their ancestral lands and commenced pepper production (KPPA, 2024). Kampot Pepper is grown exclusively in the provinces of Kampot and Kep and was registered domestically in 2010. The pepper's growing requirements and physical and organoleptic characteristics are detailed in ARISE+ (2019, pp. 39-45). Figure 1 shows the poles of Kampot pepper.



Figure 1: Poles of pepper plants at E Che Ngov Heng Food Production Company in Ta Ang Village, Kampot City

The Department of Intellectual Property considered that the impact of registration was significant (WIPO, 2021). The average farm-gate price rose from USD 7.50/kg in the year before domestic registration to USD 22.70/kg ten years after registration. For 2019, 2020 and 2021, the production of the members of the KPPA has been around 100 tonnes per annum (KPPA, 2024).

A study highlighting the role of contract farming and the role of the Kampot Pepper Agricultural Co-operative and the Kampot Pepper Promotion Association is described in detail in Thorng & Chao (2016).

2.2.2 Bolaven Coffee – International development agencies support small landholders to form a co-operative to support the development of their community

The Bolaven Plateau is a fertile rolling upland in southern Laos (Encyclopaedia Britannica, 2011). It is a significant basaltic lava intrusion at an average elevation of 1,000 metres. It is in the path of the June-to-November southwest monsoon, resulting in an average rainfall of 4,000 mm. The conditions are favourable to the production of high-quality coffee beans. Figure 2 shows a small coffee roasting oven on one of the plantations.



Figure 2: Coffee roasting oven at village on Bolaven Plateau west of Paksong

There is a mix of smallholders and commercial operations. The major co-operative consists of 1,855 smallholder families whose plantations had an average size of 3 hectares (Bolaven Plateau Coffee Producers Co-operative, 2016). The co-operative (CPC) is involved with all stages of the supply chain, from planting to the marketing of Bolaven Coffee. The objectives of the co-operative are to represent the coffee producers at both domestic and international levels for all coffee-related activities, provide technical assistance, and support all aspects of marketing and promotion (CPC 2024).

CPC is also very active on Facebook, with regular posts in Lao and English (Bolaven Plateau Coffee Producers Co-operative, 2024b).

2.2.3 Mak Mao Berry Juice – One man's 30-year passion to commercialise a local product

Mr Khanop Wannawong is of tribal heritage and lives in the Phu Phan hills of Sakon Nakhon Province in northeastern Thailand. He has spent over 30 years developing the cultivation of Mak Mao berries. His garden has around 31 different cultivars of Mak Mao berry trees with a Sakon Nakhon variant that has earned a GI mark (Mishra, 2023).



Figure 3: Dry pressing Mak Mao berries to produce Mak Mao juice

Sakon Nakhon is an undulating and wavy plain around 172 m above sea level. The Phu Pan ridge in the south and west of the province forms the great basin landscape. The province has three seasons: summer, rainy, and winter. Summer is very hot, and the annual average rainfall across the province is around 1,700 mm. With the climate and the nourishing soil, the wild berry Mak Mao Berry grows (from Sakon Nakhon Mak Mao Club banner at Wannawong orchard).

The Geographical Indication is defined by the Thai Department of Intellectual Property (Thai IP) as follows:

"Sakon Nakhon Mak Mao Berry Juice is a sweet and sour with a bitter taste of astringent juice. It is produced from large-size Mak Mao Luang fruit by passing it through a [cold] pressing process to separate the Mak Mao juice from the pulp. Ready-to-drink Mak Ma Berry Juice and Concentrated Mak Mao Berry Juice are produced by selecting only fresh and perfect fruit. Its manufacturing place is Sakon Nakhon province" (from the Thai IP banner at Wannawong orchard).

The number of producers has always been small; now, only four produce GI-certified Mak Mao Juice. Wine is also produced but does not have a GI mark.

Production is very labour-intensive, so the quantity of juice produced is relatively small.

Many studies have been undertaken on the benefits of drinking Mak Mao juice (e.g. Jorjong, Butkhup, & Samappito, 2015).

2.3 The Power of GI Products in Regional Development

Obtaining GI registration is just the beginning. For instance, the Department of Intellectual Property of Thailand has identified the following benefits from registration of a community product as a GI:

- Protection – the name of the product becomes the exclusive right of the registering community;
- Confidence building – consumers have enhanced confidence in the source and quality of the product;
- Move to the international level – the Department supports the applicant to register internationally;
- Added value – the GI registration serves as a marketing tool, and the selling price should increase;
- Maintenance – the standard of the product and the associated local wisdom is preserved;
- Support – the GI supports sustainable community tourism; and
- Strength – the GI helps unite the local inhabitants and develop the community (Department of Intellectual Property, 2016).

In September 2021, the Thai Deputy Commerce Minister identified three prominent roles of the Department of Intellectual Policy going forward:

- Promotion and protection of GIs, including advice on identifying GIs and consulting the registration process in Thailand and abroad;
- Promote and support the development of product quality control systems; and
- Support the development of images and package design for GI products and improve sales channels (Department of Intellectual Property, 2021, p. 3)

As a result, one of Thailand's major supermarket groups undertook the promotion of GI products in its supermarkets and encouraged its local sourcing teams to source GI products in the regions (Department of Intellectual Property, 2021, p. 8).

Similar support has been provided in other ASEAN jurisdictions by organisations such as Agence Française de Développement (2024), ARISE+ Indonesia (2024) Centre de Coopération Internationale en Recherche Agronomique pour le Développement (CIRAD), FAO, the European Union (FAO, 2020), and Groupe de Recherches et d'Echanges Technologiques (GRET, 2024).

Wongburanavart (2023, p. 68) concluded that Thailand's conventional IP regimes, especially GIs and plant variety rights, are compatible with protecting traditional knowledge as they "can grant indigenous and Local communities the right to control the use and ensure that the benefits are returned to the local community". Nonetheless, there are still some limitations and loopholes that also lead to misappropriations of traditional knowledge, and therefore, the development of a specific *sui generis* system to protect traditional knowledge should be considered.

3. Discussion

Geographical Indications have been seen as an effective community development tool in most ASEAN economies. A feature that differentiates the ASEAN and European approaches is the ability to register non-food items such as handicrafts and fabrics. The main criterion is that the product has properties that are unique to an identified geographical area, however defined. The registration of a GI protects a community's traditional knowledge as the GI is registered in the name of the community and not in the name of any individual.

The three examples discussed above were chosen to show three different approaches to the development of GI registration.

Kampot pepper had been a sought-after product for decades prior to the murderous Pol Pot regime taking control. The Kampot and Kep Provinces on the Gulf of Thailand remained Khmer Rouge strongholds long after the fall of the regime in most of the country. When the civil unrest ended, the traditional owners returned to redevelop the industry. Certainly, they needed assistance in the process. This enabled them to re-enter the international market and obtain local GI registration, followed by becoming the first GI registered under the Geneva Act of World Intellectual Property's Lisbon System (WIPO, 2021) to which the European Union is a party (WIPO, 2023). In 2023 Cambodia exported 103 tonnes of Kampot pepper, with "some 85 percent of the pepper shipped to Europe and the remaining 15 percent sold to other countries, including the US, Canada, China, Japan, and South Korea" (Chea Vanyuth, 2024).

In Laos, the development of the Bolaven Coffee industry was to improve the quality of life of local communities by facilitating sustainable agriculture. While the example focused on the Bolaven Plateau Coffee Producers Co-operative, this was not the only modality. Private producers were also buying up and developing extensive coffee plantations. The Food and Agriculture Organization supported the Lao government in setting up the legal framework for its GI system (Food and Agricultural Organization, 2021). In addition, Paksong Tea, Komaen Tea, Houaphanh Silk, and Luang Prabang Silk were selected for the initial set of GI registrations. In addition, Bolaven Coffee was added to the list. "Interprofessional Associations (IPAs) were formed with value chain actors for managing these products and books of specifications were developed for each GI product, detailing their unique characteristics, inputs, geographical scope and production methods" (Food and Agricultural Organization, 2021). The Bolaven Plateau Coffee Producers Co-operative, a key organisation in developing the local communities, is supported by the Lao Government, Asian Development Bank, and Agence Française de Développement. Fair Trade is a crucial partner (CPC 2024a).

In the third case the initiative remained with individual innovation and entrepreneurship of local individuals. Nevertheless, they required assistance with development and marketing activities. Marketing is supported by the involvement of local supermarkets.

Southeast Asian governments are committed to the concept of GIs to develop rural communities. Some are more able than others to commit to developing GIs and their ongoing support in the local communities. Others are dependent on external sources. In either case, the impact on the livelihoods of local communities can be very significant. Governments must also identify which GI products should be registered internationally to protect traditional knowledge and highlight their nation's products.

4. Recommendations and Conclusions

GIs can be an effective tool in promoting community development. It must be grounded in a robust intellectual property protection regime. Preferably this should be standalone sui generis GI legislation or specific GI requirements within omnibus intellectual property protection legislation. Trademark protection legislation does not have the same protections as specific GI legislation. The legislation should not be developed solely to protect wine but rather allow for the protection of farm produce, food and handicrafts, and any other products that can be defined by their "terroir" (unique habitat).

The first step is to obtain a "sponsor" such as the government, an international development agency or an active local promoter. This will enable identifying and promoting a GI in a systematic and sustainable model.

For agricultural products, the process should start with gathering information from key stakeholders using household surveys, focus group discussions, key informant surveys, and market and literature surveys to gather together all available traditional and scientific knowledge (Joshi & Gauchin, 2020, p.36), A field and laboratory evaluations should follow this to identify the potential genetic GI resources and their geographical boundaries.

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The Re-Emergence of Food Security in the Western World: Short Supply Chains in Portuguese Territorial Contexts

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Abstract: In the context of growing concerns surrounding food security and sustainability, this paper examines the emergence of short food supply chains (SFSCs) as alternative food systems. Focusing on box schemes in Portugal, the study investigates the socioeconomic factors influencing the presence of SFSC actors, utilizing a quantitative approach. Drawing on data from 420 producers offering food boxes and secondary data on municipality-level variables, the analysis reveals nuanced relationships between factors such as average income, urbanization, education levels, gender composition, and the proliferation of SFSCs. Notably, the study uncovers differential patterns in the determinants of SFSC presence between metropolitan and non-metropolitan areas, highlighting the significance of territorial contexts. The findings contribute empirical insights to the evolving literature on SFSCs, informing strategies for fostering resilient and equitable food systems in diverse geographic settings.

Keywords: Food security, Sustainability, Innovation, Short supply chains

1. Introduction

The first decades of the XXI century assisted to a re-emergence of the concern with food safety in the Western world. This "back to basics" movement is due to systemic crises, starting with the financial and economic crisis of 2008, the pandemic crisis, and, more recently, the war in Ukraine, which has had a tremendous impact on food (e.g. grain) supply chains. The re-emergence is accompanied by conceptual, political, and entrepreneurial innovations that envisage a transition of food systems towards sustainability.

The food sector corresponds to "activities, infrastructures, and people involved in feeding the world population (e.g. agricultural production, processing, distribution, consumption and disposal of goods)" (Bock et al., 2022, p.6). The current system is characterized by the concentration of power, the simplification, homogenization, and impoverishment of landscapes, the degradation of diets and cultures, but also the importance of family farming. The combination of these multidimensional effects and the geopolitical instability of the XXI century justifies the need to reflect on the role and the approaches to a central sector of our societies.

The paper builds on the evolution of the concept of food security and relates this evolution to the emergence of short food supply chains (SFSCs) as alternative food systems. SFSCs offer alternative solutions to food production and consumption that are more in line with the principles of food security and sustainable development (El Bilali et al, 2019; Stein & Santini, 2022). The proximity of producers and consumers is one of the benefits of SFSC. At this regard, and from the customers perspective, the decrease of intermediaries diminishes the asymmetry of information (De Frazio, 2016). Other benefits mentioned by literature include the dynamization of local economies through job creation, skills development, job satisfaction and the adoption of more sustainable practices by increasing the agricultural biodiversity (Mundler&Laughrea, 2016; De Frazio, 2016).

FSCs have become increasingly popular in Europe (Gori & Castellini, 2023). The literature already provides some insights into the importance of the socioeconomic characteristics of the territory for the popularity of these alternative food systems. However, existing studies tend to be qualitative case studies on specific regions or producers.

This paper aims to contribute to the nascent literature on the determinants of the growth of one type of SFSC – box schemes. It combines information on local farmers with socioeconomic characteristics of their local markets, identified by the municipalities in which they are located. The farmers were identified through their participation in a government online platform that connects small local producers with their potential markets, giving them the scale they need to survive (Jia et al., 2023). The analysis considers some socio-demographic characteristics of the territories that may influence the number of producers offering food boxes, and distinguishes the metropolitan areas of Lisbon and Porto from the rest of the territory.

The remaining of the paper is organized as follows. Section 2 presents the state of the art on this topic. Section 3 describes the method and the data used in the analysis. Section 4 presents and discusses the paper's results. The last section concludes.

2. Literature Review

In the last two decades, the issue of food security and, in this context, short food supply chains (SFSC), has received increasing attention (e.g., Raftowicz et al, 2024; Gori & Castellini, 2023; Chiffoleau & Dourian, 2020¸ Ruszkai et al, 2021). In addition to the concerns and public policies envisaging environmental and ecological purposes, this increase is explained by the crises that took place during the 21st century. This is the case of the 2008 crisis with the rise in the cereals' prices, the pandemic crisis and, more recently, the wars and the current geopolitical instability with huge implications for food security, namely the instability and dismantling of global food supply chains, with particular emphasis on cereals.

The renewed interest of Western countries in food security and food sovereignty has launched a debate on the difference between those concepts. In 1996, the World Food Summit presented the most widely accepted definition of food security: "At the individual, household, national, regional and global levels [food security is achieved] when all people, at all times, have physical and economic access to sufficient, safe and nutritious food to meet their dietary needs and food preferences for an active and healthy life". The 2021 World Food Summit consolidated this concept. In 2002, the World Food Summit presented a new definition of food sovereignty as "the true right to food and to produce food, which means that all people have the right to safe, nutritious, and culturally appropriate food and to food-producing resources and the ability to sustain themselves and their societies. Food sovereignty means the primacy of people's and community's rights to food and food production, over trade concerns' (LVC, 2002). The rights-based approach of food sovereignty is more clearly visible, and the rights no longer primarily accrue to nations, but to peoples and communities" (van Hemert, 2023, pp. 3-4).

SFSCs emerged as an alternative contributing to more economic, social, and environmentally sustainable food systems. SFSCs are presented in the literature as alternative food networks (AFN), that is, a system that "differ from the 'conventional' or is usually defined by what it is not, instead of what it is" (Michel-Villarreal et al., 2019, p. 3). In fact, the existing literature gives some insights into the role of SFSCs in food systems transition and resilience, namely concerning their up-scaling. Polita and Madureira (2021) address the transition to SFSC taking place in a Portuguese region by employing a multi-level perspective. Sousa and Ferreiro (2023) analyze the role of social innovation in sustainable food transition, focusing on box schemes. Salavisa et al. (2021) address the transition of the agro-food system in Lisbon Metropolitan Area.

According to the definition of the EU Regulation No. 1305/2013 [3], a short supply chain is a supply chain involving a limited number of economic operators, committed to cooperation, local economic development, and close geographical and social relationships between producers, processors, and consumers. Other AFNs include farmers markets, community supported agriculture (CSA), on-farm direct sales, canteen or restaurant procurement schemes, digital platforms proposing well-identified farmers' products (Chiffoleau & Dourian, 2020), and box schemes, which is the type of SFSC considered in this paper for the Portuguese case. According to Gori & Castellini the most studied AFN is farmers' market, followed by CSA, and cooperative and community garden (Gori & Castellini, 2023). Box schemes are not so addressed in the literature. Moreover, the existing empirical studies tend to resort to multiple case studies method, to address countries in the Global North, particularly in Europe with Italy and the United Kingdom scoring highest, and to focus on the "motivation of actors; collaborative governance; sustainability; social relations and trust; boundary negotiation and resilience" (Gori & Castellini, 2023, p.2).

Research provides insights on the facilitating and blocking factors of SFSC implementation, especially in Europe (Hyland et al, 2023; Enthoven et al, 2023; Aouinait et al, 2022; Popp et al., 2018). Scholars stress the importance of the role of the consumer (engagement, motivation, and participation) (Enthoven et al, 2023; Hyland et al., 2023), specifically the aspects related to the accessibility and quality of products, their variability, the support to local economy, the expense, and trust (Hyland et al., 2023; Aouinait et al, 2022). Socioeconomic factors, such as age, gender, education, and income, in consumer's propensity to adhere to FSSC are relevant in consumer's motivation towards SFSC. Escobar-Lopez et al. (2021, pp. 12) mention that "several works have reported that women have more pro-environment attitudes and take a more active part in this type of initiatives"; and "some works have established a link between the higher educational level and the possibility of choosing alternative foods due to the information available". Popp et al. (2019: p.31) show that, in the case of new EU member states, the "relatively low propensity to pay for local products on the part of the

population (…) further decreases possibilities for short supply chain development". Relatedly, Sitaker et al (2020) found that communities with higher income have more food basket offer. The relevance of contextual and territorial factors, namely the role of LEADER action groups as promoters of SFSC in Europe, is also addressed by Ruszkai et al. (2021).

SFSC is built on relational and spatial proximity, as well as trust (Thorsøe & Kjeldsen, 2016).) and rooted in specific territorial contexts (Grando et al, 2017). Thus, unique characteristics of the territory can also affect the presence of SFSC in addition to socioeconomic factors. Urban areas in particular tend to attract a diverse range of consumers with varying income levels and preferences, which may represent a larger potential market but necessitate the use of specialty retail chains as market channels for small farmers. In this sense, the European Parliament distinguishes between neo-traditional SFSC, which is cantered on cooperative networks of producers, consumers, and institutions and is typically found in urban areas, and traditional SFSC, which is based on farms (Augère-Granier, 2016).

The paper is in line with this research approach by considering socioeconomic variables of territorial contexts of the Portuguese SFSC in the model of box schemes. In the Portuguese case these contextual factors are very critical in the emergence, development and sustainability of SFSC (Polita & Madureira, 2021; Salavisa et al, 2021). The paper contributes to the scarce literature on box schemes by providing an exploratory quantitative study of the regional socioeconomic factors that may influence the demand for food boxes (local markets) and therefore may contribute to explain the number of producers offering food boxes in each region.

3. Data and Method

The empirical analysis focuses on food baskets delivered by farmers, a type of SFSC. According to the Portuguese law, a sustainable supply chain comprises producers and consumers who are far apart by up to 50 kilometres. The sample comprises 420 producers offering food boxes. They were identified from an online platform developed and updated by the Portuguese Ministry of Agriculture in partnership with other organizations[1]. The goal of this platform is to promote and disseminate SFSC by bringing closer together producers and consumers and fostering both the consumption of local products and the use of proximity markets. On this platform, producers advertise their products and baskets, and consumers can search by type of product and place their orders for delivery. As stated by Jia et al. (2023), challenges to SFSC include information asymmetry, lack of infrastructure and market dynamics. Thus, the online platform operates as a key determinant of these businesses' success, building the necessary bridges between its main actors – farmers and consumers.

The search was narrowed down to fruit, vegetables, legumes and mushrooms, the most common types of products in the boxes. The analysis focuses on characterizing the local markets in which these SFSC are built, using the municipality as the unit of analysis and distinguishing the metropolitan areas of Lisbon and Porto from the rest of Portugal. As a result, the analysis intertwines three actors: the farmers who were kicked off the platform; the platform itself, which was created as a public policy to link farmers and consumers; and the consumers themselves, who are embodied by the municipality's general socioeconomic traits.

Portugal is located in southern Europe and consists of a continental part and two autonomous archipelagos: the Azores and Madeira. It is composed of 308 municipalities. Farmers are scattered throughout the country, although their presence is greatest in the northern continental part. The boxes are very diverse, ranging from one to thirteen categories of products, some of which are processed, such as olive oil, olive paste or jam.

To characterize the local markets, secondary data was collected, from Portuguese National Statistics and Ministry of Agriculture, on the following variables: gross income per tax aggregate, the number of cities, the total population, the share of women in the population, the total average age, and education levels, all by municipality. The descriptive statistics are displayed in Table 1.

[1] These organizations include the National Rural Network, the "Minha Terra" Federation, Local Action Groups and Municipalities. The Portal is called "Alimente quem o Alimenta" which stands for "Feed those who feed you".

Table 1: Descriptive statistics by municipality

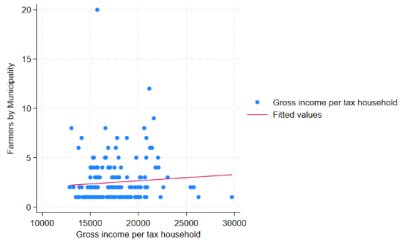
Variable	Mean	Std.dev.	Min	Max
Producers by municipality	2.497041	2.368253	1	20
Gross income per tax aggregate	17472.31	2659.18	12848	29727
Cities	0.727811	0.99247	0	9
Share of the population with secondary education	38.31757	8.12793	22.98	66.35
Share of women in total population	51.82154	0.7704134	49.37222	54.13592

Source: Author's calculations using data from Portuguese National Statistics and Ministry of Agriculture

A descriptive analysis is performed using Stata software to identify patterns of association between the number of farmers per municipality and the variables listed in Table 1.

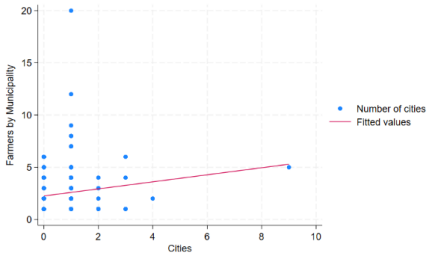
4. Results

There is a positive association between the number of producers and average income per tax aggregate by municipality as shown in Figure 1. However, Table 2 shows that the correlation between these two variables is not statistically significant. A similar but statistically significant relationship is observed with the average number of cities (Figure 2 and Table 2). Although not represented for the sake of space, a positive correlation was also found between the population and the number of villages. These data suggest that the scale (market size) at which these farmers operate is relevant to them, in line with the findings of Sitaker et al. (2020), possibly by facilitating their matching with consumers whose preferences are aligned with the products they supply, thus enabling them to take advantage of market opportunities.



Source: Authors' own elaboration

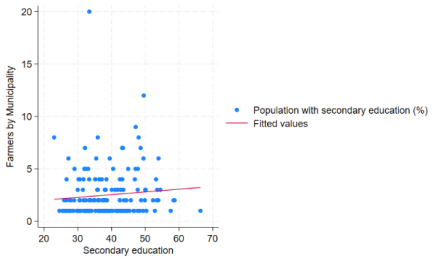
Figure 1: Number of farmers concerning gross income per tax aggregate



Source: Authors' own elaboration

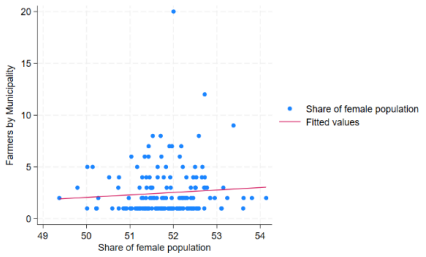
Figure 2: Number of farmers concerning the number of cities

The composition of the population also seems to be related to the presence of a greater number of farmers committed with SFSC as advanced by the literature. Figure 3, which depicts the relationship between the number of farmers and the proportion of the population with secondary education, indicates a positive association between these variables, whereas Figure 4 shows that a greater presence of women has a positive effect on the number of farmers in the municipality, both results in line with previous findings from Escobar-Lopez (2021). However, none of these associations is statistically significant (see Table 2).



Source: Authors' own elaboration

Figure 3: Number of farmers concerning the share of the population with secondary education



Source: Authors' own elaboration

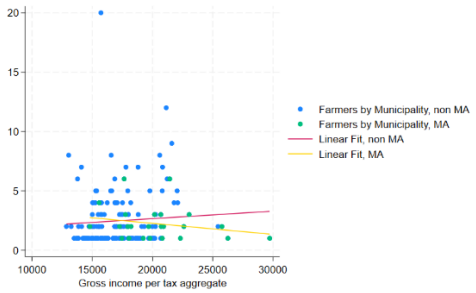
Figure 4: Number of farmers concerning the share of women in the total population

Table 2: Correlation matrix

	Farmers	Income	Cities	Education	Women
Farmers	1.0000				
Income	0.0709 (0.3595)	1.0000			
Cities	0.1415* (0.0665)	0.2041*** (0.0078)	1.0000		
Education	0.0895 (0.2473)	0.8877*** (0.0000)	0.2701*** (0.0004)	1.0000	
Women	0.0770 (0.3194)	0.3442*** (0.0000)	0.0485 (0.5310)	0.3655*** (0.0000)	1.0000
Notes: p-values between parentheses; * indicates p-value <0.01; *** * indicates p-value <0.1					

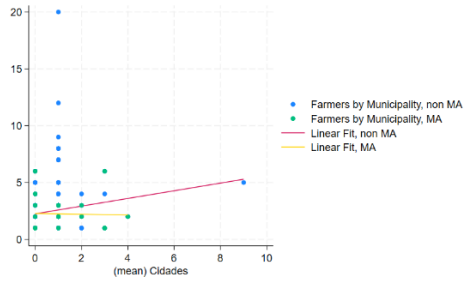
The statistical significance found in the correlation between farmers and population, as well as between these and the number of cities, might suggest that the urban concentration of population can act as a facilitator for these producers, making it easier for them to reach a larger number of consumers without having to use intermediaries, ensuring the profitability of their business.

To test if the degree of urbanization of the territory affects the presence of local producers and box suppliers, the number of farmers was regressed against gross income per tax aggregate for municipalities in the Lisbon and Porto metropolitan areas, as well as municipalities that are not in these metropolitan areas. The regressions shown in Figure 5 exhibit asymmetrical behavior for the two types of areas. While there is a positive correlation between the number of farmers and the average gross income per tax aggregate in less urbanized areas, this relationship turns negative in metropolitan areas. Figure 6 exhibits the same type of non-linearity for cities.



Source: Authors' own elaboration

Figure 5: Number of farmers concerning gross income per tax aggregate, distinguishing the metropolitan areas of Lisbon and Porto from the rest of the country



Source: Authors' own elaboration

Figure 6: Number of farmers concerning the number of cities, distinguishing the metropolitan areas of Lisbon and Porto from the rest of the country

These varying correlations by type of territory could be caused by a higher concentration of farmers in less affluent metropolitan municipalities since these typically have a higher proportion of available land. Owing to the existence of associated socioeconomic traits, these areas also have populations that are less educated and that appear to have smaller proportions of women.

Overall, the findings indicate that the characteristics that facilitate or impede the existence of these unique actors in Portuguese municipalities vary in their territorial expression and, specifically, alter in response to the level of urbanization. The correlations' reversal in sign raises the possibility that variables other than those found in conventional socioeconomic theories could influence farmers' willingness to sell their produce through SFSC. Specifically, the urban setting may help overcome obstacles noted in the literature, such as peers' inefficiency and lack of teamwork and producers' poor marketing and communication skills (Aouinaït et al, 2022).

5. Conclusion

This paper has examined the resurgence of food security and sustainability concerns in the wake of systemic crises, such as financial downturns, pandemics, and geopolitical instability. In this context, SFSCs have emerged as innovative alternatives to conventional food systems, aligning with principles of food security and sustainable development, by establishing direct relationships between producers and consumers.

Through a quantitative exploratory analysis focusing on box schemes in Portugal, the study sheds light on the socioeconomic factors influencing the growth of SFSCs, particularly to the number of producers offering food boxes. The findings reveal a nuanced relationship between various socioeconomic variables and the presence of SFSC actors, with factors such as average income, urbanization, education levels, and gender composition playing a significant role. In particular, the study uncovers distinct patterns in the determinants of SFSC presence between metropolitan and non-metropolitan areas.

As limitations, it should be noted that this study is an exploratory analysis and focuses solely on a group of farmers who produce and sell a specific type of agricultural product; thus, the results should be interpreted with caution because they may be sector-specific.

These findings suggest the importance of considering territorial contexts in understanding the dynamics of alternative food systems and have several implications for public policy. Firstly, policymakers should prioritize support for the development and expansion of SFSCs, which could include information campaigns aimed at different population profiles. Secondly, policymakers should recognize the nuanced relationship between socioeconomic factors and the presence of SFSCs, particularly the differences between metropolitan and non-metropolitan areas. Interventions and policies envisaging the promotion of SFSCs should be tailored to the specific contexts of different regions, considering factors such as income levels, urbanization, education, and gender composition.

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The Efficiency of Intellectual Capital Formation at the Scientific Institutions of Engineering and Computer Sciences

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Abstract: The research of the formation of intellectual capital (IC) of engineering and computer sciences (E&CSs) at scientific institutions (SIs) in Latvia in the present situation is highly topical. The object of the research is the formation of IC of E&CSs at SIs while the subject of the research is the comparative analysis of the efficiency of the involvement of academic staff and students in the formation of IC of E&CSs at SIs of Latvia. The objective of the research is to study the involvement of academic staff and students in the formation of IC of E&CSs at SIs in Latvia in the period from 2013 to 2018. The following tasks were determined to reach the objective: to study the formation of IC of E&CSs at SIs; to identify the concept of the efficiency of the involvement of academic staff and students in the formation of IC of E&CSs; to calculate main indicators thereof, and, to carry out the comparative analysis of indicators characterising the efficiency of the involvement of academic staff and students in the formation of IC of E&CSs at SIs in Latvia. Research methods used in the paper are content analysis, economic analysis, and economic experiment.

Keywords: Intellectual capital, Scientific institutions, Efficiency, Engineering science, Computer sciences

1. Introduction

Every six years, the Ministry of Education and Science of the Republic of Latvia (MoES) organises the International Evaluation of Scientific Institutions' Activity (IESIA) of SIs registered in Latvia. The last IESIA refers to the period from 2013 to 2018. In order to establish the dynamics of efficiency indicators of academic staff involved in the formation of IC in E&CSs at SIs of Latvia (MoES, 2021), the authors used the output data of findings across the set of evaluation of SIs of E&CSs per period from 2013 to 2018 offered by "Technopolis-group" (TG).

The comparative analysis will reveal whether the score of E&CSs at SIs of Latvia in the IESIA of TG coincides with the place of SIs of Latvia in the ratings of IC indicators, and whether the overall score of SIs of Latvia also reflects the efficiency of the involvement of the academic staff of SIs of Latvia in the IC formation.

Hypothesis: The overall score of SIs shows the efficiency of the IC formation at SIs of Latvia.

2. Theoretical Background

Spica et al (2017a) state that IC is an economic category, the spiritual value created by the human potential, and it can be accumulated and converted into the value of other capitals. By investigating certain information about the management of education, we can increase the capacity and significance of the country's total economic capital movement. Rondeau et al (2022) remind that peer reviewed publications remain a traditional form of academic productivity. Spica et al (2017a; 2017b) have worked out four indicators of the efficiency of the formation of IC in the higher education establishment (HEE): (1)The efficiency of the involvement of academic staff in the formation of IC per year in percentages (AIK); (2)The efficiency of the involvement of academic staff with a Doctorate degree in the formation of IC per year in percentages (DIK); (3)The efficiency of the involvement of students in the formation of IC per year in percentages (SIK); (4)Mutual efficiency of the involvement members of the academic staff with Doctorate degrees and the academic staff without Doctorate degrees in the formation of IC per year in times, (DE).

3. Methodology

In order to calculate the AIK, DIK, SIK, and DE of the HEE Spica et al (2017a; 2017b) have worked out four formulas: (1) AIK = (ZPS : AS) x 100; (2) DIK = (ZPS : DS) x 100; (3) SIK = (ZPS : SS) x 100; (4) DE = DIK : AIK. Where: ZPS represents the number of scientific publications of the HEE per year; AS represents the number of academic staff in full-time jobs per year; DS represents the number of academic staff with Doctorate degrees holding in full-time jobs per year; SS represents the number of students per year.

The authors modified the above mentioned formulas for the purposes of the study. Namely, they calculate IC efficiency indicators for total numbers of full time equivalent (FTE) academic and research personnel (KIK), for FTE academic personnel (AIK), for FTE academic and research personnel (PIK) and for PhDs completed at SIs (SIK). In addition, all the said IC efficiency indicators were calculated for different forms of IC such as total number of self-reported outputs of IC (KS), articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS (WS), articles in peer reviewed edited journals, and conference proceedings not included in WoS or SCOPUS (RS), monographs (MS), and Latvian patent (LPS), and European patent and International patents (EPS). The authors calculated mutual efficiency indicators (PE) regarding involvement of the FTE academic and research personnel (PS) and the FTE academic personnel (AS) in the formation of IC in times.

In the present research, the authors used the following data from the IESIA: output data on the number of FTE academic personnel (AS), the number of FTE academic and research personnel (PS), the total number of FTE academic and research personel (KS), the number of PhDs completed (SS), the number of articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS (WS), the number of articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS (RS), the number of monographs (MS), the number of Latvian patents (LPS), and the number of European and International patents (EPS), and total number of self-reported outputs (KS) in period from 2013 to 2018 per SI of E&CSs in Latvia. Authors revised the above WS, RS, MS, LPS, EPS and KS for the year.

The number of scientific publications and patents are the main results of the IC formation at SIs of E&CSs. TG analysed 16 SIs of E&CSs of Latvia, 2 were private SIs and 14 were public SIs. During the period analysed in the IESIA, there were such SIs in Latvia: Institute of Physical Energetics (IPE); ISMA Computer Technology Laboratory (ISMA/CTL); Research Institute of Latvian Maritime Academy (LMA); Rezekne Academy of Technology Institute of Engineering (RAT/IE); Riga Technical University (RTU) Faculty of Civil Engineering (CE); Transport and Telecommunication Institute (TTI); RTU Fa-culty of Electronics and Telecommunications (FET); Ventspils University of Applied Sciences Engineering and Technology Research Platform (VU/ETRP); RTU Faculty of Materials Science and Applied Chemistry (FMSAC); RTU Faculty of Mechanical Engineering, Transport and Aeronautics (FMETA); RTU Faculty of Power and Electrical Engineering (FPEE); Institute of Electronics and Computer Science (EDI); Latvian University of Life Sciences and Technologies Engineering and Technologies Unit (LULST/ETU); Liepaja University Engineering and Technologies Unit (LU/ETU); RTU Faculty of Computer Science and Information Technology (FCSIT); University of Latvia Institute of Mathematics and Computer Science (UL/IMCS).

In this study, one scientific publication or one patent are accepted as one unit of IC. Further, using the modified formulas 1; 2; 3; 4, were calculated: AIK, PIK, KIK, SIK, PE. Then, according to the results obtained through the author's calculations, a corresponding rating place was assigned to each SI of Latvia per year and each of the above indicators AIK, PIK, KIK, SIK.

Each place in the rating was then assessed with an appropriate score, where the lowest score is 1 point, while the highest score is 5 points. Thus, the SI, which took first to third place in - AIK, PIK, KIK and SIK received 5 points in the ranking, took fourth to sixth place - received 4 points, seventh to ninth place - received 3 points, tenth to twelfth place - received 2 points, and thirteenth to sixteenth place - received 1 point.

The above mentioned assessment system allows to compare the quantitative efficiency indicators of SIs of E&CSs in Latvia calculated by the authors to IESIA overall assessment criterion - quality of the SI research performance. The re-levant TG was the score of research performance of each SI using a scale where score 5 means an outstanding level of research, score 4 means a very good level of research, score 3 means a good level of research, score 2 means an adequate level of research, and score 1 means a poor level of research (MoES, 2021).

The follow-up authors compared the results of their own estimates of SIs quantitative indicators to the qualitative indicators of the relevant TG, and calculated the difference between the indicators and the changes. For this purpose, the authors calculated the average score of indicators for each SI recording the efficiency of the IC formation and compared these scores to scores of the research quality of each SI and overall score developed by the TG Panel.

4. Results

According to the authors' estimates, from the IESIA data show that the total number of self-reported outputs of SIs of E&CSs in Latvia is taken in the largest proportion by the WS - 61,80%, which is followed by the RS - 32,65%, the LPS - 3,94%, the MS - 0,96%, the EPS - 0,65%.

To calculate the efficiency of the involvement of academic and research staff in the WS formation, the authors used formulas:

AIK = (WS : AS) x 100 (1)

PIK = (WS : PS) x 100 (2)

KIK = (WS : KS) x 100 (3)

SIK = (WS : SS) x 100 (4)

PE = PIK : AIK (5)

Table 1: The efficiency of the involvement of academic and research staff in the WS formation at SIs of E&CSs in Latvia per year in period from 2013 to 2018

SI	AIK	AIK	AIK sco-re	PIK	PIK	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK score
IPE	0	0	0	141	13	1	141	5	4	0,5	0	257	8	3	1,3
ISM/CTL	833	4	4	833	1	5	417	2	5	4,5	1,0	0	0	0	3,0
LMA	14	13	1	76	15	1	12	16	1	1,0	5,5	133	15	1	1,0
RAT/IE	274	8	3	202	8	3	116	12	2	3,0	0,7	288	6	4	3,3
RTU/CE	301	7	3	202	9	3	121	10	2	3,0	0,7	209	11	2	2,7
TTI	933	3	5	468	3	5	312	3	5	5,0	0,5	279	7	3	4,3
RTU/FET	467	6	4	180	11	2	130	8	3	3,0	0,4	202	12	2	2,7
VU/ETRP	1264	2	5	234	6	4	198	4	4	4,5	0,2	654	1	5	4,7
RTU/FMSAC	706	5	4	161	12	2	131	7	3	3,0	0,2	247	10	2	2,7
RTU/FMETA	236	9	3	219	7	3	114	13	1	3,0	0,9	154	14	1	2,3
RTU/FPEE	1584	1	5	627	2	5	449	1	5	5,0	0,4	516	2	5	5,0
EDI	0	0	0	54	16	1	54	14	1	0,5	0	185	13	1	0,7
LULST/ETU	221	10	2	337	4	4	134	6	4	3,0	1,5	252	9	3	3,0
LU/ETU	74	12	2	194	10	2	53	15	1	2,0	2,6	467	3	5	3,0
RTU/FCSIT	201	11	2	292	5	4	119	11	2	3,0	1,5	360	5	4	3,3
UL/IMCS	0	0	0	124	14	1	124	9	3	0,5	0	413	4	4	1,7

SI	AIK	AIK	AIK sco-re	PIK	PIK	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK score
Average	392			242			150				0,6	296			

These indicators of SIs and their place in the rating of SIs of E&CSs in Latvia as well as its scores are summarized in Table 1. The table of the SIs indicators, ratings, and score was drawn up by authors. The summarized indicators show that in general, in Table 1, the figure rests in the range from 1584% to 12% in respect of the SIs in Latvia.

The authors compared the SIK indicators of all students of HEE in Latvia to SIK indicators of PhDs students of SIs of E&CSs in Latvia, and found that SIK indicators of the PhDs students were considerably higher. It follows from the study by Spica et all (2018) that the highest SIK indicators were held by Daugavpils University (1,45% in 2013) and the University of Latvia (1,82% in 2014). Meanwhile, between 2013 and 2018, the highest annual SIK indicator for PhDs students of SIs of E&CSs in Latvia was held by the VU/ETRP and represented 654%.

When analying the results obtained by SIs in the IC formation in the field of E&CSs, the same methodology was used as in the fields of social sciences, and, humanities and art sciences. Thus, the quantitative results of SIs in these fields can be compared. One of the main criteria for the quantitative evaluation of SIs is the efficiency of the involvement of the SIs staff in the formation of WoS and SCOPUS publications.

Table 2: The efficiency of the involvement of academic and research staff in the RS formation at SIs of E&CSs in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK ra-ting	AIK sco-re	PIK (%)	PIK rat-ing	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK score
IPE	0	0	0	99	9	3	99	5	4	1,5	0	180	6	4	2,3
ISMA/CTL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
LMA	16	12	2	88	11	2	14	15	1	2,0	5,5	154	8	3	2,3
RAT/IE	95	10	2	70	12	2	40	12	2	2,0	0,7	100	12	2	2,0
RTU/CE	248	5	4	166	5	4	100	4	4	4,0	0,7	172	7	3	3,7
TTI	829	1	5	416	1	5	277	1	5	5,0	0,5	248	4	4	4,7
RTU/FET	150	9	3	58	13	1	42	11	2	2,0	0,4	65	14	1	1,7
VU/ETRP	547	2	5	101	8	3	86	6	4	4,0	0,2	283	3	5	4,3
RTU/FMSAC	393	3	5	90	10	2	73	9	3	3,5	0,2	138	9	3	3,3
RTU/FMETA	159	8	3	148	6	4	77	7	3	3,5	0,9	104	11	2	3,0
RTU/FPEE	267	4	4	106	7	3	76	8	3	3,5	0,4	87	13	1	2,7

SI	AIK (%)	AIK ra-ting	AIK sco-re	PIK (%)	PIK rat-ing	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK score
EDI	0	0	0	16	15	1	16	14	1	0,5	0	55	15	1	0,7
LULST/ETU	174	7	3	265	3	5	105	3	5	4,0	1,5	198	5	4	4,0
LU/ETU	71	11	2	187	4	4	51	10	2	3,0	2,6	450	1	5	3,7
RTU/FCSIT	219	6	4	317	2	5	130	2	5	4,5	1,5	392	2	5	4,7
UL/IMCS	0	0	0	38	14	1	38	13	1	0,5	0	128	10	2	1,0
Average	207			128			79				0,6	156			

The comparison of the results of the three fields of science leads to conclusion that the highest score of the KIK indicator in the field of social sciences is 278% (Spica et al, 2022) while the highest score of the KIK indicator in field of E&CSs is 449%, and, the highest score of the KIK indicator in field of humanities and art sciences is 53% (Spica et al, 2023). In addition, it should be noted that the highest score of the KIK indicator in the field of humanities and art sciences is almost 9 times lower than the highest score in the field of E&CSs, and, the highest KIK indicator in field of social sciences is almost 2 times lower.

In Table 2 authors calculate efficiency of the involvement of academic and research staff in the RS formation, the authors used formulas:

AIK = (RS : AS) x 100 (6)

PIK = (RS : PS) x 100 (7)

KIK = (RS : KS) x 100 (8)

SIK = (RS : SS) x 100 (9)

PE = PIK : AIK

In Table 2, in respect of SIs of E&CSs in Latvia, the figure rests in the range from 14% to 829%. The highest indicator is the AIK in the TTI, but the lowest indicators is the KIK in the LMA. The AIK indicators were not collected for the 4 SIs of E&CSs.

Table 3: The efficiency of the involvement of academic and research staff in the MS formation at SIs of E&CSs in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK ra-ting	AIK sco-re	PIK (%)	PIK rat-ing	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK scscore
IPE	0	0	0	2	12	2	2	10	2	1,0	0	3	9	3	1,7
ISMA/CTL	142	1	5	142	1	5	71	1	5	5,0	1,0	0	0	0	3,3
LMA	0	11	2	2	9	3	0	13	1	2,5	5,5	4	5	4	3,0

SI	AIK (%)	AIK ra-ting	AIK sco-re	PIK (%)	PIK rat-ing	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK scscore
RTU/CE	3	10	2	2	10	2	1	11	2	2,0	0,7	2	11	2	2,0
TTI	88	2	5	44	2	5	29	2	5	5,0	0,5	26	2	5	5,0
RTU/FET	8	4	4	3	7	3	2	6	4	3,5	0,4	3	8	3	3,3
RTU/FMSAC	4	8	3	1	13	1	1	12	2	2,0	0,2	1	12	2	2,0
RTU/FMETA	6	7	3	5	5	4	3	5	4	3,5	0,9	4	7	3	3,3
RTU/FPEE	7	5	4	3	8	3	2	7	3	3,5	0,4	2	10	2	3,0
LULST/ETU	3	9	3	5	6	4	2	8	3	3,5	1,5	4	6	4	3,7
LU/ETU	6	6	4	16	3	5	4	4	4	4,5	2,6	39	1	5	4,7
RTU/FCSIT	8	3	5	11	4	4	5	3	5	4,5	1,5	14	3	5	4,7
UL/IMCS	0	0	0	2	11	2	2	9	3	1,0	0	6	4	4	2,0
Average	6			4			2				0,6	5			

In Table 3 authors calculate efficiency of the involvement of academic and research staff in the formation of MS, the authors used formulas:

AIK = (MS : AS) x 100 (11)

PIK = (MS : PS) x 100 (12)

KIK = (MS : KS) x 100 (13)

SIK = (MS : SS) x 100 (14)

PE = PIK : AIK (15)

In Table 3 the figure rests in the range from 0% to 142% in respect of the SIs of E&CSs in Latvia. The highest indicator are AIK and PIK in the ISMA/CTL but the lowest indicators are AIK and KIK in the LMA.

In Table 4 authors calculate efficiency of the involvement of academic personnel and research personnel in the formation of LPS, the authors used formulas:

AIK = (LPS : AS) x 100 (16)

PIK = (LPS : PS) x 100 (17)

KIK = (LPS : KS) x 100 (18)

SIK = (LPS : SS) x 100 (19)

PE = PIK : AIK (20)

Table 4: The efficiency of the involvement of academic and research staff in the LPS formation at SIs of E&CSs in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK ra-	AIK sco-re	PIK (%)	PIK ra-ting	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK& PIK & SIK score
IPE	0	0	0	22	3	5	22	2	5	2,5	0	40	3	5	3,3
RAT/IE	16	8	3	12	5	4	7	8	3	3,5	0,7	17	5/6	4	3,7
RTU/CE	17	7	3	12	6	4	7	7	3	3,5	0,7	12	9	3	3,3
TTI	20	6	4	10	8	3	7	9	3	3,5	0,5	6	11	2	3,0
RTU/FET	12	9	3	5	12	2	3	11	2	2,5	0,4	5	12	2	2,3
VU/ETRP	32	3	5	6	11	2	5	10	2	3,5	0,2	17	5/6	4	3,7
RTU/FMSAC	39	2	5	9	10	2	7	6	4	3,5	0,2	14	8	3	3,3
RTU/FMETA	24	5	4	22	2	5	12	4	4	4,5	0,9	16	7	3	4,0
RTU/FPEE	28	4	4	11	7	3	8	5	4	3,5	0,4	9	10	2	3,0
EDI	0	0	0	17	4	4	17	3	5	2,0	0	59	1	5	3,0
LULST/ETU	45	1	5	69	1	5	27	1	5	5,0	1,5	51	2	5	5,0
LU/ETU	4	10	2	9	9	3	3	12	2	2,5	2,6	22	4	4	3,0
RTU/FCSIT	1	11	2	2	13	1	1	14	1	1,5	1,5	2	14	1	1,3
UL/IMCS	0	0	0	2	14	1	2	13	1	0,5	0	5	13	1	0,7
Average	25			15			10				0,6	19			

In Table 4 the figure rests in the range from 1% to 69% in respect of the SIs of E&CSs in Latvia. The highest PIK is held by the LULST/ETU, while the lowest AIK and KIK belongs to the RTU/FCSIT.

Table 5: The efficiency of the involvement of academic and research staff in the EPS formation at SIs of E&CSs in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK ra-ting	AIK sco-re	PIK (%)	PIK ra-ting	PIK sco-re	KIK (%)	KIK ra-ting	KIK sco-re	Ave-rage of AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK score
IPE	0	0	0	4	4	4	4	2	5	2,0	0	7	3	5	3,0
RTU/CE	1	7	3	1	9	3	0	9	3	3,0	0,7	1	10	2	2,7
TTI	4	4	4	2	6	4	1	6	4	4,0	0,5	1	9	3	3,7
VU/ETRP	8	1	5	2	7	3	1	7	3	4,0	0,2	4	5	4	4,0
RTU/FMSAC	5	2	5	1	8	3	1	8	3	4,0	0,2	2	7	3	3,7
RTU/FMETA	3	6	4	3	5	4	2	5	4	4,0	0,9	2	6	4	4,0
RTU/FPEE	1	8	3	0	12	2	0	11/12	2	2,5	0,4	0	12	2	2,3
EDI	0	0	0	11	1	5	11	1	5	2,5	0	38	1	5	3,3
LULST/ETU	5	3	5	7	3	5	3	3	5	5,0	1,5	5	4	4	4,7
LU/ETU	4	5	4	9	2	5	3	4	4	4,5	2,6	22	2	5	4,7
RTU/FCSIT	0	9	3	1	10	2	0	11/12	2	2,5	1,4	1	11	2	2,3
UL/IMCS	0	0	0	0	11	2	0	10	2	1,0	0	1	8	3	1,7
Average	4			3			2				0,6	3			

In Table 5 authors calculate efficiency of the involvement of academic personnel and research personel in the formation of EPS, the authors used formulas:

AIK = (EPS : AS) x 100 (21)

PIK = (EPS : PS) x 100 (22)

KIK = (EPS : KS) x 100 (23)

SIK = (EPS : SS) x 100 (24)

PE = PIK : AIK (25)

In Table 5 the figure rests in the range from 0% to 38% in respect of the SIs of E&CSs in Latvia; the highest SIK is held by the EDI while the lowest KIK belongs to the RTU/FPEE and RTU/FCSIT.

In the all tables, the awerage indicators PE are the same, and the average SIK indicators are the highest, while the average KIK indicators; the average AIK indicators are the highest, while the average PIK indicators.

The highest average rate of the PE indicators is 1,8 (Spica et al, 2022) in social sciences, the second highest average rate of the PE indicators is 1,7 (Spica et al, 2023) in humanities and art sciences, and, the lowest average rate of the PE indicators is 0,6 in E&CSs. In addition, it should be noted that the highest average rate of the PE in the field of social sciences is three times higher than the average rate in the field of E&CSs.

Table 6: The Comparison of the results of qualitative and quantitative evaluation of Latvian SIs in the field of E&CSs using the IC forms for period from 2013 to 2018

SI	Quality score by TG (QTG)	Overall score by TG (OTG)	Total average score of AIK & PIK using IC forms (TAAP)	Difference of score (QTG-TAAP)	Difference of score (OTG-TAAP)	Total average score of AIK & PIK & SIK using IC forms (TAAPS)	Diference of score (QTG-TAAPS)	Difference of score (OTG-TAAPS)
IPE	2	2	1,0	1,0	1,0	1,7	0,3	0,3
ISMA/CTL	1	1	4,5	-3,5	-3,5	3,0	-2,0	-2,0
LMA	1	1	1,0	0,0	0,0	1,0	0,0	0,0
RAT/IE	2	2	2,0	0,0	0,0	2,3	-0,3	-0,3
RTU/CE	3	3	3,0	0,0	0,0	2,7	0,3	0,3
TTI	3	3	5,0	-2,0	-2,0	4,7	-1,7	-1,7
RTU/FET	3	3	2,5	0,5	0,5	2,0	1,0	1,0
VU/ETRP	2	2	4,0	-2,0	-2,0	4,3	-2,3	-2,3
RTU/FMSAC	3	4	3,0	0,0	1,0	2,7	0,3	1,3
RTU/FMETA	2	2	2,5	-0,5	-0,5	2,0	0,0	0,0
RTU/FPEE	3	4	5,0	-2,0	-1,0	4,7	-1,7	-0,7
EDI	4	4	0,5	3,5	3,5	1,0	3,0	3,0
LULST/ETU	2	3	3,5	-1,5	-0,5	3,3	-1,3	-0,3
LU/ETU	2	2	3,0	-1,0	-1,0	3,7	-1,7	-1,7
RTU/FCSIT	3	4	3,5	-0,5	0,5	4,0	-1,0	0,0
UL/IMCS	3	3	0,5	2,5	2,5	1,7	1,3	1,3

Table 7: The Comparison of the results of qualitative and quantitative evaluation of Latvian SIs in the field of E&CSs using the overall IC for period from 2013 to 2018

SI	Quality score by TG (QTG)	Overall score by TG (OTG)	Total average score of KIK using IC overall	Difference of score (QTG-TAKO)	Difference of score (OTG-TAKO)	Total average score of KIK & SIK using IC overall (TAKOS)	Difference of score (QTG-TAKOS)	Difference of score (OTG-TAKOS)
IPE	2	2	4,0	-2,0	-2,0	4,0	-2,0	-2,0
ISMA/CTL	1	1	2,0	-1,0	-1,0	1,0	0,0	0,0
LMA	1	1	0,6	0,4	0,4	1,1	-0,1	-0,1
RAT/IE	2	2	1,4	0,6	0,6	1,7	0,3	0,3
RTU/CE	3	3	2,8	0,2	0,2	2,6	0,4	0,4
TTI	3	3	4,4	-1,4	-1,4	3,9	-0,9	-0,9
RTU/FET	3	3	2,2	0,8	0,8	1,9	1,1	1,1
VU/ETRP	2	2	2,6	-0,6	-0,6	3,1	-1,1	-1,1
RTU/FMSAC	3	4	3,0	0,0	1,0	2,8	0,2	1,2
RTU/FMETA	2	2	3,2	-1,2	-1,2	2,9	-0,9	-0,9
RTU/FPEE	3	4	3,4	-0,4	0,6	2,9	0,1	1,1
EDI	4	4	2,4	1,6	1,6	2,4	1,6	1,6
LULST/ETU	2	3	4,4	-2,4	-1,4	4,2	-2,2	-1,2
LU/ETU	2	2	2,6	-0,6	-0,6	3,7	-1,7	-1,7
RTU/FCSIT	3	4	3,0	0,0	1,0	3,2	-0,2	0,8
UL/IMCS	3	3	2,0	1,0	1,0	2,4	0,6	0,6

5. Conclusions

The study of the authors did not result in confirmation of their hypothesis. When comparing the qualitative ratings of TG group to the quantitative assessments perfomed by the authors, it can be concluded that they differ from minus 3,5 points to plus 3,5 points in total.

The study shows that the TAAP, TAAPS, TAKO, and TAKOS of SIs of E&CSs in Latvia were higher than the results compiled by the relevant TG Panel except for the EDI, where all scores were too lower, and, exept for the LMA, where QTG, OTG, TAAP, TAAPS scores coincided.

The authors is encouraged to supplement the methodology for international evaluation of scientific institutions with four efficiency indicators AIK, PIK, KIK, SIK of the involvement of academic staff and students in the formation of IC per year in percentage, and, PE in times, in order to improve the quality of the evaluation of SIs.

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Intellectual Capital of Medical and Health Sciences and the Efficiency of its Formation at Scientific Institutions

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Abstract: The formation of intellectual capital (IC) of medical and health sciences at scientific institutions (SIs) is highly topical for all people on the world. The object of the research is formation of IC of medical and health sciences at SIs while the subject of the research is the comparative analyses of the efficiency of the involvement of academic staff and PhD students in the formation of IC of medical and health sciences at SIs of Latvia. The objective of the research is to study the involvement of academic staff and PhD students in the formation of IC of medical and health sciences at SIs in Latvia in the period from 2013 to 2018. The following tasks were determined to reach the objective: to study the formation of IC of medical and health sciences at SIs; to identify the concept of the efficiency of the involvement of academic staff and PhD students in the formation of IC of medical and health sciences; to calculate main indicators thereof, and, to carry out the comparative analysis of indicators characterising the efficiency of the involvement of academic staff and PhD students in the formation of IC of medical and health sciences at SIs in Latvia. Research me-thods used in the paper are content analysis, economic analysis, and economic experiment.

Keywords: Efficiency indicators, Intellectual capital, Scientific institutions, Medical and health sciences

1. Introduction

Every six years, the Ministry of Education and Science of the Republic of Latvia (MoES) organises an international evaluation of SIs registered in Latvia. The previous International Evaluation of Scientific Institutions' Activity (IESIA) in Latvia covered the period from 2006 to 2011. The last IESIA refers to the period from 2013 to 2018. In order to establish the dynamics of efficiency indicators of academic staff involved in the formation of IC in medical and health sciences at SIs of Latvia (MoES, 2021), the authors were used secondary output data of findings across the set of evaluation of SIs of medical and health sciences per period from 2013 to 2018 offered by “Technopolis-group” (TG).

Consequently, it provides an opportunity for the authors to calculate the IC indicators in medical and health sciences at SIs of Latvia and to compare their dynamics during the period from 2013 to 2018. The authors analyzed secondary data from the above period because newer data was not available.

Data of the comparative analysis will help to develop support programs to increase the efficiency of involvement of the academic staff in the IC formation. In addition, the comparative analysis will reveal whether the score of medical and health sciences at SIs of Latvia in the IESIA of TG coincides with the place of SIs of Latvia in the ratings of IC indicators, and whether the overall score of SIs of Latvia also reflects the efficiency of the involvement of the academic staff of SIs of Latvia in the IC formation.

Hypothesis: The overall score of SIs shows the efficiency of the IC formation at SIs of Latvia.

2. Theoretical Background

Spica et al (2017a) state that IC is an economic category, the spiritual value created by the human potential, and it can be accumulated and converted into the value of other capitals. By investigating certain information about the management of education, we can increase the capacity and significance of the country's total economic capital movement. Rondeau et al (2022) remind that peer reviewed publications remain a traditional form of academic productivity. Spica et al (2017a; 2017b) have worked out four indicators of the efficiency of the formation of IC in the higher education establishment (HEE): (1)The efficiency of the involvement of academic staff in the formation of IC per year in percentages (AIK); (2)The efficiency of the involvement of academic staff with a Doctorate degree in the formation of IC per year in percentages (DIK); (3)The efficiency of the involvement of students in the formation of IC per year in percentages (SIK); (4)Mutual efficiency of the involvement members of the academic staff with Doctorate degrees and the academic staff without Doctorate degrees in the formation of IC per year in times, (DE).

3. Methodology

In order to calculate the AIK, DIK, SIK, and DE of the HEE Spica et al (2017a; 2017b) have worked out four formulas: (1) AIK = (ZPS : AS) x 100; (2) DIK = (ZPS : DS) x 100; (3) SIK = (ZPS : SS) x 100; (4) DE = DIK : AIK. Where: ZPS represents the number of scientific publications of the HEE per year; AS represents the number of academic staff in full-time jobs per year; DS represents the number of academic staff with Doctorate degrees holding in full-time jobs per year; SS represents the number of students per year.

The authors modified the above mentioned formulas for the purposes of the study. Namely, they calculate IC efficiency indicators for total numbers of full time equivalent (FTE) academic and research personnel (KIK), for FTE academic personnel (AIK), for FTE academic and research personnel (PIK) and for PhDs completed at SIs (SIK). In addition, all the said IC efficiency indicators were calculated for different forms of IC such as total number of self-reported outputs of IC (KS), articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS (WS), articles in peer reviewed edited journals, and conference proceedings not included in WoS or SCOPUS (RS), monographs (MS), and Latvian patent (LPS), and European patent and International patents (EPS). The authors calculated mutual efficiency indicators (PE) regarding involvement of the FTE academic and research personnel (PS) and the FTE academic personnel (AS) in the formation of IC in times.

In the present research, the authors used the following data from the IESIA: output data on the number of FTE academic personnel (AS), the number of FTE academic and research personnel (PS), the total number of FTE academic and research personel (KS), the number of PhDs completed (SS), the number of articles in peer reviewed scientific edited journals and conference proceedings included in WoS or SCOPUS (WS), the number of articles in peer reviewed scientific edited journals and conference proceedings not included in WoS or SCOPUS (RS), the number of monographs (MS), the number of Latvian patents (LPS), and the number of European and International patents (EPS), and total number of self-reported outputs (KS) in period from 2013 to 2018 per SI of medical and health sciences in Latvia. Authors revised the above WS, RS, MS, LPS, EPS and KS for the year.

The number of scientific publications and patents are the main results of the IC formation at SIs of medical and health sciences. TG analysed 8 public SIs of medical and health sciences of Latvia.

During the period analysed in the IESIA, there were 8 such SIs in Latvia: Latvian Biomedical Research and Study Centre (LBRSC); Limited liability company “Riga East University Hospital” (REUH); Pauls Stradins Clinical University Hospital Research Institute (PSCUHRI); Latvian Institute of Organic Synthesis (LIOS); Latvian Academy of Sport Education (LASE); Riga Stradins University Platform of Medicine (RSU/MP); Riga Stradins University Public Health Platform (RSU/PHP); University of Latvia Medicine and Health Science Cluster (UL/MHSC).

In this study, one scientific publication or one patent are accepted as one unit of IC. Further, using the modified formulas 1; 2; 3; and 4, were calculated: KIK, AIK, PIK, SIK, PE. Then, according to the results obtained through the author's calculations, a corresponding rating place was assigned to each SI of Latvia per year and each of the above indicators KIK, AIK, PIK and SIK.

Each place in the rating was then assessed with an appropriate score, where the lowest score is 1 point, while the highest score is 5 points. Thus, the SI, which took first place in - KIK, AIK, PIK and SIK received 5 points in the ranking, took second place - received 4 points, took third place - received 3 points, took fourth place - received 2 points, and took fifth to eighth place - received 1 point.

The above mentioned assessment system allows to compare the quantitative efficiency indicators of SIs of medical and health science in Latvia calculated by the authors to IESIA overall assessment criterion - quality of the SI research performance. The relevant TG Panel was the score of research performance of each SI using a scale where score 5 means an outstanding level of research, score 4 means a very good level of research, score 3 means a good level of research, score 2 means an adequate level of research, and score 1 means a poor level of research (MoES, 2021).

The score assigned to the overall assessment by the relevant TG Panel was based on the assessment of five sub elements A to E, where element A characterises the quality of the research, element B - the impact on the development of the specific field of science, element C - the economic and social impact of the research, element D - the research environment and infrastructure of the institution, element E - the institution development potential. The Panel was provided with scores against each sub-element and the overall score and was also provided with narrative descriptions of their scores, the overall score and the sub-elements (MoES, 2021).

The follow-up authors compared the results of their own estimates of SIs quantitative indicators to the qualitative indicators of the relevant TG Panel, and calculated the difference between the indicators and the changes. For this purpose, the authors calculated the average score of indicators for each SI recording the efficiency of the IC formation and compared these scores to scores of the research quality of each SI and overall score developed by the TG Panel.

4. Results

It follows from the IESIA that in Latvia, 5 SIs of medical and health sciences have corresponding fields of science in basic medicine, 4 SIs corresponding fields of science in health biotehnology, clinical medicine, health sciences, 3 SIs corresponding fields of science in other medical sciences. In turn, such corresponding fields of sciences as biological sciences; educational sciences; sports sciences are operated by 1 SI in each field of science.

According to the authors' estimates, from the IESIA data show that the total number of self-reported outputs of SIs of medical and health science in Latvia is taken in the largest proportion by the WS - 68,14%, which is followed by the RS - 24,57%, the MS - 2,66%, the LPS - 3,34%, the EPS - 1,29%.

To calculate the efficiency of the involvement of academic and research staff in the WS formation, the authors used formulas that were developed and applied already before and are modified now:

AIK = (WS : AS) x 100 (1)

PIK = (WS : PS) x 100 (2)

KIK = (WS : KS) x 100 (3)

SIK = (WS : SS) x 100 (4)

PE = PIK : AIK (5)

Table 1: The efficiency of the involvement of academic and research staff in the WS formation at SIs of medical and health sciences in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
LBRSC	0	0	0	70	7	1	70	6	1	0,5	0	336	2	4	1,7
REUH	0	0	0	20256	1	5	20256	1	5	2,5	0	494	1	5	3,3
PSCUHRI	0	0	0	485	2	4	485	2	4	2,0	0	188	5	1	1,7
LIOS	0	0	0	52	8	1	52	7	1	0,5	0	209	4	2	1,0
LASE	21	4	2	82	6	1	17	8	1	1,5	3,8	75	8	1	1,3
RSU/MP	426	2	4	252	4	2	158	4	2	3,0	0,6	171	6	1	2,3
RSU/PHP	519	1	5	472	3	3	247	3	3	4,0	0,9	127	7	1	3,0
UL/MHSC	230	3	3	199	5	1	107	5	1	2,0	0,9	284	3	3	2,3
Average	456			160			118				0,4	209			

These indicators of SIs and their place in the rating of SIs of medical and health sciences in Latvia as well as its scores are summarized in Table 1. The table of the SIs indicators, ratings, and score was drawn up by authors. The summarized indicators show that in general, in Table 1, the figure rests in the range from 20256% to 17% in

respect of the SIs in Latvia. The highest indicators are PIK and KIK in the REUH, while the lowest indicators is KIK in the LASE. Comparing the figures collected in Table 1, the authors conclude that the AIK indicator rests in the range from 21% to 519%. The lowest SIK indicators of 75% is for the LASE, the highest SIK indicator of 494% is for the REUH. The PS of the SIs of medical and health sciences are 0,6 times to 3,8 times efficient in the WS formation.

In Table 1, the authors created the rating and score of the SIs of medical and health sciences in Latvia based on the AIK, PIK, KIK, SIK indicators of the efficiency of the academic research personnel and PhDs involvement in the WS formation. According to the AIK indicator, the first place, and highest score is taken by the RSU/PHP; according to the PIK, KIK and SIK indicators, the first place, and highest score are taken by the REUH.

The authors compared the SIK indicators of all students of HEE in Latvia to SIK indicators of PhDs students of SIs of medical and health sciences in Latvia, and found that SIK indicators of the PhDs students were considerably higher. It follows from the study by Spica et all (2018) that the highest SIK indicators were held by Daugavpils University (1,45% in 2013) and the University of Latvia (1,82% in 2014). Meanwhile, between 2013 and 2018, the highest annual SIK indicator for PhDs students of SIs of medical and health sciences in Latvia was held by the REUH and represented 494%.

When analysing the results obtained by SIs in the IC formation in the field of medical and health sciences, the same methodology was used as in the fields of social sciences, and, humanities and art sciences. Thus, the quantitative results of SIs in these fields can be compared. One of the main criteria for the quantitative evaluation of SIs is the efficiency of the involvement of the SIs staff in the formation of WoS and SCOPUS publications.

The comparison of the results of the three fields of science leads to conclusion that the highest score of the KIK indicator in the field of social sciences is 278% (Spica et al, 2022) while the highest score of the KIK indicator in field of medical and health sciences is 20256%, and, the highest score of the KIK indicator in field of humanities and art sciences is 53% (Spica et al, 2023). In addition, it should be noted that the highest score of the KIK indicator in the field of humanities and art sciences is 382 times lower than the highest score in the field of medical and health science, and, the highest KIK indicator in field of social sciences is 73 times lower.

A similar trend is observed when comparing the efficiency of the involvement PhD degree holders in the formation of WoS and SCOPUS publications in the three above-referred fields of science. Here, the highest rate of the SIK indicator in social sciences is 667% (Spica et al, 2022) while in medical and health sciences the highest rate is 494%, and, the highest rate of the SIK indicator in humanities and art science is 450% (Spica et al, 2023). In turn, the lowest rate of the SIK indicator in the field of medical and health sciences is 75%; the lowest rate of the SIK indicator in the field of social sciences is 58% (Spica et al, 2022); the lowest rate of the SIK indicator in the field of humanities and art science is 13% (Spica et al, 2023). This means that the lowest rate in the field of medical and health sciences, however, is almost 6 times higher than the lowest rate in the field of humanities and art science, and, almost 1 times higher than the lowest rate in the field of social sciences.

In Table 2 authors calculate efficiency of the involvement of academic and research staff in the RS formation, the authors used formulas 6; 7; 8; 9; 10:

$$AIK = (RS : AS) \times 100 \quad (6)$$

$$PIK = (RS : PS) \times 100 \quad (7)$$

$$KIK = (RS : KS) \times 100 \quad (8)$$

$$SIK = (RS : SS) \times 100 \quad (9)$$

$$PE = PIK : AIK$$

In Table 2, in respect of SIs of medical and health science in Latvia, the figure rests in the range from 3% to 7992%. The highest indicator are the PIK and KIK in the REUH, but the lowest indicators are the PIK and KIK in the LBRSC and LIOS.

The AIK indicators were collected only for the 4 SIs of medical and health sciences, and the authors conclude that the highest AIK indicator of 165% is held by the RSU/MP while the lowest AIK indicator of 39% belongs to the LASE; the highest SIK indicator of 195% is held by the REUH, while the lowest SIK indicator of 12% belongs to LIOS.

Table 2: The efficiency of the involvement of academic and research staff in the RS formation at SIs of medical and health sciences in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
LBRSC	0	0	0	3	7/8	1	3	7/8	1	0,5	0	14	7	1	0,7
REUH	0	0	0	7992	1	5	7992	1	5	2,5	0	195	1	5	3,3
PSCUHRI	0	0	0	469	2	4	469	2	4	2,0	0	182	2	4	2,7
LIOS	0	0	0	3	7/8	1	3	7/8	1	0,5	0	12	8	1	0,7
LASE	39	4	2	150	3	3	31	5	1	2,5	3,8	138	3	3	2,7
RSU/MP	165	1	5	98	4	2	61	3	3	3,5	0,6	66	4	2	3,0
RSU/PHP	99	2	4	90	5	1	47	4	2	2,5	0,9	24	6	1	2,0
UL/MHSC	40	3	3	35	6	1	19	6	1	2,0	0,9	50	5	1	1,7
Average	164			58			43				0,4	75			

Table 3: The efficiency of the involvement of academic and research staff in the MS formation at SIs of medical and health sciences in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
LBRSC	0	0	0	0	7	1	0	7	1	0,5	0	1	7	1	0,7
REUH	0	0	0	641	1	5	641	1	5	2,5	0	16	2	4	3,0
PSCUHRI	0	0	0	33	3	3	33	2	4	1,5	0	13	3	3	2,0
LASE	5	3	3	18	4	2	4	5	1	1,0	3,8	17	1	5	3,3
RSU/MP	21	2	4	12	5	1	8	4	2	2,5	0,6	8	5	1	2,0
RSU/PHP	43	1	5	39	2	4	21	3	3	1,0	0,9	11	4	2	3,7
UL/MHSC	4	4	2	4	6	1	2	6	1	0,5	0,9	5	6	1	1,3
Average	18			6			5				0,4	8			

In Table 3 authors calculate efficiency of the involvement of academic and research staff in the formation of MS, the authors used formulas 11; 12; 13; 14; 15:

AIK = (MS : AS) x 100 (11)

PIK = (MS : PS) x 100 (12)

KIK = (MS : KS) x 100 (13)

SIK = (MS : SS) x 100 (14)

PE = PIK : AIK (15)

In Table 3 the figure rests in the range from 0% to 641% in respect of the SIs in Latvia. The highest indicator are PIK and KIK in the REUH, but the lowest indicators are PIK and KIK in the LBRSC.

In Table 4 authors calculate efficiency of the involvement of academic personnel and research personnel in the formation of LPS, the authors used formulas 16; 17; 18; 19; 20:

AIK = (LPS : AS) x 100 (16)

PIK = (LPS : PS) x 100 (17)

KIK = (LPS : KS) x 100 (18)

SIK = (LPS : SS) x 100 (19)

PE = PIK : AIK (20)

Table 4: The efficiency of the involvement of academic and research staff in the LPS formation at SIs of medical and health sciences in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
LBRSC	0	0	0	19	2	4	19	2	4	2,0	0	92	1	5	3,0
REUH	0	0	0	256	1	5	256	1	5	2,5	0	6	4	2	2,3
PSCUHRI	0	0	0	7	4	2	7	3	3	1,0	0	3	7	1	1,0
LIOS	0	0	0	3	6	1	3	5	1	0,5	0	11	2	4	1,7
LASE	1	4	2	5	5	1	1	8	1	1,0	3,8	4	5	1	1,0
RSU/MP	17	1	5	10	3	3	6	4	2	4,0	0,6	7	3	3	3,7
RSU/PHP	2	3	3	2	8	1	1	7	1	2,0	0,9	1	8	1	1,7
UL/MHSC	3	2	4	2	7	1	1	6	1	2,5	0,9	3	6	1	2,0
Average	22			8			6				0,4	10			

In Table 4 the figure rests in the range from 1% to 256% in respect of the SIs in Latvia. Comparing the figures collected in Table 4, the authors conclude that the highest PIK and KIK score is held by the REUH, while the lowest AIK and KIK score belongs to the LASE, the lowest SIK score go to the RSU/PHP.

In Table 5 authors calculate efficiency of the involvement of academic personnel and research personel in the formation of EPS, the authors used formulas 21; 22; 23; 24; 25:

AIK = (EPS : AS) x 100 (21)

PIK = (EPS : PS) x 100 (22)

KIK = (EPS : KS) x 100 (23)

SIK = (EPS : SS) x 100 (24)

PE = PIK : AIK (25)

Table 5: The efficiency of the involvement of academic and research staff in the EPS formation at SIs of medical and health sciences in Latvia per year in period from 2013 to 2018

SI	AIK (%)	AIK rating	AIK score	PIK (%)	PIK rating	PIK score	KIK (%)	KIK rating	KIK score	Average of AIK & PIK score	PE in times	SIK (%)	SIK rating	SIK score	Average of AIK & PIK & SIK score
LBRSC	0	0	0	3	2	4	3	2	4	1,0	0	13	2	4	2,7
LIOS	0	0	0	6	1	5	6	1	5	0,5	0	22	1	5	3,3
RSU/MP	2	1	5	1	3	3	1	3	3	4,0	0,6	1	3	3	3,7
UL/MHSC	0	2	4	0	4	2	0	4	2	3,0	0,9	1	4	2	2,7
Average	9			3			2				0,4	4			

Table 6: The Comparison of the results of qualitative and quantitative evaluation of Latvian SIs in the field of medical and health sciences using the IC form for period from 2013 to 2018

SI	Quality score by TG (QTG)	Overall score by TG (OTG)	Total average score of AIK & PIK using IC form (TAAP)	Difference of score (QTG-TAAP)	Difference of score (OTG-TAAP)	Total average score of AIK & PIK & SIK using IC form (TAAPS)	Diference of score (QTG-TAAPS)	Difference of score (OTG-TAAPS)
LBRSC	4	4	0,5	3,5	3,5	1,7	2,3	2,3
REUH	2	2	2,5	-0,5	-0,5	3,3	-1,3	-1,3
PSCUHRI	3	3	2,0	1,0	1,0	2,3	0,7	0,7
LIOS	5	5	0,5	4,5	4,5	0,7	4,3	4,3
LASE	1	2	1,5	-0,5	0,5	1,3	-0,3	0,7
RSU/MP	4	4	3,0	1,0	1,0	2,3	1,7	1,7
RSU/PHP	4	3	4,0	0,0	-1,0	3,0	1,0	0,0
UL/MHSC	3	3	2,0	1,0	1,0	2,0	1,0	1,0

Of the 8 Latvian SIs in the field of medical and health sciences, only the 4 SIs have the EPS. In Table 5 the figure rests in the range from 0% to 22% in respect of the SIs in Latvia; the highest SIK score is held by the LIOS while the lowest AIK, PIK, and KIK score belongs to the UL/MHSC.

In the all tables, the average indicators PE are the same, and the average SIK indicators are the highest, while the average KIK indicators; the average AIK indicators are the highest, while the average PIK indicators.

The comparison of the results of the three fields of science leads to conclusion that the highest average rate of the PE indicators is 1,8 (Spica et al, 2022) in social sciences, the second highest average rate of the PE indicators is 1,7 (Spica et al, 2023) in humanities and art sciences, and, the lowest average rate of the PE indicators is 0,4 in medical and health sciences. In addition, it should be noted that the highest average rate of the PE in the field of social sciences is almost five times higher than the lowest average rate in the field of medical and health sciences.

Table 7: The Comparison of the results of qualitative and quantitative evaluation of Latvian SIs in the field of medical and health sciences using the overall IC for period from 2013 to 2018

SI	Quality score by TG (QTG)	Overall score by TG (OTG)	Total average score of KIK using IC overall (TAKO)	Difference of score (QTG-TAKO)	Difference of score (OTG-TAKO)	Total average score of KIK & SIK using IC overall (TAKOS)	Difference of score (QTG-TAKOS)	Difference of score (OTG-TAKOS)
LBRSC	4	4	2,2	1,8	1,8	2,6	1,4	1,4
REUH	2	2	4,0	-2,0	-2,0	3,6	-1,6	-1,6
PSCUHRI	3	3	3,0	0,0	0,0	2,4	0,6	0,6
LIOS	5	5	1,6	3,4	3,4	2,0	3,0	3,0
LASE	1	2	0,8	0,2	1,2	1,4	-0,4	0,6
RSU/MP	4	4	2,4	1,6	1,6	2,2	1,8	1,8
RSU/PHP	4	3	1,8	2,2	1,2	1,4	2,6	1,6
UL/MHSC	3	3	1,2	1,8	1,8	1,4	1,6	1,6

5. Conclusions

The study of the authors did not result in confirmation of their hypothesis. When comparing the qualitative ratings of TG group to the quantitative assessments performed by the authors, it can be concluded that they differ from minus 2,0 points to plus 4,5 points in total. The hypothesis is accepted *pro tem* for other branches of SIs of Latvia.

The study shows that the AIK, KIK, PIK, and SIK of SIs of medical and health sciences in Latvia were lower than the results compiled by the relevant TG Panel except one SIs of these sciences, and, except for the PSCUHRI, where QTG, OTG, TAKO scores coincided.

The authors is encouraged to supplement the methodology for international evaluation of scientific institutions with efficiency indicators in order to improve the quality of the evaluation.

The scientific novelty of the research: 1)comparative analysis of indicators characterising the efficiency of the involvement of academic staff and PhD students in the formation of IC of medical and health sciences at SIs in Latvia; 2)modified the formulas of efficiency of the involvement of academic staff and PhD students in the formation IC of medical and health sciences; 3)system of efficiency indicators of IC formation at SIs.

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Am I Successful? An Answer of Women Entrepreneurs

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Abstract: The success of women entrepreneurs is almost uniformly judged by financial criteria. As a result, the so-called underperformance hypothesis is put forward. However, this hypothesis may be ill-founded, and it may serve to reproduce and reinforce myths about women and entrepreneurship. It is important to understand what success means for women entrepreneurs operating in a given socio-economic context before we label them as underperformers. Moreover, although the importance of the contextual approach is recognized, some contexts are under-researched and less visible. Results from North America and Western Europe cannot be replicated in other contexts, especially in developing countries or patriarchal societies. For different contexts, we need new evidence. And this new evidence can make us realize that some concepts need to be revised to capture the collective vision of entrepreneurs. Instead of one paradigm, we should recognize the existence of a diversity of forms, motives, and understanding of success in entrepreneurship, as well as the contexts in which it occurs, to ensure holistic knowledge on entrepreneurship. To respond to these challenges, the research is conducted on a sample of 300 female entrepreneurs in the Republic of Serbia who operate in manufacturing. The respondents were asked to state what business success means to them and then to subjectively assess how successful they are according to the same criteria. In this way, the research results reveal how successful women entrepreneurs are, but measured in a way that reflects their perceptions of success. Results show that the importance that a certain criterion has for female entrepreneurs as an indicator of success is positively related to their success measured by that criterion. Not imposing on women entrepreneurs the usual measures of business success, the paper responds to calls to de-masculinize women's entrepreneurship research by introducing gender-specific variables and widening the set of measures of success. In doing so, it is placed in specific and under-researched contexts of a developing country and manufacturing industry. In this way, the paper further contributes to the enrichment of the entrepreneurship knowledge base.

Keywords: Female entrepreneurship, Manufacturing, Developing countries

1. Introduction

The majority of studies on women's entrepreneurship exclusively use some financial measure as an indicator of business success. Despite the wide consensus that women value qualitative aspects of business performance, the success of women entrepreneurs is almost uniformly judged upon financial criteria (Sullivan and Meek, 2012). As a result, the so-called underperformance hypothesis is put forward, suggesting that women entrepreneurs perform worse compared to their male counterparts (Deng, Liang and Wang, 2020). And since entrepreneurship contributes to economic growth, this underperformance of female entrepreneurs becomes a problem (Ahl, 2006). In investigating the causes of this *problem,* studies mainly point out some *flaws* or *deficits* of women entrepreneurs (Henry et al, 2021). Hence, women entrepreneurs underperform because they are less entrepreneurially oriented, they are less motivated to grow, they do not have adequate education or experience, they are cautious, they apply inadequate or feminine management practices, they lack networking skills and similar. Consequently, women are perceived as the *others*, secondary, complementary to men, or, in the best case, as an unused resource.

The field of entrepreneurship is highly masculinized. Because women are not men, they are seen as *others* who differ and who have to become more similar to men who are the norm, the standard (Lockeyer, Hoyte and Dewitt, 2018). And the status of the *other* implies some weakness, a worse position from which women need to be saved. The assumption is that those who are *less,* want to become better by imitating those who are *more*. But, instead of ironing out the differences no matter what, perhaps women should be appreciated as they are, and a new frame of reference should be built. Instead as *the others,* we should start perceiving female entrepreneurs as *the ones.*

Researchers focus on investigating the reasons for female entrepreneurs' underperformance, rather than questioning the standards of success themselves (Dean et al, 2019). The underperformance hypothesis is a reflection of the tendency for women to be evaluated in relation to masculine business norms and conventional measures of economic performance, which are considered to be the hallmark of entrepreneurial success (Watson, Stuetzer and Zolin, 2017; Du Rietz and Henrikson, 2000). Therefore, women are less successful because

of the way we define and judge their success (Lockeyer, Hoyte and Dewitt, 2018). The focus on economic growth in women's entrepreneurship research hides the heterogeneity and complexity of women's experiences (Dean et al, 2019). It is a narrow window through which we observe and evaluate performance (Lockeyer, Hoyte and Dewitt, 2018). So, why don't we open the window wide to see the entire landscape of entrepreneurship? To do that, we need to redefine the way we understand women entrepreneurs' performance (Irene, 2018; Lockeyer, Hoyte and Dewitt, 2018).

In addition to probably concealing the real truth, the underperformance hypothesis serves as a mechanism that maintains the gender hierarchy in favour of men (Dean et al, 2019). The preconceived notion is that when you think of a successful entrepreneur, you think of a man (Aidis, 2018). This can lower the entrepreneurial self-confidence of women (McAdam, 2023), it can discourage them from entering entrepreneurship (Watson, 2020), and it affects the decision-making of those who dispose and allocate resources (Aidis, 2018; Voitkane et al, 2018). Because of its important implications, we need to be sure whether this underperformance hypothesis is just a result of a methodological narrowness, or whether it faithfully reflects the reality.

Because of the management practice-industry interactions, women's entrepreneurship scholars call for industry-specific research orientation (Carter, Williams and Reynolds, 1997). As a result, most of the studies on women's entrepreneurship are conducted in the service and retail sectors (Henry, Foss and Ahl, 2016). In some way, this is justified by the fact that both as employees and as entrepreneurs, women are overrepresented in the services industries (Aidis, 2016; Henry, Foss and Ahl, 2016; Terjesen, 2016; Braches and Elliot, 2017; Brixiova, Kangoye and Said, 2020; Gawel and Mroczek-Dabrowska, 2021), and this is one of the most common observations of entrepreneurship scholars (Sullivan and Meek, 2012; Mitchelmore and Rowley, 2013). All of the above results in studies of women's entrepreneurial activity in manufacturing being rare.

Moreover, although the importance of the contextual approach to entrepreneurship is recognized, certain social, economic and cultural contexts are under-researched and less visible. Research on the subject is generally performed in developed countries, with North American, the UK, and Australian studies dominating the field (Henry, Foss and Ahl, 2016; Cabrera and Mauricio, 2017). Nevertheless, the results from developed countries cannot be merely replicated in other contexts, such as developing countries or patriarchal societies. For different contexts, we need new evidence. And this new evidence can make us realize that some concepts need to be revised to capture the collective vision of entrepreneurs. Instead of one paradigm, we should recognize the existence of a diversity of forms, motives, and understanding of success in entrepreneurship, as well as the contexts in which it occurs, to ensure holistic knowledge of entrepreneurship (Baker and Welter, 2017). The present study is one step on that journey. It aims at expanding the understanding of business success and its achievement by female entrepreneurs in under-researched contexts such as manufacturing and a developing country. To deliver this, the paper has the usual structure of a quantitative study. After the introductory considerations of the background, significance, and goal of the study, relevant literature is analysed and hypotheses are set. Methodological aspects of the study, including the sample, data collection, variables, and methods are presented in the third section of the paper, after which the research results are presented and discussed. The paper ends with certain concluding remarks.

2. Literature Review and Hypotheses Development

As a research field, entrepreneurship is criticized for not being methodologically diverse (Neergaard and Ulhøi, 2007). Studies on women's entrepreneurship often use gender-biased measures and other male constructions which are then just imposed on women through questionnaires (Henry, Foss and Ahl, 2016). Normative standards are set for what a successful business should look like. Common standards of success, such as profit or growth, are just attributed to women, without questioning (Lerner and Almor, 2002; McAdam, 2023). And in relation to them, women are found to be underperformers (Cabrera and Mauricio, 2017; Henry et al, 2021). Nevertheless, when controlling for structural factors, there is no difference in the performance of women and men entrepreneurs (Ahl, 2006; Marlow and McAdam, 2013; Watson, Stuetzer and Zolin, 2017; Sappleton, 2018). Moreover, there are arguments suggesting that women entrepreneurs are not underperformers, but rather restrained performers (Marlow and McAdam, 2013). Underperformance suggests that women have failed to realize their entrepreneurial potential and that they need to be *fixed* to meet the standards set by men (Henry, Foss and Ahl, 2016; Foss, Henry and Mikalsen, 2019; Marlow, 2023; McAdam, 2023). Constrained performance suggests that firms (regardless of gender) realize the potential that their environment allows them.

Ignoring the fact that women entrepreneurs' performance is restrained is not the only problem with the underperformance hypothesis. Neglecting the multifaceted nature of business success is another one. Dean et al. (2019) argue that the underperformance hypothesis springs not from empirical evidence, but from the

dominance of neoclassical growth discourse and official statistics and politics. Hence, this hypothesis may be ill-founded and it may serve to reproduce and reinforce myths about women and entrepreneurship (Marlow and McAdam, 2013). It is important to understand what success means for women entrepreneurs operating in a given socio-economic context, before we label them as underperformers (Hailemariam and Kroon, 2018). Not only that it subordinates women by default, but mainstream research practice also fails to register potential differences in women's approach to business (Morris et al, 2006).

Business success cannot (always) be simply equated with financial outcomes (Hailemariam and Kroon, 2008). Solely relying on one type of business performance indicators does not provide a complete insight into women's entrepreneurship and their performance (Cabrera and Mauricio, 2017). It is found that women do value financial business results, but that they attach high importance to qualitative outcomes as well (Sullivan and Meek, 2012). In other words, women expect a broader scope of entrepreneurship's benefits (Morris et al, 2006; Jennings and Brush, 2013). Female entrepreneurs themselves are a heterogeneous group, they differ by many criteria (Hailemariam and Kroon, 2008). Basically, the motivation and goals of entering entrepreneurship combined with a specific social-economic-cultural context determine how a woman will define business success. The way women define their success depends on the gender socialization they went through, their motives, background, and value priorities (Hailemariam and Kroon, 2008).

All of these diversities should be recognized, appreciated, and conceptualized in such a way as to capture the actual, rather than the assumed reality (Henry et al, 2021). This will sometimes require us to critically re-examine certain basic assumptions on which we build knowledge on entrepreneurship (Marlow and McAdam, 2013; Narendran, 2018). Adopting Baron's and Henry's (2011) framework, the present study focuses on the postlaunch phase of the entrepreneurial process. The main dependent variable of this phase is the performance and success of an entrepreneurial venture. The business success of an entrepreneur is a multidimensional construct that cannot be fully captured only by financial and economic indicators (Hailemariam and Kroon, 2008). Therefore, along with quantitative, entrepreneurial success should also be captured in qualitative terms (Carbera and Mauricio, 2017). Quantitative indicators of success are those referring to the economic, and financial business results, while the qualitative dimension includes outcomes such as independence, autonomy, flexibility, recognition, personal development, and the like. This study answers the calls to include qualitative indicators when researching the performance of entrepreneurs in general, and of female entrepreneurs, in particular (Baron and Henry, 2011; Zolin, Watson and Stuetzer, 2013).

Various theories, including the Expectancy Theory (Vroom, 1964), the Entrepreneurial Event Model (Shapero and Sokol, 1982), and the Theory of Planned Behaviour (Ajzen, 1991) offer explanations for individuals' engaging in certain actions. What all these theoretical frameworks recognize is the importance of personal attitudes and values for an action or a behaviour. Along with other antecedents, for a specific engagement, it is important how much an individual values the outcomes or the rewards that the focal engagement or behaviour will result in. The higher the perceived value, attractiveness, or desirability of a certain outcome, the stronger the intention will be to engage in behaviour that results in a specific outcome. And according to the Goal-setting Theory, goals (or intentions) have a directive function, they direct attention and effort to activities that are important to the goal and distract attention from those activities that are not important to the goal (Locke and Latham, 2002).

So, in line with the previous, the rationale of this paper is as follows. The way women entrepreneurs perceive business success (which is their goal), affects their behaviour, or commitment to achieving that goal. And the level of commitment is related to the level of success in achieving the goal. In other words, the more a specific output is a measure of business success for female entrepreneurs, the more successful they will be in achieving it. Within the presented framework, we hypothesize that:

Hypothesis 1: Female entrepreneurs look at business success from different angles, measuring and achieving it throughout a broad scope of success outcomes.

Hypothesis 2: Female entrepreneurs' business success achievement is associated with their perception of business success.

3. Methodology

3.1 Data and Sample

The target population consists of Serbian business entities in manufacturing, whose founders and legal representatives are women. A stratified simple random sample is selected from the database of the Serbian Business Registers Agency. The stratification is obtained by crossing the legal form, size class and territory of the

business entity. In line with Serbian Statistical Office practice, four size classes (less than 10 employees, 10-49, 50-249, 250 and more employees), three legal forms (limited liability company, entrepreneurs, other), and four regions (Belgrade, Šumadija and Western Serbia, Southern and Eastern Serbia, and Vojvodina) are used for stratification. A total of 42 strata are defined.

A questionnaire with a combination of open and closed questions is used to collect data. Field research is conducted during January and February 2024. Public opinion polling agency conducted a telephone survey of female entrepreneurs, following the questionnaire provided by the authors of this study. A total of 300 filled questionnaires are obtained.

3.2 Variables

3.2.1 Business success

This variable is considered twice, as a perception and as an achievement. First, it is measured how female entrepreneurs perceive business success. They were asked what it meant for them to achieve business success. They were offered a set of success outcomes (indicators). For each, they had to express the level of agreement or disagreement with the statement that the given indicator is a measure of business success (1-completely disagree, 5-completely agree). Then, they were asked to rate the extent to which they were successful in achieving each of the indicated indicators of success (1-very unsuccessful, 5-very successful). Both questions used the same indicators. Similar to Irene (2018) or Hailemariam and Kroon (2018), we use the following business success indicators: income and profit increase; employment increase; personal wealth; personal achievement and development; reputation in the community; customer satisfaction and loyalty; satisfaction and relations with employees, suppliers, customers; family-business balance; and contribution and creating value for the community.

3.2.2 Control variables

Because it is shown that they can affect female entrepreneurs' perception and achievement of success (Morris et al, 2006; Elam and Terjesen, 2010; Sullivan and Meek, 2012; Marlow and McAdam, 2013; Watson, Stuetzer and Zolin, 2017; Hailemariam and Kroon, 2018; McAdam, 2023), working hours (full time: yes/no), work from home (yes/no) and age (up to 49, more than 50 years) are included as control variables.

3.3 Methods

For evaluating the first hypothesis, descriptive statistics is used. To examine whether there is a dependence between the importance of a certain indicator of success for female entrepreneurs and their success measured by that indicator, the Chi-Square test of independence is applied. As the distribution of answers for each of the mentioned variables significantly deviates from the normal distribution, independence testing is based on the non-parametric test. Though usually applied when examining the dependence between two categorical variables, the Chi-Square test is also used when ordinal variables are not normally distributed. We use Spearman's correlation coefficient to assess the direction of correlation between variables. SPSS v. 29 is used as technical support.

4. Results and Discussion

Except for one outcome related to the realization of personal wealth, all other indicators of business success have an average score higher than 4, and half of the indicators have an average score higher than 4.5 (Table 1). Moreover, the median is not less than 4 for any indicator, while half of the business success indicators have a median of 5. This means that female entrepreneurs strongly agree that business success has many forms, so it cannot be limited to achieving financial outcomes. Our results suggest that women understand success as a multidimensional variable that needs to be measured and expressed in different terms. Overall, the results confirm that women entrepreneurs value a broad scope of business success outcomes (Sullivan and Meek, 2012), which validates our first hypothesis.

There is a statistically significant relationship between how women perceive business success and how successful they are (Table 2). The more female entrepreneurs understand success through the prism of a certain indicator, the more successful they are, measured by the same indicator. This holds for all the indicators of success evaluated in this study. In most cases, this relationship is not affected by female entrepreneurs' age, or whether they work full-time or from their home. Therefore, the second hypothesis is confirmed as well.

Table 1: Women entrepreneurs' perceptions of business success

What it means to achieve success in business (1-totally disagree; 5-totally agree)	Mean	St. deviation	Median
Income and profit increase	4.29	0.868	4.5
Employment increase	4.24	0.929	4.0
Personal wealth	3.51	1.220	4.0
Personal achievement and development	4.53	0.729	5.0
Reputation in the community	4.00	1.069	4.0
Customer satisfaction and loyalty	4.73	0.553	5.0
Satisfaction and relations with employees, suppliers, customers	4.71	0.559	5.0
Family-business balance	4.62	0.640	5.0
Contribution and value for the community	4.50	0.743	5.0

In some cases, female entrepreneurs' working hours influence the association between their perceptions and achievement of success. The results indicate that the relationship between the perception of success as an increase in income, profit, employment, and personal wealth, on the one hand, and the achievement of such success, on the other, exists only when female entrepreneurs work full-time. Similarly, there seems to be no relationship between the achieved and the success perceived as reputation in the community, in the group of female entrepreneurs who do not work full-time. This indicates a moderating effect of working hours. Also, it seems that for the association between understanding and achieving (primarily) financial outcomes of business success, the working time of female entrepreneurs is more important than working from home. While shorter working hours can disrupt this connection, the association is not affected by whether female entrepreneur works from home or not.

The connection between the perception and achievement of business success exists in each of the two female entrepreneurs' age groups, in all cases, except when success is perceived and achieved as an increase in employment. In this case, the greater importance of employment growth as a measure of success is associated to a higher level of achieving this aspect of business success, but only in the group of older female entrepreneurs (50+).

By showing that female entrepreneurs appreciate a wide set of success outputs and that there is a connection between the way they perceive and the level at which they achieve success in terms of the same output, our findings support the argument that the set of measures of entrepreneurial business success should be expanded (Henry, Foss and Ahl, 2016; Watson, 2020; McAdam, 2023), because women entrepreneurs perceive success in many different ways (Sullivan and Meek, 2012; Cabrera and Mauricio, 2017; Hailemariam and Kroon, 2018; Lockeyer, Hoyte and Dewitt, 2018; Henry et al, 2021). Moreover, the results suggest that the hypothesis of their underperformance should be critically re-examined (Ahl, 2006; Marlow and McAdam, 2013; Dean et al, 2019; Treanor, 2022). So, when we find that female entrepreneurs achieve lower incomes or profits, or that they have fewer employees, it may be because they do not perceive success in those terms and, therefore, do not strive to achieve these outcomes. We should take this possibility into account when designing our research and interpreting research results.

Table 2: Relationship between women entrepreneurs' perception and achievement of business success

	All entrepreneurs		Full working time		Work from home		Age	
	n=300		Yes (n=263)	No (n=37)	Yes (n=139)	No (n=161)	49 (n=144)	50+(n=156)
Income and profit increase	χ^2(sig.)	90.56(<.001)	76.68(<.001)	16.31(.178)	130.01(<.001)	26.96(.042)	30.59(.015)	84.54(<.001)
	r_s(sig.)	.173(.003)	.145(.019)	.256(.126)	.317(<.001)	.063(.431)	.113(.179)	.225(.005)
Employment increase	χ^2(sig.)	40.46(<.001)	38.50(<.001)	6.27(.712)	26.63(.046)	28.83(.025)	18.82(.278)	38.16(.001)
	r_s(sig.)	.130(.025)	.102(.099)	.158(350)	.182(.032)	.077(.332)	.042(.621)	.206(.010)
Personal wealth	χ^2(sig.)	147.30(<.001)	149.30(<.001)	10.52(.838)	85.24(<.001)	73.81(<.001)	47.14(<.001)	119.22(<.001)
	r_s(sig.)	.482(<.001)	.511(<.001)	.163(336)	.614(<.001)	.377(<.001)	.409(<.001)	.533(<.001)
	χ^2(sig.)	71.25(<.001)	61.45(<.001)	15.85(.045)	50.40(<.001)	27.85(.001)	22.63(.007)	51.22(<.001)

	All entrepreneurs		Full working time		Work from home		Age	
	n=300		Yes (n=263)	No (n=37)	Yes (n=139)	No (n=161)	49 (n=144)	50+(n=156)
Personal achievement and development	r_s(sig.)	.281(<.001)	.272(<.001)	.330(.046)	.258(.002)	.295(<.001)	.261(<.001)	.292(<.001)
Reputation in the community	χ^2(sig.)	146.4(<.001)	158.40(<.001)	12.66(.394)	107.74(<.001)	100.08(<.001)	49.86(<.001)	128.64(<.001)
	r_s(sig.)	.517(<.001)	.570(<.001)	.119(.484)	.539(<.001)	.505(<.001)	.493(<.001)	.516(<.001)
Customer satisfaction and loyalty	χ^2(sig.)	54.18(<.001)	48.82(<.001)	17.66(.007)	44.98(<.001)	35.23(<.001)	19.86(.019)	55.60(<.001)
	r_s(sig.)	.395(<.001)	.406(<.001)	.338(.041)	.404(<.001)	.385(<.001)	.286(<.001)	.503(.001)
Satisfaction and relations with employees, suppliers, customers	χ^2(sig.)	73.73(<.001)	70.72(<.001)	12.32(.015)	59.78(<.001)	34.77(<.001)	23.64(.005)	61.74(<.001)
	r_s(sig.)	.434(<.001)	.459(<.001)	.265(.112)	.445(<.001)	.419(<.001)	.322(<.001)	.545(<.001)
Family-business balance	χ^2(sig.)	52.97(<.001)	53.60(<.001)	16.47(.036)	28.86(<.001)	29.69(.003)	24.17(.019)	41.49(<.001)
	r_s(sig.)	.357(<.001)	.251(<.001)	.345(.036)	.343(<.001)	.369(<.001)	.288(<.001)	.427(<.001)
Contribution and value to the community	χ^2(sig.)	84.32(<.001)	84.16(<.001)	17.49(.042)	56.92(<.001)	38.14(<.001)	45.45(<.001)	63.40(<.001)
	r_s(sig.)	.408(<.001)	.450(<.001)	.309(.063)	.471(<.001)	.349(<.001)	.338(<.001)	.456(<.001)

5. Conclusion

By investigating women entrepreneurs in under-researched contexts such as manufacturing and a developing country, this study reveals that business success is a multifaceted phenomenon for women entrepreneurs. Moreover, results show that there is an association between how women entrepreneurs perceive success and the level of their success. The greater the importance of a certain indicator for measuring business success, the more successful female entrepreneurs will be, measured by that indicator. Therefore, the study argues that we should first be aware of how women entrepreneurs understand success. Then, we should relate women entrepreneurs' understanding of success to their achievements. In this way, we may find out that they actually achieve what they consider a success. That does not make them underperformers. On the contrary, if we dislocate ourselves from the imposed and prevailing understanding of business success, we may find that female entrepreneurs are as successful as their male counterparts. Therefore, we have to be very careful in labelling women entrepreneurs as underperformers, thus making them subordinated and discouraging other women from entering entrepreneurship.

In arguing this, we are not downplaying the importance of the barriers faced by female entrepreneurs in achieving (financial) success. Hence, we are not questioning the argument that the performance of female entrepreneurs is restrained. Moreover, the study does not address the question of why female entrepreneurs have certain perceptions of success. Although aware of this, we are not dealing with the social imperatives, assigned roles, and other elements of a social and cultural background that shape female entrepreneurs' perceptions of business success. Instead, the study points out the necessity to expand the set of measures of entrepreneurial success, and to demasculinize the field, both in the methodological and in the discursive sense. When this is done, the myth of underperformance will prove to be just that, a myth. A hypothesis that is not sufficiently or adequately supported by evidence.

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The Effect of Social Media Marketing on Consumers' e-Waste Recycling Intention to Participate: The Case of the Vietnamese Market

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Abstract: According to the United Nations, the world generates about 61.3 million tons of electronic waste yearly, increasing at a significant rate of 3-5% per year, with nearly $10 billion of precious metals wasted in e-waste. In contrast, global recycling rates fall to approximately 17%. Improper e-waste dismantling leads to severe health hazards, environmental issues, and resource conservation. Therefore, handling e-waste correctly is the top priority that needs to be addressed, and recycling is the safest and most effective method. This study adopts the SOR model to examine the effect of social media marketing on consumers' intention to participate in e-waste recycling programs. The study utilized data from 345 Vietnamese consumers, as the nation is recognized for the rapid increase in discarded electronic products. SmartPLS 4.0 was used to analyze the collected data. The findings highlight the use of social media marketing in influencing consumers' recycling intention and reveal a sequential mediation in which social media marketing impacts consumers' e-waste recycling intention through the link of consumers' attitudes and perceived behavioral control. This study contributes to existing knowledge by highlighting social media marketing as a critical tool for promoting consumers' recycling practices. The sequential mediation found in the study suggests a practical marketing strategy for policymakers and businesses to encourage consumers to maintain their e-waste intention to participate.

Keywords: E-waste recycling, SOR, Social media marketing, Vietnam

1. Introduction

Global electrical and electronic waste is alarmingly growing, as Forti (2020) predicted, to reach 74 million tons by 2030, doubling the amount from 2014. Electronic waste worldwide can be processed through formal or informal recycling systems. Formal e-waste recycling, which requires cutting-edge equipment to recover salvageable materials properly, is costly. Developing countries use informal recycling procedures to collect resources from e-waste, exposing workers to the harmful contents of e-waste. This improper e-waste processing begets significant disruptions to community health, environmental issues, and resource preservation. Therefore, the expanding global efforts in e-waste recycling aim to strictly manage the sources of e-waste to minimize negative impacts on environments and communities. Hence, consumers' involvement in e-waste recycling plays a crucial role in sustainable development.

Social media is becoming popular with most people, and it is an effective means for organizations and governments to convey messages about sustainable development. However, the impact of marketing messages for e-waste recycling practices on consumers' habit of recycling has been inadequately examined. We adopt the Stimuli-Organism-Response framework to investigate the effects of social media marketing on pro-environmental behavior in the context of e-waste recycling. We propose that social media marketing influences consumers' habits through its impact on shaping their attitudes and perceptions of behavioral control. The study also adds insights into the practices in Vietnam, a developing country with increasing e-waste. Based on our results, the government and businesses could develop initiatives that motivate e-waste recycling more effectively and encourage consumers to engage more actively in e-waste programs.

2. Theoretical Background

Stimulus-Organism-Response (SOR) theory was a psychological behavior theory developed by Mehrabian and Russell in 1974, focused on exploiting the influence of stimulus factors on an individual's behaviors. The stimulus factor in this model refers to external variables, Organisms represent consumers' emotions and perceptions, and Response refers to their reactions after receiving stimulus and self-awareness. This model describes the closed connection between Stimulus-Organism-Response; when stimulus factors influence the individual's attitude and perception, they will have a response-like behavior (Mehrabian and Russell, 1974; Jacoby, 2002; Shen and Khalifa, 2012). In the context of sustainability, especially in the e-waste context, social

media marketing is still unexplored as a stimulus factor to promote the recycling intention of consumers. Moreover, researchers have found conflicting effects of social media marketing on consumers' behavior (Karimi et al., 2021; Nekmahmud et al., 2022; Trivedi et al., 2018; Ying & Wang, 2019), which suggests a potential for a mediation effect. Adopting this SOR framework, this study considers the attitude and perceived behavioral control for e-recycling practices as the mediators that transfer the impact of social media marketing on consumers' intention to participate in e-waste recycling.

3. Hypotheses Development

3.1 Social Media Marketing

Social media marketing (SMM) is a business's marketing campaign to disseminate content to consumers and is considered a practical option for advertisers in the digital economy (Lee et al., 2018). It has been shown to positively influence consumers' behavior to engage in pro-environmental behavior (Hynes and Wilson, 2016; Minton et al., 2021). This effect is due to the information and entertainment that advertisements communicate to consumers and the two-way communication between the advertisers and consumers (Dao et al., 2015). The information regarding e-waste programs included in social media marketing highlights the environmental value of recycling practices. Therefore, it is proposed that the following:

H1(+): Social media marketing has a positive impact on consumers' intention to participate in e-waste recycling programs

Minton et al. (2012) showed that advertising on social media promotes consumers' green behavior for recycling, green transportation, organic food, recycling, charity, and anti-materialism by emphasizing their motives for involvement in green practices. As attitude is an association between an object and an evaluation of the object (Fazio, 1995), customers likely form positive perceptions toward recycling when interacting with green advertisements on social media platforms. Therefore, it is offered that:

H2(+): Social media marketing has a positive impact on attitudes toward e-recycling

Perceived behavioral control is the individual's assessment of the difficulty or ease of performing a behavior (Ajzen, 1985). This construct is based on the individual's confidence in performing a practice. The more resources and opportunities an individual has to perform an activity, the more favorable the environment, the fewer constraints to adopt the behavior, and the greater the perceived control of behavior. Sustainable advertising often provides information on green issues to promote supportive behavior (Liu et al., 2022). Social media allows two-way communication between the organization and consumers so they can seek information and clarify concerns over the practices for recycling (Rosenthal and Linder, 2021). Consumers can gain more confidence in the practice with sufficient information on what to do and how to recycle. Therefore, it is suggested that:

H3(+): Social media marketing positively impacts perceived behavioral control.

3.2 The Effects of Attitude and Perceived Behavior Control

E-waste products refer to all electrical and electronic equipment the owner discards with no intention to reuse. Examples of e-waste are tablets, monitors, mobiles, computers, notebooks, refrigerators, washing machines, digital cameras, power cords, banks, desktops, memory cards, laptops, and speakers. E-waste recycling includes routine cleaning, storing, sorting, moving, separating, disassembling, upgrading, returning, incinerating, disposing, reusing, giving or donating, or selling the wasted product (Aboelmaged, 2021). In the e-waste literature, attitude and perceived behavioral control affect the intention to participate in e-waste recycling (Thukral et al., 2022). Therefore, it is offered:

H4(+): Consumers'attitude toward e-waste recycling is positively associated with their intention to participate in e-waste recycling

H5(+): Consumers'perceived behavioral control toward e-waste recycling is positively associated with their intention to participate in e-waste recycling

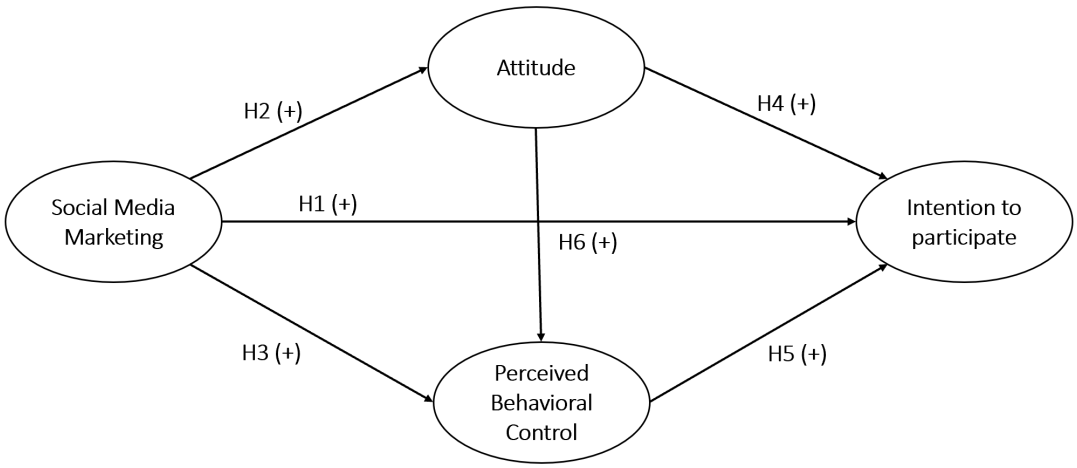


Figure 1: Conceptual model

Minton et al. (2012) showed that contemporary consumers have now passed the point where they are committed to green practices for rewards and become more actively involved in sustainable actions. This intrinsic motivation for sustainability is linked with a positive attitude toward recycling and can motivate consumers to seek information on processing recyclable wastes (Rosenthal & Linder, 2021). More information on practical solutions can help consumers gain confidence in their practices. Therefore, it is proposed that:

H6(+): consumers' attitude toward e-waste recycling is positively associated with their Perceived Behavioral Control of e-recycling

4. Methodology

4.1 Data Collection and Sampling

The study used a convenient sampling technique to collect data. We surveyed 345 consumers from December 21, 2023 to January 6, 2024. Respondents live in Ho Chi Minh City, where e-waste issues are becoming more serious, and the consumers' awareness of these issues has not been high. A Google Forms was distributed to young consumers active on social media platforms.

Table 1 Shows the sample demographic, the proportion of females to males is one to one (51.1% and 48.9% respectively). This gender structure is similar to the gender ratio in Ho Chi Minh City (48.7% for males and 51.3% for females). Most of the responses are from university students between 19 and 25, with monthly income below 10,000,000 VND (approximately equivalent to US$400) and the frequency of their exposure to sustainability content on social media.

4.2 Measurement of Constructs

The study used a total of four constructs, including Social Media Marketing (7 Indicators) adapted from Nekmahmud et al. (2022), the other three constructs of attitude toward e-waste recycling (6 Indicators), Scales to measure Perceived Behavioral Control (7 Indicators) and intention to participate in e-waste recycling programs (5 Indicators) were adopted from Sari et al., (2021). All constructs were measured by a Five-point Likert scale, ranging from 1 for "Strongly disagree" to 5 for "Strongly agree".

Table 1: Demographic Statistics

Variable	Category	Frequency	Percentage
Gender	Male	146	42.3
	Female	199	57.7
Age Group	15-18	74	21.4
	19-25	271	78.6
Education	Secondary School	15	4.3
	High School	17	4.9
	College	6	1.7
	University	301	87.2
	Master's degree or higher	6	1.7
Monthly Income (VND)	< 10,000,000	312	90.4
	10,000,000 - 20,000,000	24	7.0
	20,000,001 - 30,000,000	4	1.2
	30,000,001 - 40,000,000	3	.9
	> 40,000,000	2	.6
Frequency	Never	6	1.7
	Rarely	40	11.6
	Sometimes	161	46.7
	Usually	106	30.7
	Every day	32	9.3

4.3 Analysis Methods

SPSS 25 software was used to clean the collected data and show the sample descriptions. After that, we used SmartPLS 4.0 software to analyze measurement and structural models. The partial least squares structural equation modeling (PLS-SEM) method was used to evaluate the structural model. Data was first analyzed to assess the inner model for the validity and reliability of the constructs. Subsequently, the model was assessed using criteria of R2, f2, and coefficients of relationships in the model.

5. Data Analysis and Results

5.1 Measurement Model

Cronbach's alpha and composite reliability were used to assess datasets' reliability and internal consistency. All variables have Cronbach's Alpha coefficient values and Composite Reliability values exceeding 0.7 and lower than 0.9, demonstrating that the latent variables have qualified internal consistency and reliability (Hair et al., 2014). Item removal was made to ensure the convergent validity of the constructs. The final measurement model satisfies all thresholds for Cronbach's Alpha, Composite Reliability, and AVE, as shown in Table 2. Discriminant validity of the constructs is shown in Table 3 and Table 4.

5.2 Structural Equation Model

Figure 2 shows the variation of endogenous variables. The model can explain 58.4% of the variance of intention to participate, 23.1% of the variance of attitude, and 34.5% of perceived behavioral control.

Social media marketing positively influences intention to participate with a small effect size (β=0.137; p=0.010, f^2=0.034). Therefore, hypothesis H1 is accepted. Social media marketing also has a positive impact on attitude (β=0.484; p <0.001, f2=0.3) and on Perceived Behavioral Control (β=0.227; p <0.001, f2=0.06). It can be seen that social media marketing has a more substantial effect on Attitude ($f2$ = 0.30) compared to the relationship with Perceived Behavioral Control ($f2$ = 0.061). These results support both hypotheses H2 and H3. Results show that both attitude and perceived behavior control have influence on E-waste Recycling intention to participate with a large effect size (β=0.418; p < 0.001, $f2$ = 0.153), while Attitude has a positive effect on the intention with a medium effect size (β=0.358; p < 0.001, $f2$ = 0.214) (see Figure 2).

The impact of Attitude on Perceived Behavioral Control is also significantly positive with a medium effect size (β=0.443; p < 0.001, $f2$ = 0.231), confirming H6.

Table 2: Factor loading, the Cronbach's alpha, CR, and AVE values

Variables	Indicators	Loading Factor	Cronbach's Alpha	Composite Reliability	AVE
Attitude	AT1	0.718	0.837	0.881	0.552
	AT2	0.743			
	AT3	0.741			
	AT4	0.788			
	AT5	0.754			
	AT6	0.710			
Perceived Behavioral Control	PBC2	0.654	0.763	0.841	0.516
	PBC4	0.697			
	PBC5	0.800			
	PBC6	0.779			
	PBC7	0.648			
Social Media Marketing	SMM1	0.690	0.899	0.921	0.625
	SMM2	0.704			
	SMM3	0.803			
	SMM4	0.834			
	SMM5	0.842			
	SMM6	0.817			
	SMM7	0.830			
E-waste recycling intention to participate	IP1	0.808	0.850	0.893	0.625
	IP2	0.759			
	IP3	0.787			
	IP4	0.775			
	IP5	0.823			

Table 3: Fornell-Larcker Criterion

	AT	IP	PBC	SMM
AT	0.743			
IP	0.344	0.799		
PBC	0.575	0.478	0.718	
SMM	0.484	0.268	0.459	0.791

Note: SMM stands for social Media Marketing, AT stands for attitude, PBC stands for perceived behavioral control, and IP stands for intention to participate in e-waste recycling. The square root of AVE for discriminant validity is placed along the diagonal; off the diagonal are the correlations among constructs.

Table 4: Heterotrait-Monotrait ratio (HTMT)

Variables	Item Indicators	Correlations			
		AT	IP	PBC	SMM
AT	6				
IP	5	0.440			
PBC	5	0.711	0.642		
SMM	7	0.549	0.329	0.551	

Note: SMM – Social Media Marketing, AT – attitude; PBC – perceived behavioral control; IP - E-waste recycling intention to participate.

Table 5: Specific indirect effects (mediation analysis)

Path	β	SD	T statistics	P value
SMM – PBC - IP	0.107	0.033	3.268	0.001
SMM – AT – PBC – IP	0.100	0.020	5.088	0.000
SMM – AT – IP	0.149	0.032	4.668	0.000
SMM – AT – PBC	0.213	0.043	4.960	0.000
AT – PBC – IP	0.209	0.033	6.279	0.000

Note: SMM – Social Media Marketing, AT – attitude; PBC – perceived behavioral control; IP - E-waste recycling intention to participate.

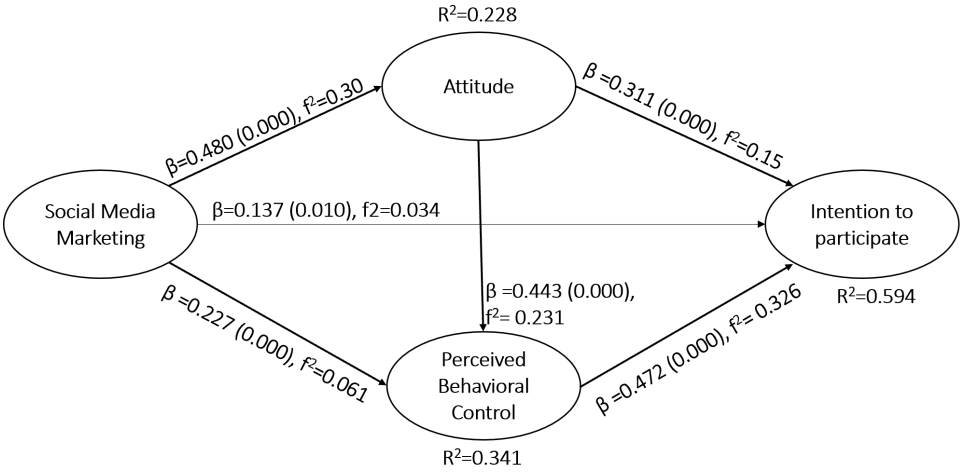


Figure 2: Testing results

6. Discussions

Adopting the Stimuli-Organism-Response theory, this study investigated the effect of social media marketing on consumers' intention to participate in an e-waste recycling program. While social media marketing has been found to influence consumers' sustainability behavior (Nekmahmud et al., 2022; Ying and Wang., 2019), its effect on e-waste recycling has not been adequately explored.

The findings of this study emphasized the use of social media marketing in promoting appropriate recycling practices for consumers. While only 20% of e-waste produced was recognized, collected, and recycled in 2018, the findings of this study point out an essential factor that promotes proper e-waste recycling practices. The result shows that social media marketing influences consumers' intentions through its effect on attitudes toward e-waste recycling. This is consistent with previous research that has confirmed this effect in various green contexts, such as food waste (Teoh et al., 2021), and green cosmetics (Pop et al., 2020). The findings of the study also corroborate with previous studies that point out that social media marketing affects pro-environmental behavior (Karimi et al., 2021) through perceived behavior control. An important of this study is to show that attitude positively impacts perceived behavioral control, revealing a sequential mediation effect transfering the effect of social media marketing on consumers' intention to participate in e-waste recycling programs.

This study focused solely on individuals aged 19 to 25 in HCMC. While this sample size was statistically significant, potential limitations exist in the generalizability of the findings to other demographics or areas. Future studies could broaden the location and age range to understand consumers' habits better. Moreover, our research only examined one external factor influencing internal factors that shape consumers' e-waste recycling habits. Future research should incorporate more factors to offer a more comprehensive understanding of the determinants of consumers' e-waste recycling behaviors.

7. Conclusion

The study investigates the effect of social media marketing on consumers' intention to participate in e-waste recycling programs. Adopting the SOR theory, the study reveals that social media marketing impacts consumers' participation intention through a series of mediation effects: attitude toward recycling, perceived behavioral control of recycling activities, or the linkage between attitude and perceived behavioral control. These findings emphasize the use of information in social media marketing to highlight the values of recycling activities and make consumers perceive their recycling practices as feasible and convenient. This insight assists policymakers and businesses in developing and promoting social marketing campaigns related to sustainability and the environment, thereby fostering the formation of e-waste recycling intention among consumers.

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Appendix A

Construct	Item	Measurement	Reference
Intention to participate	IP1	I plan to participate in e-waste recycling programs by bringing my used electronics to recycling centres	(Sari et al., 2021)

Construct	Item	Measurement	Reference
	IP2	I am willing to participate in e-waste recycling programs by bringing my used electronics to recycling centers	
	IP3	I would consider participating in e-waste recycling programs by bringing my used electronics to recycling centers	
	IP4	I hope to participate in e-waste recycling programs by bringing my used electronics to recycling centers	
	IP5	I want to participate in e-waste recycling programs by bringing my used electronics to recycling centers	
Perceived Behavioral Control	PBC1	I feel uncomfortable participating in e-waste collection programmes by bringing my used electrical devices to recycling programmes.	(Sari et al., 2021)
	PBC2	The decision of whether I participate in e-waste recycling programmes or not is entirely up to me.	
	PBC3	I do not know how to participate, but I want to participate in the e-waste recycling programmes.	
	PBC4	I have the resources, time, will, and opportunity to participate in e-waste recycling programmes by bringing my used electrical devices to recycling programmes.	
	PBC5	I believe that if I want, I can participate in e-waste recycling programmes by bringing my used electrical devices to recycling programmes.	
	PBC6	I believe that I can participate in e-waste recycling programmes by bringing my used electrical devices to recycling programmes.	
	PBC7	I feel that participating in e-waste recycling programmes by bringing my used electrical devices to the recycling programmes is not entirely within our control.	
Attitude toward sustainability	ATT1	I think e-waste recycling programmes by bringing my used electronic devices to recycling programmes is useful and profitable.	
	ATT2	I think participating in e-waste recycling programmes by bringing my used electronic devices to recycling programmes is important for protecting the environment.	
	ATT3	I think participating in e-waste recycling programmes by bringing my used electronic devices to recycling programmes is useful for reducing natural resource shortages.	
	ATT4	I think participating in e-waste recycling programmes by bringing my used electronic devices to recycling programmes is a good idea.	
	ATT5	I like the idea of participating in e-waste recycling programmes by bringing my used electronic devices to recycling programmes.	
	ATT6	I support participating in e-waste recycling programmes by bringing my used electronic devices to recycling programmes.	
Social Media Marketing	SMM1	I receive information from people on social media that e-waste recycling programmes can contribute to human health and protect the environment.	
	SMM2	Using social media to search for information about e-waste recycling programmes that I am thinking about buying is very fashionable.	
	SMM3	I would like to share information from social media about e-waste recycling programmes with my friends.	
	SMM4	Social media marketing is a good source of e-waste recycling programmes information and supplies relevant programmes information.	
	SMM5	Social media advertising about e-waste recycling programmes provides timely information.	
	SMM6	Social media advertising is a good source of up-to-date e-waste recycling programmes information.	
	SMM7	Social media advertising is a convenient source of e-waste recycling programmes information.	

Factors Affecting Entrepreneurial Activity in an Emerging Economy in the Case of Turkey: The Role of the COVID-19 Pandemic

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Abstract: This paper seeks to study factors influencing the early stages of entrepreneurship within the context of coronavirus pandemic, specifically within an emerging country. We utilize from a unique dataset collected by Global Entrepreneurship Monitor which is the sole global research repository compiling data on entrepreneurial activities and individual entrepreneurial attributes across 50 countries worldwide. In particular, this study focuses on the GEM survey data pertaining to Turkey during the period coinciding with the COVID-19 pandemic in the year 2021. The analysis is done by binary logistic regression with dependent variable being total entrepreneurship activity. Findings indicate that opportunity-driven respondents, with high-status aspirations, possessing necessary skills and acknowledging the challenges of their entrepreneurial environment, are the ones who show a higher probability of engaging in entrepreneurial activities. While these variables have been scrutinized in existing literature, our contribution lies in examining their effects within an emerging market, a relatively understudied context, particularly in the aftermath of a global pandemic. Results suggest that the individuals reporting a substantial increase in income during the pandemic, and perceiving a harder business environment to start a new venture show elevated probabilities of becoming an entrepreneur. These two are the pandemic-related variables demonstrating statistical significance, which highlights the fact that this period created its entrepreneurs, who exploit high resilience and dynamic capacity to adapt to crisis times. They experienced a significant increase in their income, capitalized on their comparative advantage in entrepreneurial skills within an environment where starting a business is not easy and took advantage of the opportunities seeking for high status using their adaptive capacity. These findings are consistent with Theories of Resilience and Dynamic Capabilities. Finally, younger respondents are more inclined to engage in entrepreneurial activity, which is consistent with the existing literature. In light of these findings, policymakers are encouraged to invest in educational programs for potential entrepreneurs to enhance their self-efficacy, given that the necessary skills for business initiation emerge as a pivotal factor for engaging in entrepreneurial activities. Moreover, creating platforms for successful entrepreneurs to share their experiences could amplify the perceived prestige associated with entrepreneurship, which may attract potential entrepreneurs.

Keywords: Covid-19, GEM data, Total early entrepreneurial activity, Resilience theory, Dynamic capabilities

1. Introduction

Entrepreneurship, both as a process and at the individual level, involves multiple phases: from the initial gestation phase to the established phase or the discontinuation phase. An entrepreneur can be someone who is just starting a business and striving to survive in the market, or someone who has owned an established business for many years. According to Reynolds et al (2005), early stage entrepreneurs are those who are actively engaged in starting or managing a business that they own wholly or partly, and which is less than three and a half years old. Established entrepreneurs, on the other hand, are those who own and manage a business that has been paying wages or salaries for more than three and a half years (Bosma and Harding, 2007). Early-stage entrepreneurship reflects the dynamic entrepreneurial potential of a country, indicating the percentage of the population that is willing and able to embark on entrepreneurial ventures (Özdemir and Karadeniz, 2011).

Covid-19 is a crisis that can be considered as deeper than the 2008-2012 financial crisis (Liñán and Jaén, 2022). The Turkish entrepreneurial environment, like those in other countries, has been significantly impacted by the COVID-19 pandemic. Significant drops as a result of losing current clients and finding it difficult to get new ones in Turkish manufacturing output were seen in several important industries, such as clothes, textiles, and automobiles, with some companies closing. The unpredictability of the epidemic has also increased investor caution, which has an impact on start-up investment. Some venture capitalists (VCs) have moved their focus to industries like health, online education, and hygiene goods, while others have focused on sustaining existing portfolio businesses. Demand and supply have both suffered from lower consumer demand for specific products and supply chain disruptions brought on by operational halts and quarantines.

Positive advancements have occurred despite these obstacles, especially with regard to the transition to online business models. Several companies that had not previously sold products online swiftly made the transition by

creating mobile applications, providing touchless delivery option, and encouraging contactless payments. With government measures supporting TV-based distance learning, educational institutions quickly made the switch to online platforms. Through cooperative initiatives within the entrepreneurial ecosystem, new firms tackling pandemic-related problems have emerged, and creative solutions have been developed. Health-related start-ups producing critical supplies like testing kits and ventilators have received substantial governmental support, highlighting the resilience and adaptability of Turkish entrepreneurs during this crisis.

This paper examines the factors affecting total early entrepreneurial activity in an emerging economy, Turkey, in the post-covid-19 period. Further, by comparing the effect of same variables in the pre- and post-pandemic period, the paper presents the difference between these two periods, underlying the divergence of the relationships between certain variables in the post-pandemic period. We use Global Entrepreneurship Monitor data for the periods 2018 and 2021 and aim to determine the factors affecting early entrepreneurial activity in Turkey. Our contribution to the literature is threefold; 1) studying early-stage entrepreneurial activity in an emerging economy, 2) examining the effects of covid-related variables to this activity, 3) explaining early entrepreneurial activity basing our arguments on entrepreneurs' resilience and dynamic capabilities. To the best of our knowledge, no empirical studies have directly examined the impact of the COVID-19 pandemic on early-stage entrepreneurship activity in an emerging economy with an explanation based on resilience and dynamic capabilities of entrepreneurs. Our paper aims to address this gap in the literature.

2. Theoretical Framework

2.1 Resilience and Dynamic Capabilities Theories

The COVID-19 pandemic profoundly impacted global economies, presenting businesses with unprecedented challenges. Resilience theory (RT) provides a framework for understanding how entrepreneurs identified and capitalized on new opportunities amidst uncertainty and rapidly changing market conditions. Key elements like adaptive capacity, diversity, and learning enabled entrepreneurs to identify and pursue new opportunities. Those who quickly adjusted strategies, diversified revenue streams, and learned from setbacks were more likely to succeed. Understanding and applying these principles is crucial for businesses to navigate future disruptions and thrive in a post-pandemic economy. This theory emphasizes absorbing shocks, adapting to new circumstances, and transforming systems to flourish in a changed environment. Adaptive capacity, the ability to reorganize structures, strategies, and behaviors in response to external changes while preserving core functions (Walker et al, 2004), proved critical. Entrepreneurs with strong adaptive capacity pivoted their business models to meet evolving market demands, such as transitioning to remote services or online delivery during lockdowns. Kuckertz et al (2020) highlight that startups with a digital-first approach swiftly adopted virtual communication tools and focused on online services like e-learning, telehealth, and fitness classes. Entrepreneurs with strong business skills and industry-specific knowledge rapidly pivoted their models, leveraging digital marketing, logistics, and customer engagement. Resilient, adaptable, and resourceful entrepreneurs garnered significant respect for navigating the pandemic's challenges.

Dynamic capabilities (DC) are defined as a firm's ability to integrate, build, and reconfigure internal and external competencies to address rapidly changing environments, enabling new and innovative competitive advantages (Teece et al, 1997). Emerging from strategic management literature, DCs explain how current resources can be exploited to adapt to change (Ambrosini and Bowman, 2009). In volatile and uncertain environments, DCs are crucial for integrating resources and recognizing new opportunities, generating economic value by replacing old structures with new ones (Schumpeter, 1994). Entrepreneurs' responses depend on their ability to adapt resources (Teece, 2012). Focusing on capabilities enhances understanding of firm recovery (Sullivan-Taylor and Branicki, 2011). Managerial perceptions of environmental change are crucial in utilizing DCs, leading to different capabilities deployment in similar uncertain environments (Aragon-Correa and Sharma, 2003). Post-pandemic, entrepreneurs who deploy necessary DCs can adapt to new business environments. DCs explain how entrepreneurs identify and pursue new opportunities during crises like the COVID-19 pandemic, helping businesses survive (Eisenhardt and Martin, 2000). This concept serves as a useful tool for understanding factors affecting early entrepreneurial activities.

2.2 Hypotheses

Opportunity recognition is central to entrepreneurial activity, as highlighted in the literature (Bird, 1988; Eckhardt and Shane, 2003; Shane and Venkataraman, 2000). Entrepreneurs motivated by profits, innovation, and growth are termed "opportunity-driven" (Schade & Schuhmacher, 2023). These opportunities often arise from changes in policies, socio-economic structures, technologies, or the environment (George et al, 2016; De

Massis et al, 2018). Covid-19, while challenging, also presents entrepreneurial opportunities that require acknowledgment and action. However, negative emotions in crisis conditions can hinder opportunity recognition (Chhatwani et al, 2022). Post-Covid-19, resilient individuals can leverage their entrepreneurial mindset to find opportunities (Zahra, 2020). Dynamic capabilities theory also emphasizes the importance of adapting and identifying opportunities in volatile environments (Battisti & Deakins, 2017). Combining resilience and dynamic capabilities theories suggests that recognizing opportunities quickly and effectively, especially during crises, offers a comparative advantage in entrepreneurship. Therefore, we hypothesize that;

H_1: *Opportunity recognition in the post-covid-19 period positively affects being involved in TEA activities.*

Self-efficacy also significantly affects entrepreneurial intentions, actions, and behaviors (Byod and Vozikis, 1994; Chen, Greene, & Crick, 1998). Self-confidence mediates entrepreneurial intentions and is higher among entrepreneurs (Zhao, Seibert, & Hills, 2005; Tyszka et al, 2011). Early-stage entrepreneurs often exhibit overconfidence in their abilities (Koellinger, Minniti, & Schade, 2007). Higher self-efficacy also increases the likelihood of new firm creation by the unemployed (Laguna, 2013; Verheul, Uhlaner, and Thurik, 2003). During crises like the Covid-19 pandemic, entrepreneurial resilience is crucial for success, and self-efficacy strengthens this resilience (Hedner, Abouzeedan, & Klofsten, 2011; Sharma and Rautela, 2022). Self-efficacy remains a predictor of entrepreneurial intentions under uncertainty (Bergenholtz, Klyver, and Vuculescu, 2023) and in extreme conditions like war (Bullough, Renko, & Myatt, 2014). Increased self-efficacy enhances dynamic capabilities, crucial for adapting to the changing entrepreneurial environment (Kevill, Trehan, & Easterby-Smith, 2017). Thus, we hypothesize based on resilience and dynamic capabilities theories in relation to entrepreneurial self-efficacy;

H_2: *Higher entrepreneurial self-efficacy in the post-covid-19 period positively affects being involved in TEA activities.*

Income inequality significantly impacts entrepreneurial dynamics, activity, and motivation (Halvarsson et al, 2018; Packard and Bylund, 2018; Bruton et al, 2021). Covid-19 caused significant income losses and increased uncertainty, reducing available funds for potential entrepreneurs (Almeida et al, 2021). Low-income and low-educated individuals faced the highest income and job losses globally (Bradley et al, 2020). New venture rates dropped dramatically, akin to the 40% decline during the Great Recession. However, unlike the Great Recession, where high-income households were most affected due to real estate issues, the Covid-19 crisis hit low- and medium-income potential entrepreneurs harder due to financing difficulties (Albert et al, 2023). The 2020 GEM survey included questions about income losses due to the pandemic to understand this impact. Thus, we hypothesize;

H_3: *Higher income in the post-Covid-19 period positively affects being involved in TEA activities.*

The entrepreneurial environment, including regional factors, institutional factors, and regulations, significantly affects new venture entry rates (Armington and Acs, 2002). During crises, starting a new business depends on individual factors like self-efficacy and resilience (Doern et al, 2019) and contextual factors like the crisis's depth and nature (Hofer, 1980). The pandemic exemplified a severe crisis, with businesses facing unprecedented limitations. Rescue packages had marginal effects on startups, especially in emerging economies needing urgent public health support (Salamzadeh and Dana, 2021). This situation worsened for countries like Brazil, India, Iran, Russia, Mexico, and Turkey due to less systematic markets and higher investment risks (Kawamorita et al, 2020; Salamzadeh and Dana, 2021; Ojha and Shubha, 2020).Despite adverse conditions, the pandemic created new opportunities for potential entrepreneurs, leading to either faster failure or success depending on resilience and dynamic capabilities (Zahra, 2020). A favorable business environment with fair markets, reduced startup costs (Lim et al, 2010), and effective institutions (Liu and Li, 2022) stimulates entrepreneurship. Thus, we hypothesize;

H_4: *Having a favorable perception on easiness to start a business in ones' country in the pre-covid-19 period positively affects being involved in TEA activities.*

H_5: *Having a favorable perception on easiness to start a business in ones' country in the post-Covid-19 period positively affects being involved in TEA activities.*

Additionally, we remain the highly studied status variable that measures the high status attributed to successful entrepreneurs, and add age as control variable.

H_6: *High level of status and respect attributed to successful entrepreneurs in one's country positively affects being involved in TEA activities.*

H_7: *Age negatively affects being involved in TEA activities.*

3. Data, Methodology, and Findings

We used data from Global Entrepreneurship Monitor which is originated in 1999 as a collaborative research initiative providing information regarding entrepreneurship and entrepreneurial environment in 120 countries from all over the world. We used the adult population survey data for years 2018 and 2021, which covers individual responses of 2424 and 2404 participants, respectively from Turkey. We specifically select these two years, which corresponds to the before- and after-covid period, to be able to capture the effects of pandemic on the entrepreneurial activities, in particular, early entrepreneurial activities in an emerging economy. Demographic indicators for both years are quite similar to each other. When we evaluate the basic demographic variables for 2021 in comparison with 2018; gender breakdown is almost the same, with 51% male and 49% female, for two years. Concerning age breakdown, respondents of 2021 are more clustered in 35-64 years compared to that of 2018. Hence, for the first two categories covering ages 18-34, respondents of 2018 are higher in number compared to that of 2021. Still, for both years, almost 52% of the participants fall in the 25-44 interval of age, signaling a similar distribution. Comparing the occupation answers, in 2021 we have less homemaker, unemployed, and student while have more full employed (including self- employed) and retired/disabled compared to 2018. Yet, the general breakdown is quite similar. In terms of education, first and second stage tertiary educated respondents are higher, in 2021 compared to 2018. Considering income, we divide the sample into three for both years as lowest 33% tile, middle 33% tile and upper 33% tile. In 2021, participants falling into the upper 33% tile (lower 33%) is higher (lower) than 2018 while the middle 33% tile is quite similar.

We employ a Binary Logistic Regression taking the most well-known variable of the GEM database named TEA as the dependent variable. It is a yes/no (1/0) question about whether the respondent is currently engaging in an early stage entrepreneurial activity (nascent or a new entrepreneur) or not. An early stage entrepreneurial activity corresponds to initiating a “new” business (paying salaries for at least 3 months but no more than 42 months) or actively managing enterprises that are less than 42 months old. The independent variables include entrepreneurial attitude and perceptions such as perceived capabilities, perceived opportunity, perceived high status due to entrepreneurial success, perceived easiness of starting a business. In addition, we have two variables measuring the effect of corona on individual income and on the perception about easiness of starting a new business. Opportunity perception (opport) is a yes/no (1/0) question concerning whether the respondent see good opportunities for starting a business in the next 6 months. Perceived capabilities (suskill) is a self-perception of the respondent about his/her skills and knowledge concerning starting a business, measured as 1/0 (yes/no). First pandemic variable, change in income during corona (crincome) is a 5 point scale question asking whether the coronavirus pandemic led the respondents’ household income to strongly decrease (1), or strongly increase (5). Perceived easiness of starting a business (easystart) variable is a yes/no question and indicates whether the respondent perceive that starting a new business in his/her country is easy (1) or not (0). Other corona variable measures respondents’ perception of easiness to start a business in corona times (crstart) with a 5 point scale question asking whether it is significantly easier (1) or significantly harder (5) to start a business in the respondents’ country compared to pre-covid-19 period. Perception of high status (nbstatus) indicates that if the respondent has the perception that in their country, those successful at starting a new business have a high level of status and respect (1) or not (0). Finally, we have age in 7 categories.

Figure 1 plots the responses for the effect of covid-19 pandemic on income with respect to income groups in Turkey. It is evident that pandemic comes as a negative income shock for every income group in general. Yet, we have a small group that faces an increase in their income due to pandemic. It is worth noting that a majority of those who experienced an income increase due to pandemic are from the highest income segment of the respondents. Thus, we can conclude that there is a small group of people, mostly coming from high income segment, having a positive income shock due to covid-19. This is significant as they are the ones who have a comparative advantage in terms of financial sources which may affect entrepreneurial intention and activity.

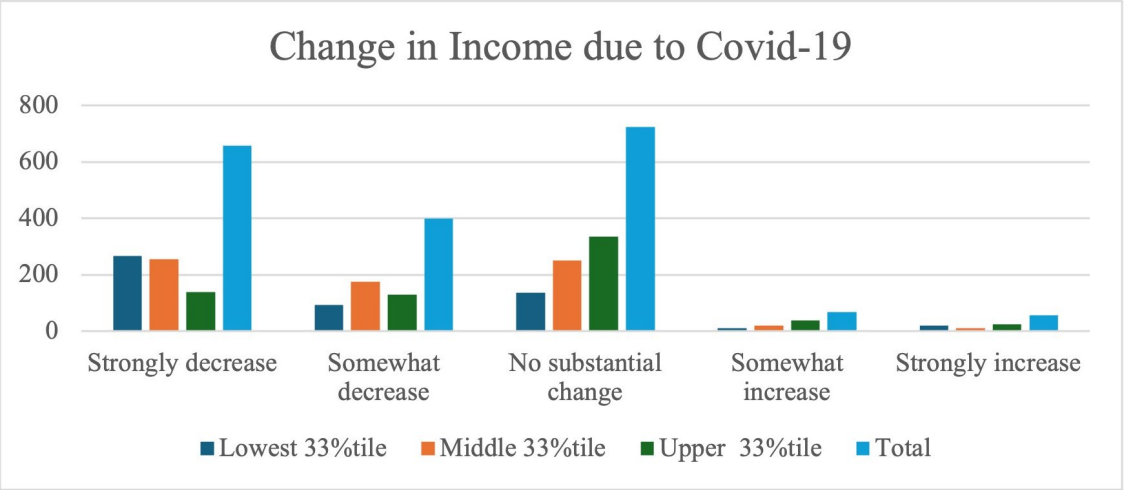


Figure 1: The effect of Covid-19 on income with respect to 3 income classes

In order to test and compare our hypotheses on core variables in the pre- and post-pandemic period, we consider 2018 and 2021 year GEM data for Turkey. We run a Binary logistic Regression taking TEA as the dependent variable and hypothesized variables; opportunity recognition (opport), self-efficacy indicating perceived skills on start-up activities (suskill), income in the post-covid-19 period (crincome), perception on easiness to start a business in the pre- and post-covid-19 period (easystart and crstart), high status attributed to successful entrepreneurs (nbstatus), and age as the independent variables for both years. Hence, following is the model we test:

$TEA=\alpha+\beta_1*opport+\beta_2*suskill+\beta_3*crincome+\beta_4*easystart+\beta_5*crstart+\beta_6*nbstatus+\beta_7*age+\varepsilon$

Although we had two sample of 2424 and 2404 respondents for 2018 and 2021 initially, our sample sizes decreased to 1574 and 17, respectively, due to missing data. Results are presented in Table I. We have good model fit, indicated by significant Chi-square values of 153.653($p<0.001$) and 33.886 ($p<0.001$) respectively. And the classification tables suggest our models predict involving in entrepreneurial activity correctly 82.8% and 69% of the time for 2018 and 2021, which are quite high accuracy rates (considering our modest sample size for the period 2021).

Results suggest that the factors influencing entrepreneurial activity changed significantly from the pre- to the post-Covid-19 period. Before the pandemic, only self-efficacy, income, and age significantly affect entrepreneurial activity. Opportunity recognition, favorable environment for start-ups, and high status associated with successful entrepreneurs are all lack explanatory power of entrepreneurial activity in the pre-Covid-19 period. However, all these three variables prove significance in the post-pandemic period.

Let us delve into the findings concerning the post-pandemic period. Literature suggests that opportunities arise from environmental shifts that create imbalances individuals can exploit (Holcombe 2003). During crises, recognizing these opportunities is expected to increase early entrepreneurial activity (Shane and Venkataraman 2000) consistent with our findings. A prevalence of necessity-driven entrepreneurs, driven by the need to meet basic needs, is expected in an emerging economy like Turkey (Estrin et al, 2019). However, our model shows that opportunity recognition positively impacts early entrepreneurial activity. Individual self-efficacy is closely linked to entrepreneurial activity and success (Krueger et al, 2000; Shane et al, 2003), which our results support. Higher income positively affects entrepreneurial intentions and early activity by reducing financial constraints confirming literature (Evans & Jovanovic, 1989). Hence, individuals who can adapt to changing entrepreneurial environment using their dynamic capabilities and adaptive capacity indicated by higher income and accumulated knowledge and skills are more probable to engage in new venture creation. Additionally, higher status perception associated with successful entrepreneurs positively influences entrepreneurial activity, particularly in individualistic economies where status provides greater utility (Liñán, Santos, and Fernández, 2011). Our findings align with this perspective.

Table 1: Binary Logistic Regression Variable Results for 2018-2021

	2018			2021		
	B	**p-value**	**Exp(B)**	**B**	**p-value**	**Exp(B)**
opport	0.206	0.160	1.229	1.206	0.006	3.339
suskill	1.602	<0.001	4.961	1.005	0.048	2.733
income/crincome	0.202	<0.001	1.224	0.357	0.048	1.429
easystart	0.148	0.337	1.159	-1.071	0.012	0.343
crstart				0.299	0.043	1.349
nbstatus	0.183	0.238	1.200	0.945	0.023	2.572
age	-0.204	<0.001	0.816	-0.243	0.096	0.784
Constant	-3.307	<0.001	0.037	-2.539	0.033	0.079
N			1579			171
Omnibus Chi-square	153.653 (p_value<0.001)			33.886 (p-value<0.001)		

On the contrary, perception of a favorable start-up environment in the country proves significance but with a negative sign. In a similar vein, pandemic variable, measuring the perception of easiness of starting a new venture compared to pre-pandemic period, proves significance with a positive sign, meaning perception of increased difficulty in starting a new business has positive effect on entrepreneurial activities. Combining these two variables, our findings suggest that individuals who think that it is not easy to start a new venture in their country and gets even more difficult in the post-pandemic period are the ones who show higher probabilities to engage in early entrepreneurial activities. These findings does not support our hypotheses and they also contradict with the vast literature suggesting a favorable business environment would have fostering effects on entrepreneurial activities (Amorós, Bosma and Levie, 2013; Kaufmann, Kraay and Mastruzzi, 2006; Klapper, Laeven and Rajan, 2006). However, these results are supported by Djankov et al (2002) which demonstrates that startup activity is generally higher when the regulatory requirements for entry are more stringent, meaning when the easiness to start a business is lower. This can also be explained by Theories of Resilience and Dynamic Capabilities as individuals with high resilient and dynamic capacity can consider such hard times as an opportunity where they can use their comparative advantage over low-income and low-skilled entrepreneurs to become successful. This may be the case for Turkey where individuals perceiving a difficult start-up environment are more probable to engage in early entrepreneurial activity. Hence, in highly challenging times of post pandemic period, opportunity-driven individuals who enjoy high resilient capacity and dynamic capabilities, supported by high self-efficacy and elevated income during this period are more probable to engage in entrepreneurial activity.

4. Discussion and Conclusion

This paper studies the factors affecting total entrepreneurial activity in an emerging economy in the post-covid-19 period. Results show that opportunity recognition, individual self-efficacy, higher income in the post-covid-19 period, and perception of higher status attributed to successful entrepreneurs positively affect the probability of engaging in total early entrepreneurial activities in the post-pandemic period. Thus, although existing literature would anticipate of Turkey as dominated by necessity-driven entrepreneurs, our results suggest that opportunity driven individuals are more probable to engage in entrepreneurial activities in the post-covid-19 period.

On the other hand, individuals who perceive a difficult entry environment for start-ups are more probable to engage in early entrepreneurial activity. Combining these results, we can infer that pandemic act as a contextual factor creating its own type of potential entrepreneurs. They recognize new opportunities and rely on their increased income in the post-pandemic period and high self-efficacy in exploiting these new opportunities in an environment where starting a new business is harder compared to pre-pandemic period. Theory of Resilience and Dynamic Capabilities can shed a light on why they are eager to exploit opportunities in challenging times. These new type of potential entrepreneurs rely on their dynamic capabilities and high resilience which enable

them to adapt to changing environments. Their high skills, knowledge, and increased income during crisis times feed their adaptive capacity and hence they show higher probabilities of engaging in new venture creation.

In light of these findings, policymakers are encouraged to invest in educational programs for potential entrepreneurs to enhance their self-efficacy, given that the necessary skills for business initiation emerge as a pivotal factor for engaging in entrepreneurial activities. It may even overcome the effect of fear of failure in a post-crisis period, in this case a global pandemic. Moreover, creating platforms for successful entrepreneurs to share their experiences could amplify the perceived prestige associated with entrepreneurship, which may attract potential entrepreneurs. Finally, increasing availability of financial funds to potential entrepreneurs can support them in their start-up activities. In the past twenty years, the significance of venture capital and similar financing methods (such as angel financing) in promoting the growth of new firms has significantly increased, both in the United States and globally, encompassing developed and emerging economies (Chemmanur and Fulghieri, 2014).

There are certain limitations to this study. First of all, this study takes only one emerging economy as sample of interest. Further studies can add other emerging countries, and can come to more generalizable conclusions, or make comparisons among them. In addition, since we could attain only 1 year data in the post-pandemic period, we could run our analysis considering only 1 year of data. Future studies can add time variation in the data and can make conclusions about the effect of recovering on total early entrepreneurial activity. Finally, due to missing data in specifically the pandemic-related question, our ending sample size is quite modest in this study. Increasing sample size would entail to more generalizable conclusions.

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Innovation Success in the European Union: Aggregate Demand Analysis

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Abstract: In the current period of uncertainty in the European Union, innovation is becoming a key factor for maintaining not only economic stability but also competitiveness in the globalised environment. Following the financial crisis that hit Europe, aggregate demand indicators slowly started to stabilise, mostly reaching their peak in 2019. However, in the following year, due to the pandemic crisis, these indicators fell again, posing a new challenge for researchers around the world. This study examines the relationship between macroeconomic indicators of aggregate demand and innovation performance in 25 EU countries. Using data for the period 2013-2021 as input for the regression analysis, the research identifies firm investment and exports as important innovation support factors and highlights their key role. On the other hand, the research shows that household consumption and imports are barriers to innovation. Somewhat surprisingly, government spending on goods and services does not have a significant impact on innovation success, underlining the need to rethink government investment policies. This finding highlights the need for a more thorough analysis of the effectiveness of state investment in innovation and possible adjustments to state policies to maximise the promotion of innovation activities in the state. The study also highlights the importance of comprehensive strategies that promote investment and exports, while emphasising the removal of barriers to innovation in the form of household consumption and imports.

Keywords: Innovation success, Aggregate demand, Investment, Export, Import

1. Introduction

Innovation is an important driver of both national and regional development (Xu et al, 20-23). The link between economic growth and innovation remains an interesting concept for researchers and is frequently explored in the literature (Pece et al, 2015; Kijek, 2019). Currently, the world is entering the fourth industrial revolution (Schwab, 2017), which is characterised by new technological transformations in different fields. The ever-evolving artificial intelligence or new practices in the healthcare and financial sectors are just the tip of the iceberg of the transformation of the contemporary world. It is these changes and transformations that can be seen as the result of the much discussed and needed innovations (Malik, 2023).

Technological innovation not only supports economic growth, but also plays a key role in strengthening regional competitiveness (Pece et al, 2015; Zeboite et al, 2019; Szopik-Depczyńska et al, 2020). Thus, a region's ability to adapt to new technologies and implement them effectively becomes a critical factor for its success in the global economic space. For these very reasons, it is now imperative to properly measure and monitor innovation success within a region. The Global Innovation Index (GII) can be a useful tool for identifying and measuring the overall innovation success of countries. In this way, it can help individual economies to better monitor the innovation environment within a country, which can be seen as an important step towards enhancing overall growth in a global context (Jankowska et al, 2017; Yu et al, 2022).

Innovation is not only an important driver of growth for a region, but it is also an important source of competitive advantage for a region (Prokop et al, 2021). An evolutionary approach to technological change points to the fact that innovation is the result of interactions between individuals, firms and organisations in a specific socio-economic and institutional context (Iammarino et al, 2009; d'Agostino and Scarlato, 2013). In this context, it is therefore particularly important to measure innovation and discuss the outcomes associated with it. At the expert level, there are numerous discussions on the determinants that promote or, on the contrary, reduce the success of innovation in a region. Given the evolutionary approach to technological change mentioned above, in this paper we focus on the different actors of innovation success within a region. Thus, the aim of this paper is to use a regression model to test the influence of households, firms, government and other countries, as expressed by the determinants of aggregate demand - consumption, investment, government spending, exports and imports - on the innovation success of the 25 countries of the European Union, expressed as a Global Innovation Index score.

The paper is structured as follows: Section 2 presents recent findings from the known literature and hypothesis development, Section 3 briefly describes the methodology and data we used, Section 4 presents the results of our research, which are then discussed in more detail in Section 5. Section 6 presents conclusions, including theoretical and practical implications, limitations of the research, and suggestions for future research.

2. Literature Review and Hypothesis Development

Since the middle of the twentieth century, many schools of thought have considered innovation to be an important determinant of productivity. Following the pioneering work of Romer (1986) and Lucas (1988) on the endogenous growth model, there have been subsequent large-scale studies showing that innovation is an important driver of long-term economic growth and that innovation also increases the international competitiveness of regions (Prokop et al, 2021; Alekseeva et al, 2022; Tadevosyan, 2023). Innovation activities are an essential factor in the competitiveness of virtually any economic entity (Alekseeva et al, 2022; Wahyudi et al, 2023). As mentioned above, according to the evolutionary approach to technological change, the basic actors of innovation are individuals, firms and organisations.

The impact of individuals, expressed in this case as household consumption, on the innovation success of regions has been studied several times in the past. A positive relationship between household consumption and regional innovation can be observed, where higher levels of household consumption can lead to increased incentives for innovation and overall technological progress. Similarly, innovation can affect household consumption in a number of ways. For example, it can lead to the development of new products and services, which can fundamentally affect consumption patterns and preferences and subsequently affect overall consumption in the economy (d'Agostino and Scarlato, 2013; Schot, 2018). As household consumption is also closely linked to savings, the impact of savings on the innovation success of regions can also be examined. Empirical evidence shows that household savings have a positive impact on innovation success, especially in poorer emerging economies. In contrast, richer countries often have extensive innovation networks that do not depend on household savings to finance and subsequently implement innovation projects (Aghion et al., 2016). Based on these findings, we therefore put forward a first hypothesis:

H1: Household consumption has a positive impact on the innovation success of the region.

According to the evolutionary approach to technological change, the second actor of innovation is firms. In this case, firms are proxied by their private investment as a component of aggregate demand. There are several papers on the positive impact of private investment by firms on the innovation success of regions. Research has shown that firms' investment, especially investment through venture capital, can significantly boost regional innovation as well as the creation of new firms (Dyer et al, 2016; Fu, 2008). This finding is further supported by the positive impact of foreign direct investment (FDI) on regional innovation success, with the strength of this effect depending on the absorptive capacity and innovative complementary activities in the region (Fu, 2008). Hintosh et al. (2020) add that FDI has a positive impact and contributes significantly to the innovation performance of regions, but only if it is FDI from domestic firms. Dorzhieva and Kirillova (2019) then provide an opposing view of investment, emphasising that financial investment alone is not synonymous with innovation. On the contrary, they argue that strategic reorganisation and rationalisation of productive resources through competitive priorities is more important and can also lead to innovation in various fields, ultimately increasing both the competitiveness and economic growth of a country. Based on these findings, we therefore put forward a second hypothesis:

H2: Private investment by firms has a positive impact on the innovation success of the region.

The third actor in the region's innovation success is the state, represented in this paper by government spending on the purchase of goods and services. Different governments support innovation activity in the region in both the public and private sectors through different economic policy instruments (Avellar, 2011; Kijek, 2019). Public funding stimulates innovation activity in a region, but does not significantly increase innovation activity (Kokot-Stępień and Krawczyk, 2020). The level of public funding can also influence the adoption of new innovative practices, and the system of such funding is particularly important (Salmi, 2012). According to Salmi (2012), lower levels of public funding facilitate innovative practices. On the other hand, if we look at the most effective tool for stimulating innovation activities in the private sector - public procurement - we can find a rather significant positive impact of public procurement on innovation activities in the region (Kijek, 2019). Higher public spending in the form of public procurement also motivates companies to engage in innovative activities, which in turn increases the innovation success rate of a given region (Kijek, 2019). Based on these findings, we therefore present a third hypothesis:

H3: Public spending has a positive impact on the innovation success of a region.

The final innovation actor in our paper is foreignness, expressed as the size of each country's exports and imports. If only exports are considered, expert studies show that they have a significant impact on innovation activity, especially for firms operating in the region (Ebling and Janz, 1999; Fassio, 2018). However, it is important

to note that this impact varies significantly depending on the destination of the exports (Fassio, 2018). Aghion et al (2018) further add that while export shocks increase innovation incentives for all firms, independent of other factors, they can also indirectly reduce profits for firms with lower productivity. This claim is also supported by Cai et al (2020), who show, using the case of Chinese firms, that firms' export participation significantly increases the probability of innovation, with the effect of export market size being important. Based on these findings, we present a fourth hypothesis:

H4: Exports have a positive impact on the innovation success of the region.

On the other side of the external market are imports, for which academic publications also show a positive relationship between import-related activities and the innovation performance of the region. Blind (2004) and Bertschek (1995) in their studies have shown a clear positive relationship between imports and innovation using the services sector as an example. These claims are further extended by Chen et al. (2017), who present the finding that imports stimulate innovation mainly through knowledge spillovers from foreign firms, using the example of Chinese firms. A similar result is then presented by Montégu et al (2021), who confirm, using the example of Chilean firms, that import activity has a positive effect on promoting not only technological areas but also non-technological innovation in the region. The authors also agree that imports through the high-income channel have a much greater impact on innovation in the region than imports through the low-income channel (Chen et al, 2017; Montégu et al, 2021). Based on these findings, we therefore present our final hypothesis:

H5: Imports have a positive impact on the innovation success of the region.

Based on the findings from a comprehensive literature search of factors that influence innovation success and the formulated hypotheses, we present a conceptual model for our study (see Figure 1).

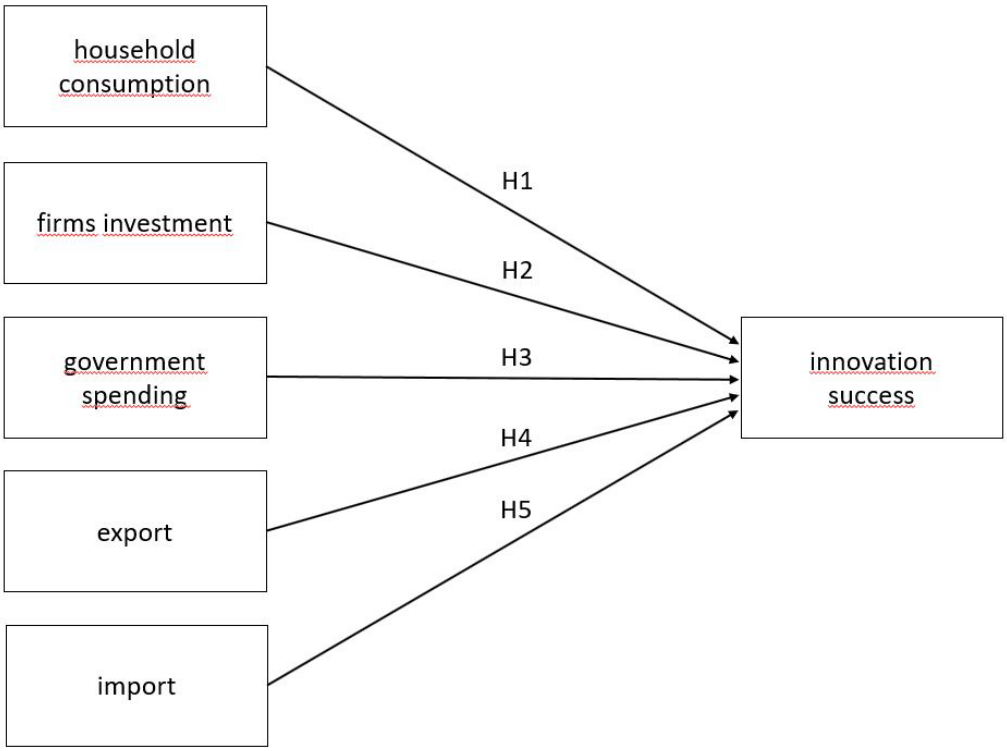


Figure 1: Research framework

3. Data and Methodology

To create the linear regression model that was chosen as appropriate for our analysis, we collected data from 25 European countries. We obtained these data from the OECD and Eurostat databases for the period 2013 to 2021, thus focusing exclusively on the period between the financial crisis and the pandemic crisis with spillovers to the pandemic crisis. The result was a panel dataset that includes 225 observations over 9 calendar years. The countries included are Austria, Belgium, Bulgaria, Croatia, Czech Republic, Denmark, Estonia, Finland, France,

Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, the Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, and Sweden.

To quantify innovation success as a dependent variable, we used a widely accepted international indicator, the Global Innovation Index (GII). The independent variables in our model then represent the individual components of aggregate demand - household consumption (HSC), firms' investment (INV), government spending (GOV), exports (EXP) and imports (IMP). Finally, we supplement our model with a control variable very closely related to innovation – R&D expenditures (R&D). A more detailed overview of the individual variables, including their use in thematically similar studies, is given in the following table (see Table 1).

Table 1: Overview of Variables

Type	Variable	Description	Unit	Source	References
Dependent		Score of Global Innovation Index	Score (0-100)	GII	Rehman et al (2020)
Independent	HSC	Household Consumption	%GDP	Eurostat	d'Agostino and Scarlato (2013); Schot (2018)
	INV	Firms Investment	%change, previous period	OECD	Dyer et al (2016); Fu (2008)
	GOV	Government Spending	Thousands of US dollars/capita	OECD	Salmi (2012); Kokot-Stępień and Krawczyk (2020)
	EXP	Export	%GDP	OECD	Fassio (2018); Cai et al (2020)
	IMP	Import	%GDP	OECD	Chen et al (2017); Montégu et al (2021)
Control	R&D	R&D Expenditures	%GDP	Eurostat	Rehman et al (2020)

Before fitting the regression model, we first normalised the data using the min-max method. This ensured that all variables had the same range and were comparable. We then constructed a linear regression model that allowed us to analyse the relationship between dependent (GII) and independent (HSC, INV, GOV, EXP, IMP) variables. On the basis of the results, we can assess how these factors have an impact on the success of innovation in each country.

The coefficient of determination was also an integral part of our calculation. This allows us to assess how well our regression model fits the real data. A higher value of the coefficient of determination indicates a better fit of the linear regression model to our collected data. For a more detailed description of linear regression, see, e.g., Montgomery et al (2021).

All calculations in this study were performed in Gretl software.

4. Results

Several interesting findings emerge from the results of our linear regression model (see Table 2). The validity of these findings is further enhanced by the coefficient of determination, which reaches a value of 0.710. This means that up to 71% of the variability in the original data is explained by our model. The relevance of our analysis is further underlined by the 99% significance of our chosen control variable (R&D).

Table 2: Regression Analysis Results

Independent	Coeff. Estimate	Std. Error	*t*-value	*p*-value	
CONST	0,392	0,081	4,831	2,56E-06	***

Independent	Coeff. Estimate	Std. Error	*t*-value	*p*-value	
EXP	1,836	0,426	4,313	2,44E-05	***
IMP	−1,584	0,409	−3,876	0,0001	***
INV	0,255	0,119	2,149	0,0327	**
GOV	−0,136	0,095	−1,436	0,1523	
HSC	−0,475	0,080	−5,900	1,37E-08	***
R&D	0,611	0,050	12,28	1,05E-26	***
R-squared 0.710					

According to the results of the regression model, we first reject hypothesis H1 about the positive effect of household consumption on innovation success. On the other hand, there is evidence at the 99% level that household consumption has a negative effect on innovation success in the selected countries. On the contrary, hypothesis H2 confirms the positive effect of business investment on innovation success, but at the 95% level of significance. With regard to government expenditure, we cannot reject hypothesis H3 of a positive effect on innovation success, as this relationship is not statistically significant. Finally, the different impact on innovation success is illustrated by exports and imports - in both cases these variables are significant at the 99% significance level, but only exports have a positive impact on innovation success. Therefore, we confirm hypothesis H4 and reject hypothesis H5 regarding the positive effect of imports on innovation success.

5. Discussion

The following conclusions are possible about the research hypotheses identified in this study. Hypothesis H1 had to be rejected because in the regression model household consumption showed a negative effect on regional innovation success, which contradicts the claim of d'Agostino and Scarlato (2013) who argue that higher levels of household consumption can have a positive effect on regional innovation. The negative effect in our case can be explained, for example, by the fact that households in European regions often focus more on short-term consumption to satisfy their immediate needs. This in turn may lead regional firms to focus more on short-term products that are already on the market, leaving no room for innovation and research that could bring longer-term benefits to the region. Households may also have limited financial resources to devote to innovative services and products. This can lead to some limitation of the region's capacity to innovate.

We accept hypothesis H2 at the 95% significance level, which can still be considered a significant effect, confirming the positive impact of private investment on the innovation success of the region. This result confirms and complements the findings of Dyer et al. (2016) and Fu (2008), who also agree that private investment by firms has a positive impact on regional innovation. Given the private investment by domestic firms, this result is also consistent with the finding of Hintosh et al (2020), who highlight the positive impact of investment mainly by domestic firms on the innovation success of the region. However, our result is not consistent with Dorzhieva and Kirillov (2019). They find that investment should not be confused with the concept of innovation. However, it is important to point out the similarity between these two aspects of the economy, as our study mainly investigates the impact of private investment by firms and does not try to directly substitute innovation with private investment by firms.

Another aspect of aggregate demand included in hypothesis 3 is government expenditure on the purchase of goods and services, which was found to be insignificant in our regression model, so hypothesis H3 has to be rejected. This result contradicts the results of Avellar (2011) and Kijek (2019), who argue in their studies that public spending is a crucial tool of economic policy to influence innovation in a region. Our result also contradicts the finding of Salmi (2012), according to which the level of public expenditure facilitates innovation practices within a region. However, it is important to note that the model we examined only includes public expenditure on the purchase of goods and services, and thus does not include the total public sector or total public expenditure, which includes science and research expenditure, which was included as a control variable in our model.

Hypotheses H4 and H5 then included the foreign segment, represented in our model by the export and import variables. In the case of exports, we accept hypothesis H4, as exports have a positive parameter at the 99% significance level. This result is not surprising and confirms the claim of Ebling and Janz (1999), Fassio (2018) and Cai et al. (2020) that exports do indeed have a significant impact on innovation activity in a region through firms operating in that region. On the other hand, our results force us to reject hypothesis H5. Imports are significant at the 99% significance level, but with a negative parameter, which means that imports have a negative effect on a region's innovation performance. This result contradicts the findings of Bertschek (1995), Blind (2004), Chen et al. (2017) and Montégu et al (2017), who reported in their studies that imports are positively related to regional innovation. The difference between our results and those of other authors can mainly be explained by the nature of the countries studied. Most countries in the European Union are innovation performers, which means that they are often the carriers of their own innovativeness, which may explain why imports are not an important aspect of their innovative success.

6. Conclusion

From the results of our study, we can conclude that there is a strong relationship between aggregate demand indicators and the innovation success of regions. The implications of our findings are twofold. First, they show the importance of aggregate demand indicators as one of the key determinants of regional innovation success and suggest that policy makers should prioritise aggregate demand stimulation strategies with the clear objective of fostering innovation ecosystems. Second, the observed negative impact of government spending on the purchase of goods and services and the negative impact of imports calls for a critical rethinking of established policy approaches to fostering innovation. Government spending has traditionally been seen as a catalyst for economic growth and regional innovation. However, our findings suggest a somewhat different reality, where indiscriminate or inefficient spending may be hindering rather than facilitating innovation in the regions. Moreover, the negative impact of imports highlights the challenges posed by global economic dynamics. While international trade can facilitate knowledge transfer, it also exposes domestic industry to increased competition from abroad, which can undermine new incentives to innovate. Policymakers therefore need to strike a delicate balance between promoting open markets and protecting domestic innovation capabilities. In light of these implications, policymakers should rigorously assess and recalibrate their spending priorities to ensure that government spending is aligned with innovation objectives and complements rather than hinders private sector innovation initiatives. In addition, there is an urgent need for targeted policies to mitigate the negative impact of imports on domestic innovation ecosystems, such as strategic trade policies, investment in skills development and support for technology adaptation and diffusion.

Our analysis also introduces the positive effect of exports and private investment by firms, as well as a control variable in the form of R&D expenditure. Policy makers should therefore favour policies that promote exports, encourage private investment in innovation and strengthen R&D efforts to create an enabling environment for innovation at the regional level. These results suggest that aggregate demand indicators are one of the most important triggers of a region's innovation success.

Our research also has some limitations. Our research focused on the period 2013-2021, so it would be useful for future research to also cover 2022 and 2023, when the full impact of the current crises and challenges that have shaken the whole of Europe will be felt. Another limitation is the inclusion of the full range of EU countries in our model. For future research, it would be useful to categorise countries according to their innovation performance, for example, as our research included countries that can be considered innovation leaders, but also countries that struggle with low innovation performance. Such a categorisation could therefore yield further interesting results.

Future research should not only focus on aggregate demand indicators, but also include other indicators that are closely related to aggregate demand. For example, extending the model to include labour market indicators could provide insights into innovation success from another perspective - human capital in the labour market.

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Business Transfers in Entrepreneurship Education: A Gap Covered by Buyer School and Successor School

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Abstract: Aging is a great challenge for European societies. When the time comes for the entrepreneur to retire, either a business transfer takes place or the firm ceases to exist. This means there is an increasing need for 'takeover entrepreneurs'. Entrepreneurship education to improve entrepreneurial competencies or learn about starting a business is common in European HEIs, but there is relatively little attention given to family business succession as a career choice and practically none to entrepreneurship through acquisition. Entrepreneurship courses focus on starting a business, implicitly carrying the assumption that this is the sole way of becoming an entrepreneur or implementing a business idea. In this descriptive paper, a Buyer School and a Successor School developed by one university to bridge the gap is showcased and the rationale behind their development is discussed. The authors conclude that Successor and Buyer Schools show promise in closing the distance between HEI entrepreneurship education and the lived experience of entrepreneurial life. It is hoped that other HEIs are encouraged to offer similar courses or, failing that, to refer to takeover entrepreneurship in their other courses.

Keywords: Entrepreneurship education, Family business, Succession, Acquisition, Entrepreneurship-through-acquisition

1. Introduction

Aging is a great challenge for European societies. The proportion of people over the age of 65 in the European Union countries will increase to around 29 % by 2080 compared to around 20 % in 2019 (EuroStat, 2023). As populations age, also entrepreneurs age, and firm continuity becomes an issue. When the time comes for the entrepreneur to retire, either a business transfer takes place, or the firm ceases to exist. This means that there is an increasing need for 'takeover entrepreneurs'. There is also evidence that even well before the actual retirement, the expectation of continuity, or the lack of it, has an impact on the growth intentions of a firm (Joensuu-Salo *et al.*, 2019).

A business transfer can refer to a family business succession, where a younger member of the family takes over, or to a business being sold to an individual or another business. Business transfers have a unique potential to transform firms and contribute to strategic renewal. The aging of entrepreneurs and the increasing number of firms looking for buyers and successors offer great potential for younger entrepreneurs to start a business or grow their existing businesses with an acquisitive strategy. Furthermore, the fact that family businesses, too, would need successors from within the family is often overlooked. Traditionally, about a quarter or third of family businesses have a successor in sight within the family (e.g., Varamäki *et al.*, 2021).

Higher education institutions (HEIs) are increasingly recognizing the importance and relevance of teaching entrepreneurship and entrepreneurial teaching. Today, improving entrepreneurial competencies or teaching about starting a business is common in European HEIs, but relatively little attention is given to family business succession as a career choice and practically none to entrepreneurship through acquisition. Entrepreneurship courses relate to entrepreneurial competence in the general sense (see e.g., Bacigalupo *et al.*, 2016) or to startup. The unspoken assumption in most of HEI lessons about entrepreneurship is that to become an entrepreneur, you must start your own business. The alternative, taking over an existing business, is rarely recognized, although business takeovers outperform starters in terms of survival (Xi *et al.*, 2020; van Teeffelen, 2012). Another point of view not often considered is that the students in higher education with a family business background have, from childhood on, been immersed in an entrepreneurship learning environment. Research on entrepreneurial intentions has long recognized the influence of role models (Chlosta *et al.*, 2012; Joensuu-Salo *et al.*, 2015; Zellweger and Sieger, 2012), and recently Joensuu-Salo, Viljamaa and Varamäki (2022) demonstrated that role models are also linked to entrepreneurial competences. Previous studies strongly indicate that students with a family business background generally have higher entrepreneurial intentions (e.g., Carr and Sequeira, 2007; Zellweger and Sieger, 2012; Hahn *et al.*, 2017). Furthermore, students with family business backgrounds are more likely to have business takeover intentions (Joensuu-Salo *et al.*, 2021). The available evidence suggests that the exclusive focus of HEI entrepreneurship education on starting a business is unjustified (Freyman and Durst, 2023).

In Seinäjoki University of Applied Sciences (SeAMK), where business transfers are among the focal areas in research and development (Seinäjoki University of Applied Sciences, n.d.), a specific effort was made to tackle

this gap. This paper describes two business transfer focused courses developed in SeAMK – the Buyer School and the Successor School – and the first experiences of implementing them.

2. The Buyer School

Buyer School, i.e. a course of study aimed at instilling the competences needed in acquiring an SME, was first implemented in SeAMK in 2022. The original Buyer School, i.e. *SME Acquisition (5 ECTS)*, aims to encourage future entrepreneurs to become entrepreneurs more often by buying a ready-made company or business, and at the same time to encourage existing companies to actively seek growth through an external growth strategy, i.e. acquiring others to expand operations. The objective is thus not only to instil competencies to handle an acquisition as a buyer but also to create a mindset that views M&As as a natural part of doing business. A graduate of the Buyer School is aware of the possibilities of mergers and acquisitions, has the basic skills to carry out a takeover, and has an idea of the external expertise that may be needed to buy a company.

The Bachelor level course is based on a multimodal structure, with online pre- and post-class assignments. The course is part of the free choice study offering and available to all degree programmes as well as to open university students. Classes (five times four hours) are organized online at scheduled times, with the interim work carried out by students independently. Interaction between participants in the class sessions is an important part of the learning process; discussion between those considering buying a business is a key element in developing a mindset that is conducive to acquisitions. The involvement of other participants helps to dispel the uncertainty of a first-time acquirer; it is encouraging to realize that many others are in the same situation and in need of further information. Discussion is facilitated by group work in the class sessions. Outputs of group work as well as independent assignments are included in the portfolio required for the completion of the course. A handbook describing the implementation in detail is available in Finnish (Viljamaa *et al.*, 2022).

After the first Buyer School, it quickly became apparent that a course once a year does not suffice. To make basic information on SME acquisitions available all year round, a slightly shorter non-stop course *Basics of SME Acquisition (3 ECTS)* was produced in 2023 as a scalable online course. Due to the different scope, the learning outcomes were modified to allow automated assessment. Non-stop implementations are characterized by complete independence of time and place, so also the content to be learned must be fully embedded in the material. In the case of this course, the material was compiled from a variety of sources. The core material consists of teacher and expert guest lecturer videos. The course also made extensive use of a variety of other online materials such as guides on the subject, research reports, blog posts, marketplaces, articles, and a collection of articles available online. The course is passed by successfully completing five online exams (multiple choice, with a time limit of 30 minutes and a maximum of three tries).

Despite the differences in methodology and learning outcomes, both courses cover five key themes. The first, *Thinking in terms of acquisition*, considers the acquisition mindset as discussed previously. The aim is to learn to view a business as a bundle of resources that can be shaped by a takeover and to understand the owner, with their skills and experience, as part of that resource bundle. In addition, the first theme discusses the stages of a takeover and compares the advantages and challenges of buying and setting up a business. The advantages of buying a business include ready cash flow, operating methods and partners, and the recognition of the business among customers. Challenges include financing and business development. The advantages of setting up a business include the absence of old burdens or ways of doing things, while the challenges include finding customers and generating cash flow. In both forms of entrepreneurship, developing profitability is equally a challenge.

The second theme, *Management challenges in acquisition*, focuses on self-management, management of the acquisition process, management of staff, and finally the takeover of the business. Clarifying the buyer's own vision and capabilities is a key starting point for a successful acquisition. Management of the buying process refers to the management approach required in the negotiation of a transaction, which includes familiarization with the target and making one's own calculations. In terms of managing staff, the emphasis is on gaining the trust of staff, and in planning a takeover, on pre-qualification. Strategic renewal through acquisition is not a given - a well-planned takeover plays an important role.

The theme *Acquisition targets and negotiations* looks at the development of acquisition criteria and different ways of identifying potential acquisition targets. It also looks at the process of negotiating a takeover, in particular in relation to the due diligence process. The fourth theme is *Valuation in acquisition*. Valuation is generally considered to be the biggest challenge in a takeover (e.g., Varamäki *et al.*, 2018, 2021). This section provides a comprehensive overview of the various factors that need to be taken into account in the valuation

process. A key element is also the clarification of the concepts of transaction price and value: finding the transaction price requires that the buyer, the seller and the financier find a common understanding. Although the determination of the intrinsic value may be simplistic, the buyer's expectations for the future are also key, and these in turn are partly buyer-specific. The final theme, *Execution and Financing*, discusses the differences between a share transaction and a business acquisition, in particular from the buyer's perspective, and possible financing channels for the acquisition. It also examines, inter alia, the financing criteria and collateral requirements of financiers and the risks associated with tying the purchase price to future revenues.

Both courses are also available to external students and non-degree students via the Open University of Applied Sciences, so there are no restrictions on eligibility. This is an important consideration, as the majority of individuals buying businesses are mature (Hoffmann *et al.*, 2023; Vanoorbeek and Spolverato, 2022)

Becoming an entrepreneur by buying an existing business is a more important theme than its popularity in entrepreneurship education would suggest. Businesses, especially in rural areas, urgently need successors from outside the family. The 3-credit online course on the basics of SME acquisition offers anyone interested in the subject, regardless of time, place and student status, the opportunity to learn about the subject under the guidance of competent and experienced experts. It could be said that the online implementation of the course fulfilled a long-standing dream of SeAMK's researchers and developers in the field of business ownership. It is particularly important that the content is accessible not only to students at SeAMK, but also to anyone interested in entrepreneurship. By becoming an entrepreneur through acquisition, one can get a flying start in realising one’s entrepreneurial dream.

As a pedagogical project, the design and implementation of both Buyer School courses was a good experience for the team involved, probably partly due to the fact that project resources could be used to develop the implementations. In both cases, thorough pedagogical scripts were devised at an early stage. The team members involved in the implementation had divergent skills and expertise, which is an advantage when it can be exploited in close cooperation. Particularly in the case of the scalable online course, the support given by SeAMK’s experts in digital pedagogy was of great importance.

A key element of successful implementation in both courses was also the willingness of external experts to contribute. In the schedule-based version, each class session had a special guest, either someone who could tell the story of their own acquisition or a consultant (business broker or similar specialist). The same guests also contributed to the educational videos immersed in the time-independent online implementation. With several different speakers, the message is conveyed in multiple voices, and it is easier for the student to remain interested in the content. In particular, the contribution of the individuals who were able to narrate their personal stories about their own SME acquisitions was an important addition to the overall experience.

3. The Successor School

As discussed earlier, taking over a family business is also an entry mode into entrepreneurship. It is, however, qualitatively very different from starting a new business or buying an existing business with no connection to one’s family. Taking over through family succession entails a level of commitment to maintaining the socio-economic wealth internalized in the business (Berrone *et al.*, 2012; DeTienne and Chirico, 2013; Makó *et al.*, 2018), and calls for dealing with family dynamics. Finding a successor within the family cannot be taken for granted (Schlömer-Laufen and Rauch, 2022), and family businesses, too, require awareness-raising activities aimed at making them aware of the issue. As Le Breton–Miller, Miller and Steier, (2004, p. 324) point out, “Succession is not an accident nor an event but a sophisticated process occurring over a very long period of time”.

Like both versions (3 or 5 ECTS) of the Buyer School, the Successor School is included in SeAMK studies as a course for credit (3-5 ECTS over the academic year), but students may also participate in monthly meetings without completing the written assignments. The Successor School is meant for family entrepreneurs’ children studying in higher education. It is thus limited to a very specific target group. However, the Successor School is open to students from all fields of study as well as through Open University of Applied Sciences to anyone interested who is not a degree student. This inclusive approach has proven beneficial, as the challenges and strengths of family businesses remain consistent regardless of the industry. As an added benefit, the multidisciplinary Successor School gives the students a natural opportunity to engage with students from different fields.

To reach the potential participants, i.e., students with a family business background, SeAMK utilizes a tool named Entre Intentio. This measurement tool of entrepreneurial intentions among students has been in constant

development since 2008 (e.g. Varamäki *et al.*, 2013, 2015) and has been complemented with specific family business-related questions (e.g. Joensuu-Salo, Viljamaa and Varamäki, 2022). The Entre Intentio survey is given to all first-year undergraduate students and includes questions on students' backgrounds. Students with a family business background are approached directly and offered the option of participating in the Successor School, assuming they have given their consent for contact in the survey.

The overall objective of the Successor School is to promote the continuity of family businesses. This is done by (a) providing family entrepreneurs' children with opportunities to consider the succession of the family business as a viable career option, (b) providing them with competences and tools for a possible future transfer of knowledge, management, and ownership, and (c) preparing them for the processing and management of the dynamism between family, work and ownership, and finally (d) providing them with tools for the creation of an open conversational culture at family businesses. The Successor School as a whole can be characterized as a framework for a personal growth process – a forum for thinking about a highly complex career choice.

The Successor School consists of the following elements: monthly meetings, discussions with experts, writing a learning diary, and preparation of a preliminary succession plan. The latter two are requirements for receiving credits for the course, but simply attending the monthly meetings is also possible. Each of the monthly meetings lasts 2 to 2.5 hours and has a specific theme. The meetings work best as face-to-face appointments, but during the COVID-19 pandemic, they were arranged over Teams or as hybrid implementations. A typical meeting has the following structure:

1. a fact section, e.g., previous research knowledge and literature, or an expert's personal experience,
2. a practical case story, primarily to be presented by a SeAMK alumnus with a family business background,
3. a joint discussion on the theme, and
4. review of the forthcoming independent learning assignment.

The themes for meetings vary, ranging from coping with siblings to the meaning of ownership, transfer of knowledge and tax relief in family succession. Further examples can be found in the course description (Seinäjoki University of Applied Sciences, 2024). The students are also invited to propose themes, and the students' entrepreneur parents can also be invited to attend some of the meetings if the theme is appropriate. In the meetings, SeAMK's own alumni are excellent "guest lecturers": they not only tell the story of their family business but also explain the process they went through, their succession implementation path, and, above all, what lessons they have drawn from the experience. Although other family business owners could share their experiences as well, alumni of the same university are particularly relatable. Another aspect worth particular highlighting is the peer support students get as they participate. Students who are similarly situated provide each other with a community of shared experiences and find new perspectives on the operations of their own family businesses.

The learning diaries of the Successor School consist of learning assignments relating to the themes discussed in the meetings. Two examples are provided in Table 1. One central purpose of learning tasks is for students to initiate open discussions within their own families about the upcoming succession process, and according to informal feedback received from students, this has indeed occurred in several cases. In addition to the learning diary, the students can prepare a preliminary succession plan, which includes nine sections, namely background and situational analysis, current roles, personal motivation, knowledge transfer, transfer of leadership, transfer of ownership, utilization of external experts, post-succession business development and role of the retiring entrepreneur.

The Successor School was first piloted in SeAMK in 2022 and has continued since. At the time of writing, there are 40 students enrolled in the Successor School, and it is particularly noteworthy that students from agriculture, a sector dominated by family businesses, have taken great interest. From the resourcing perspective, the ongoing operation of the Successor School demands approximately 150–200 hours annually, including tasks such as recruitment, marketing, appointment planning, expert coordination, assignment evaluation, and student engagement. In addition to the Entre Intentio survey mentioned previously, marketing efforts are extended to entrepreneurship and business courses, ensuring awareness among students of all academic levels. Importantly, marketing targets students of all study years, as enrolment in the Successor School is open throughout their studies.

Table 1: Examples of learning assignments in the Successor School

Learning assignment	Questions for reflection
Planning for unexpected events affecting the entrepreneur	• Think of three things that would be first assigned to you at your family business if your entrepreneur parents unexpectedly fell seriously ill, or even passed away? • What competences would you currently have to take care of these things? • How can you improve your own abilities / competence in relation to these things?
Exploring the concept of ownership and its implications for management and family dynamics.	• Do you think management also requires the ownership of your family business: does the owner also have to be CEO, or can the CEO also be someone from outside of the family? • Should the successors or all the family members working for the business own the business with equal shares? • Can some of the family members be owners of the business even if they do not work for the business? • What liabilities and rights does the ownership of the family business give you?

4. Student Feedback

At the time of writing this, student feedback on the 5 ECTS Buyer School for the current implementation is not available, as the course feedback collection is still underway. For the online 3 ECTS Buyer School, a continuous feedback survey has been established, with a single qualitative question: *Please tell us what worked well on the course and what needs improving*. Responses are fully anonymous. The current (ongoing) survey has resulted in 83 replies so far with a total of 169 participants registered for the course, giving a response rate of 49 %. For the purposes of this paper, the responses were analysed and sorted into categories (Table 2). Of the 83 responses, 60 had only positive comments, 6 only negative comments, and 17 were classified as having both or neutral. The responses included in total 29 suggestions for improving the course.

All in all, the feedback is quite positive and encouraging for the teaching team. It is also gratifying that so many students give constructive suggestions as to how to improve future implementations; although many of the suggestions are unfeasible or would expand the course beyond the set extent, the interest taken by the respondents demonstrates engagement on the students' part.

For the Successor School, in which a single implementation lasts a whole academic year, student feedback is collected through the formal SeAMK feedback system towards the end of the spring semester. At the time of writing, the collection is still underway, but the preliminary results indicate a good level of satisfaction with the course. The formal feedback system has two items ("In my opinion, the course was at least good" and "I think I learned a lot on the course") with a 5-point Likert scale (1 = totally disagree, 5 = totally agree) and one open question. For the Successor School 2023-2024, the average rating for both items was 4.6, with no respondents giving a rating below 4. Open-question responses (7 replies) were also very positive. In addition, informal feedback has been received from participants as both spontaneous individual messages and as part of the final discussions in the last sessions of each semester.

Table 2: Student feedback on online Buyer School (3 ECTS, non-stop implementation)

Category	No of responses	Illustrative examples (authors' translation)
Positive comments and thanks only	60	• In my opinion, the implementation of the course worked, and it also called for an effort to immerse oneself in the contents of the videos and texts. The tools provided by this course are a good starting point to consider buying a business! • The course gave a deep and practical view into business acquisitions, and it exceeded my expectations in many ways. I became excited about business acquisitions, and now I can't stop browsing the list of businesses for sale.
Negative comments only	6	• The content of the videos could have perhaps been a bit more extensive in some respects. I imagined that after this course, I would have a handle on business valuation, but it's not quite there yet. • A bit too many videos, it would be easier to study using slides.

Category	No of responses	Illustrative examples (authors' translation)
Both negative and positive comments / Neutral	17	• The materials were good. There was quite a bit of repetition in some of the materials though. • Especially the video materials of the course were very clear and straightforward - there was no unnecessary chatter. Some of the exam questions were formulated somewhat unclearly, it was difficult to associate them with the source material.
Total	83	
Suggestions for improvement	29	• It would have been nice to see a concrete example of, for instance, business valuation, even if it was from a totally imaginary company. • More written materials would be good, it is hard to retain information from videos. • Succession and especially succession-related taxation would be a nice addition. • Maybe the materials on the videos could be provided also as pdfs on the learning platform.

5. Conclusions

Focus on starting a business in HEI entrepreneurship teaching is understandable and perhaps unavoidable: starting a business resonates more strongly with the idea of opportunity-driven entrepreneurship than does taking over an existing business. To develop an entrepreneurial mindset, one needs to work on new ideas and value creation, and thus startup training is easier to view as a part of becoming more entrepreneurial in all working life roles. Yet, as European entrepreneurs age, successors from within and without the family are increasingly needed if viable businesses are not to be closed for the lack of a successor. For higher education students to at least be aware of the possibility is important. Having a Buyer School available sends a powerful message, and for those who attend it, it gives a good starting point for thinking about entrepreneurship-through-acquisition. Although there is little research available on such entrepreneurship, what evidence there is suggests that buying a business rather than creating one from scratch is potentially a successful entrepreneurial endeavour (Hoffmann *et al.*, 2023).

Unlike other students, students with a family business background are probably aware of the possibility of continuing the family business. For them the HEI can provide a growth process, conceptual tools, practical information, and the opportunity to reflect among their peers on issues relating to family business. Students with a business in the family have an opportunity that others lack – helping students to realize this, even if they choose not to take advantage of that opportunity, is a worthwhile goal in itself.

For both Successor and Buyer Schools, a survey of entrepreneurial intentions such as the Entre Intentio instrument used in SeAMK, is an invaluable tool. It helps identify the students with a family business background and can also be used to recognize the students with a high level of entrepreneurial intentions, to provide them with different support measures. It is advisable to conduct a survey to identify students with a family business background or high entrepreneurial intentions as early as the beginning of their studies. After the survey, a good practical measure is to invite the students with preliminary interest in successions to a face-to-face meeting for the presentation and marketing of the Successor School and to specifically advertise the Buyer School and startup support available to those with interest in becoming an entrepreneur. It is also important to bring up The Successor and Buyers Schools on courses in entrepreneurship, or in other business courses.

Successor and Buyer Schools show promise in bridging the gap between HEI entrepreneurship education and the lived experience of entrepreneurial life. On the societal level, a few courses in one university are not likely to make much difference, but if the practice spreads, it will help ensure qualitatively better family communications and successions, offer more secure starts for many aspiring entrepreneurs and promote growth through acquisitive strategies for SMEs. All these contribute to economic growth and resilience.

Seinäjoki University of Applied Sciences has over two decades of experience in researching, developing, and providing training in business transfers, with a significant number of experts in this field. Years of active work on regional, national and international development in the topic provide a fertile ground for the growth of business ownership transfer expertise. Furthermore, entrepreneurship is deeply ingrained in the university's strategy and vision, an entrepreneurial spirit being a core value of the HEI. Hence, establishing operational models for the Buyer School and the Successor School was a logical progression as well as a natural extension of the university's

ethos. By bringing the developed solutions to the notice of academic audiences, the authors hope to encourage also other HEIs to include in their entrepreneurship curricula similar courses, or if that is not feasible, to at least include in basic entrepreneurship courses a reference to the options of succession and acquisition.

For higher education students to at least be aware of the possibility is important. As Freyman and Durst (2023, p. 13) note, "…promoting more balanced models and approaches starting early in formal higher education may foster entrepreneurial activity that benefits both different types of students as well as society at large".

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Developing and Testing a Rural Business Incubator: A Best Practice Framework

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Abstract: Compared to an urban context, starting a business in a rural context has its distinctive challenges such as the lack of entrepreneurial support infrastructures typical in an urban context. Business incubators are types of entrepreneurial support organizations that support the creation and growth of new companies with tangible and intangible resources. They help incubatees transform their ideas and concepts into feasible products and services with tangible and intangible resources such as facilities, shared equipment, administrative services, knowledge, and access to networks. In the rural context, business incubators can help to address rural entrepreneurship challenges such as population and infrastructure deficiencies, and rural entrepreneurship opportunities such as strong social bonds and embeddedness to a rural environment. In this manner, they can help to mitigate entrepreneurial challenges and foster the use of entrepreneurial opportunities through direct and indirect effects to the local, regional, and national economy. However, rural incubators tend to perform worse than their urban counterparts. The reasons for this aren't well understood, as there is a lack of incubator research on how locational attributes affect rural business incubators. There is a need for further knowledge about how rural context influences business incubators to improve the development, tracking, and impact of rural business incubators. This study addresses this research gap by creating a rural business incubator best practice framework that addresses general incubator best practices and rural entrepreneurship-specific challenges and opportunities that should be addressed in rural business incubators. The proposed framework is tested in rural VAU!HAUTOMO business incubator and the results are analysed to review the framework´s capabilities and suggest future use cases and research avenues. The framework provides a novel approach to plan, measure, and manage rural business incubators which both researchers and incubator actors can use to develop rural business incubators that better take into account rural entrepreneurship challenges and opportunities.

Keywords: Rural business incubator, Rural entrepreneurship, Incubator model, Pre-incubator, Rural context

1. Introduction

Companies are molded by their environment which can be in turn shaped by their actions (Anderson, 2000; Mair & Marti, 2009). This is also true in rural contexts where rural companies are molded by their rural environment and vice versa (Baumgartner et al. 2013). However, entrepreneurship policies have considered rural entrepreneurship challenges and opportunities insufficiently, and rural entrepreneurship is often approached in the same manner as urban entrepreneurship (Korsgaard et al 2015; Fortunato, 2014). Business incubators can help to mitigate entrepreneurial challenges and foster the use of entrepreneurial opportunities (OECD, 2019; Hausberg & Korreck, 2021). While business incubators can improve entrepreneurship capabilities also in rural areas, studies have shown that rural business incubators tend to perform worse than their urban counterparts (Dickes, 2011). Rural business incubator challenges can be partially explained by rural entrepreneurship challenges from which very little is still known as most of the entrepreneurship research has focused on business incubators in an urban context (Cheng & Schaeffer, 2011; Pato & Teixeira, 2016; Freire-Gibb & Nielsen, 2014).

To address these knowledge gaps, this study creates a rural business incubator best practice framework to help researchers and rural actors to better identify, track, and manage rural entrepreneurship challenges and opportunities in rural business incubators. To do this, we first identify incubator best practices, and central rural entrepreneurship challenges and opportunities. This knowledge is then applied to create the framework which is tested to analyse VAU!HAUTOMO business incubator. Finally, avenues for further testing, use, and development of the framework are suggested.

2. Literature Review

2.1 Business Incubators

Business incubators are entrepreneurial support organizations that aim to enhance the local entrepreneurial climate (Dickes, 2011). Business incubators aim to develop the entrepreneurial competence needed to initiate and engage in the practice of entrepreneurship through the process of entrepreneurial learning and the development of entrepreneurial self-efficacy (Newman et al 2019). Some business incubators have a specific sector focus such as food processing, medical technologies, or tourism (Adkins et al 2001) while others have diverse sets of incubates from different sectors. Many localities have business incubators that have been

modified to meet local needs and maximize entrepreneurial yield (Dickes, 2011). Truly, business incubators differ from each other and some argue that there are no two business incubators alike (Allen & McCluskey, 1990). Incubator management team determines business incubator's objectives, designs the suite of services, builds relationships with affiliated organizations and institutions, and selects the incubatees (OECD/European Commission, 2019). The management team is responsible for incubation counselling, the actual dissemination of knowledge, and advice to incubatees, which has a critical role in the incubation.

2.2 Best Practices for Business Incubators

In their systematic literature review, Hausberg and Korreck (2021) identify 16 different typologies for business incubator. This comparison shows that identification of incubator best practices varies between authors according to selected incubator type and dimension. From these 16 typologies we select sponsor/partner focused typology originally presented by Zedtwitz (2003) to investigate business incubator best practices in further detail. In his study, Zedwitz presents different incubator strategies, business models, management practices, and incubator services. Due to its comprehensiveness and adaptability, we will use it as a base for the development of a rural business incubator framework.

Business incubators typically offer five types of services (Table 1). Business incubators offering all five types of services are called incubators in the strong sense of the term. Business incubators that offer only four types of services are called incubators in the weak sense of the term. Finally, business incubators that offer fewer than four of these services lack too many incubator services to be called incubators and should be therefore approached differently.

Table 1: Five types of incubator services (modified from Zedtwitz, 2003)

Service	Description of service
Access to physical resources	Physical incubator spaces such as office spaces
Office support	Office support such as bookkeeping and IT support
Access to financial resources	Venture capital opportunities through incubator activities
Entrepreneurial start-up support	Support activities in entrepreneurial topics such as idea development, management, and legal
Access to networks	Networking opportunities through incubator activities

For-profit and not-for-profit are two basic types of incubators. For-profit incubators´ main goal is to generate profit while not-for-profit incubators have non-profit-based main goals such as regional development. Incubators can be then associated further with five incubator archetypes which all have different degrees of competitive focus in terms of incubator segment, industry, and geography (Table 2). Incubators can be strictly one of these archetypes or have elements from multiple of them.

Table 2: Five incubator archetypes (modified from Zedtwitz, 2003)

Incubator archetype	Typical objectives	Typical establishers
Independent commercial incubators	Commercial objectives	Venture capital firms and independent entrepreneurs
Regional business incubators	Public objectives such as employment	Local governments and organizations with similar regional interests
University incubators	Commercial objectives	Universities and local technology transfer offices
Company-internal incubators	Commercial objectives	Companies with internal R&D capabilities
Virtual incubators	Commercial objectives	Service aggregators

In the generic incubator business model, investors provide venture capital to the incubator which supports incubatees through incubator services so that incubatees can generate value. This value then proceeds partly to the incubator from which it returns partly to the incubator´s investors. The incubator´s management plays a key role in the success of this model. Management´s goal is to leverage investors' venture capital to provide timely and efficient deployment of incubator services and create synergy potential between incubatees through segmentation of similar incubatees.

Regardless of the selected incubator archetype, there seem to be four incubator management practices that are considered valuable for good incubator management (Table 3). Together with a long-term commitment to the

incubator by the key investors, these management practices form the basis for a successful incubator business model.

Table 3: Key practices for incubator management (modified from Zedtwitz, 2003)

Incubator management practice	Description of the practice
Incubation charter	Incubator has a clear and well-communicated vision statement that motivates investors and incubatees
Day-to-day management	More personal hands-on coaching is provided by focusing on fewer incubatees at the time and by maintaining optimal incubatee capacit
Optimizing leverage	Individuals with relevant know-how and experience are recruited, selected and retained as incubator managers
Optimizing synergy	Incubatees are selected so that their synergy value can be maximized in the incubator

2.3 Entrepreneurship in Rural Context

2.3.1 Rurality and rural entrepreneurship

The essence of rurality is still under ongoing debate (Pato & Teixeira, 2016). Rurality can be seen as a set of hard measures (such as geographical scope and population density) and soft measures (such as characteristics of social networks) (Labrianidis, 2006; Stathopoulou et al 2004). Halfacree (1993) and Siemens (2007) identify three categories from the literature for rurality. These are social definition (focus on individuals' interpretation of rurality), a definition based on lack of population (focus on disadvantages of rural areas' population density compared to urban areas population density), and geographical definition (focus on physical location, natural resources, and geographical connections to urban areas).

There are a multitude of debatable definitions for rural entrepreneurship (Gaddefors & Anderson, 2019). For example, McElwee and Atherton (2021) define rural entrepreneurship as entrepreneurship that happens to occur in a rural environment. Rural entrepreneurship often involves engagement in the rural milieu and making use of different types of resources of a rural environment (Gashi & Tillmar, 2022). Rural entrepreneurship is thus seen as spatially bound to a particular setting (Korsgaard et al 2015) so the context of rural entrepreneurship matters as each rural setting is diverse in its way (Gaddefors & Anderson, 2019).

2.3.2 Challenges of rural entrepreneurship

Different rural entrepreneurship challenges and opportunities have been identified in the literature. Stathopoulu et al. (2004) present environment-based grouping (physical, social and economic dimension) that helps to compare rural entrepreneurship challenges and opportunities. Table 4 summarizes some of the most addressed challenges and opportunities in rural entrepreneurship literature. Although this comparison is not comprehensive, it helps us to form an overview of the topic.

Table 4: Summary of identified rural entrepreneurship challenges and opportunities in Stathopoulu et al. (2004) environment-based grouping

Dimension	Typical rural entrepreneurship challenges when compared to urban entrepreneurship	Typical rural entrepreneurship opportunities when compared to urban entrepreneurship
Physical dimension	Weaker accessibility to customers, suppliers and institutions (Stathopoulou et al 2004)	Better accessibility in terms of migration (Keeble & Tyler, 1995)
	Smaller local market size and demand (Stathopoulou et al 2004; Dabson, 2001)	Lower rent costs (Imedashvili et al 2013)
	Higher distribution and marketing costs to enter external markets (Lekhanya, 2016; Sternberg, 2009)	More natural resources that may offer business opportunities (Johnson & Rasker, 1995; Tennesen, 1994)
	More difficulties to reach economies of scale (Dabson, 2001)	Entrepreneurs have more knowledge about locally available resources (Müller, 2013)

Dimension	Typical rural entrepreneurship challenges when compared to urban entrepreneurship	Typical rural entrepreneurship opportunities when compared to urban entrepreneurship
	Weaker access to skilled and educated human capital (Deller et al 2019)	Rural landscape has the potential for greater work satisfaction and for a more ethical office environment (Tennesen, 1994)
Social dimension	Over embeddedness to local social networks decreases competitivenes (Uzzi, 1997) Stronger social obligations may cause irrational behavior (Kjeldsen & Svensen, 2011) Less potential interpersonal interactions (Francis & Sandberg, 2000) Stronger fears of social exclusion that decreases entrepreneurial behavior and culture (Spigel & Harrison, 2018) Attitude towards entrepreneurial actions is less encouraging (Honig & Dana, 2008)	Stronger social relationships and trust facilitate regional cooperation and networking (Müller, 2013; Kjeldsen & Svensen, 2011; Lee et al 2005) Rural cultural identity and embeddedness can be utilized to build specialty that attracts external resources (Ray, 1998)
Economical dimension	More skepticism towards digital technologies (Hardy et al 2019) Entrepreneurs are more inclined to use locally available resources even if they aren´t economically the best choice (Müller, 2013) Less finance and human capital to entrepreneurial development (Müller, 2013) Slower creation and adoption of innovations (Harrison & Kelley, 1996)	Less developed infrastructure offers more opportunities for innovation (Canfield et al 2019) Digital technologies offer opportunities to mitigate disadvantages of rural environments such as distances and small market size (Stathopoulou et al 2004)

2.3.3 Rural business incubators

Rural business incubators are business incubators operating in rural contexts. Studies have shown that rural incubators tend to perform worse than their urban counterparts likely requiring ongoing subsidization (Dickes, 2011). Both regional factors and incubator factors explain this but the relationship between them has been unclear until recent study by Harper-Anderson & Lewis (2018). They show that regional capacity has a weaker relationship to incubator outcomes than incubator quality. This indicates that optimal incubator program operations can compensate for the lack of regional capacity. However, when incubatees graduate from the incubator, regional capacity´s importance increases as graduated incubatees will hire employees at a faster rate in regions with higher capacity for innovation.

Rural business incubators' challenges can be at least partially explained by the challenges of rural entrepreneurship (Cheng & Schaeffer, 2011). Some approaches to mitigate these challenges have been proposed in the literature. For example, it has been proposed that rural incubators should be arranged as virtual incubators or hybrid incubators combining physical and virtual incubator approaches (OECD/European Commission, 2019). While virtual incubators have been shown to lower rural entrepreneurs' barriers to participate in incubator programs (OECD, 2021), they lack the richness of interaction common to physical incubators which may decrease synergy and commitment between incubatees. To mitigate this shortcoming, the incubator can be arranged as a hybrid incubator combining both virtual and physical incubator to achieve the advantage of both incubator models. (Zedtwitz, 2003) Virtual incubators offer two types of functions that can help to mitigate rural entrepreneurship challenges (Zedtwitz, 2003). First, they offer online matchmaking

such as online communication, seminars, and learning groups. Second, they offer service aggregation such as access to external professional services.

3. Research Design

3.1 Rural Business Incubator Best Practice Framework

We use previously presented Zedtwitz (2003) incubator strategy, management model, business model, and incubator services. For each of these, our rural business incubator framework (Figure 1) proposes an approach that takes into account both rural region and rural incubator program factors. Stathopoulu et al. (2004) environment-based grouping of rural entrepreneurship challenges and opportunities is used in the framework to distinguish different perspectives. Decisions that led to the framework are discussed in more detail in the next sub-chapters.

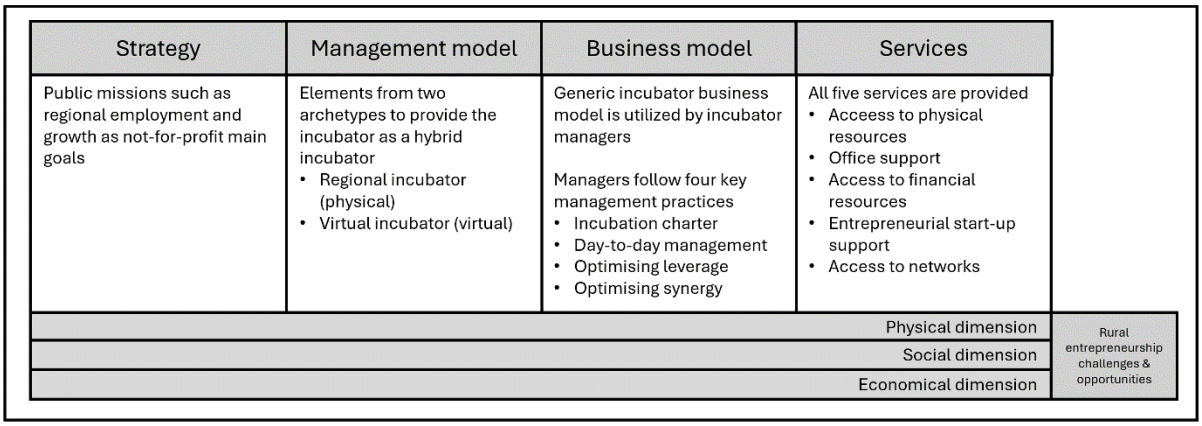


Figure 1: Rural business incubator best practice framework (Adapted from Zedtwitz, 2003 & Stathopoulu et al. 2004)

3.1.1 How Zedtwitz (2003) strategy, management model, business model and services is applied

Regional capabilities affect rural business incubators which in turn foster entrepreneurship in the area. Both rural regions and rural business incubators can benefit from incubators if their strategy and management model are chosen wisely. With this in mind, we argue that not-for-profit-based public mission goals are more fitting goals than for-profit-based goals for rural business incubators as they prioritize regional development over profitability. In the same manner, we argue that from different types of incubator archetypes, a hybrid mix of regional business and virtual incubator fit best to this use case. Regional business incubators focus on local communities and their priority is in public development. Rural entrepreneurship challenges and opportunities can be addressed in these incubators even better if virtual incubator capabilities are applied in them. Generic incubator business models can be adapted to rural environments. Incubator managers play a key role in the business model so special attention should be put on their managerial practices, especially in rural environments where skilled managers are rarer than in urban environments. Four key management practices are a good starting point for management and they can be expanded according to incubator-specific needs. Finally, rural business incubators should adapt all five types of services to be incubators in the strong sense of the term. Emphasis and content of these services should be planned case-by-case.

3.1.2 How Stathopoulu et al (2004) environment-based grouping is applied

Environment-based grouping helps to identify, distinguish, and track different types of rural entrepreneurship challenges and opportunities in rural business incubators. We argue that this knowledge can help rural incubator managers address the influence of the rural context better in their incubators and thus improve their incubation activities. While rural entrepreneurship challenges and opportunities vary in different rural environments, environment-based grouping sets a good starting point for a case-by-case review. Specific challenges and opportunities identified in previous studies can also help to identify challenges and opportunities for specific cases. We propose in the framework that rural entrepreneurship challenges and opportunities should be taken into account in the incubator´s strategy, management model, business model, and services. We see rural entrepreneurship challenges and opportunities as an overarching theme that helps to connect incubator best practices to the current rural entrepreneurship context.

3.2 Testing Framework in Development Project – Case VAU!HAUTOMO

To test the framework in practice, we used the framework to plan and track rural business incubators in Finland. The incubator was developed as a part of European Regional Development Fund development projects which aimed to start a business incubator in the Nivala-Haapajärvi sub-region area. The development project was conducted together with the Nivala-Haapajärvi sub-region´s business development organization NIHAK. Nivala-Haapajärvi sub-region is located to Southern part of Northern Ostrobothnia region in Finland. Sub-region´s population is small by European standards with a total population of 26 806 people in 5 municipalities: Haapajärvi, Kärsämäki, Nivala, Pyhäjärvi and Reisjärvi (Tilastokeskus, 2023). NIHAK, the Nivala-Haapajärvi sub-region development organization, is responsible for entrepreneurship development in the sub-region area. Its main missions are the regional development of sub-region municipalities and the development of the sub-region business environment for companies.

4. Results

4.1 Overall Results From the Incubator

64 incubatees took part in the incubator from which 20 utilized actively different types of incubator services throughout their stay in the incubator. The other 44 incubatees either only short time in the incubator or utilized incubator services only partially. From the 20 active incubatees, 4 incubatees were ideating, 12 incubatees were implementing their idea, and 4 incubatees were developing their innovation further and seeking funding when the development project ended. In total 38 workshops were organized on various themes such as team building, funding, innovation, marketing, and legal. The management team organized visits to several start-up competitions where incubatees presented their ideas and innovations, and sought funding from the investors. After the end of the development project, the incubator continued through a new still ongoing development project which aims to increase cooperation with the sub-region´s educational institutions and establish a sub-regional level capital investment fund for the incubator. Although these development steps are interesting for further study, our analysis is limited only to the first VAU!HAUTOMO development project.

4.2 Using the Framework to Analyze the Incubator

The incubator´s best practices and rural entrepreneurship challenges and opportunities which it addressed were analysed by using the framework (Figure 2). The incubator had a similar strategic objective and management model as in the framework. The main goals were not-for-profit and the incubator was organized as a hybrid incubator consisting of regional and virtual incubator. Business model actors and examples of four key management practices were easy to identify. The incubator offered many incubator services but didn´t offer access to financial resources as there were no in-house instruments for venture capital.

Different rural entrepreneurship challenges and opportunities were addressed in the incubator. In the physical dimension, challenges of small local market size, high marketing costs lack of skilled workforce, and opportunities for entrepreneurial local knowledge were addressed. In terms of the social dimension, challenges of over-embeddedness to local social networks reserved attitudes towards entrepreneurship, and opportunities of strong trust among local and rural cultural identity were addressed. In terms of the economic dimension, challenges of scepticism towards digital technologies and slow adoption of innovations, and opportunities of digital technologies were addressed.

The analysis indicates that the incubator managed to address different physical, social, and economical rural entrepreneurship challenges and opportunities. The incubator followed the framework´s best practices in many respects although its services lacked in terms of access to financial resources. The incubator´s results were analysed only subsequently when VAU!HAUTOMO development project had ended. Thus the framework´s potential use case to plan incubator activities couldn´t be analysed. However, the analysis can be utilized and expanded to plan activities in VAU!START+ to develop the incubator further. This could include topics such as fulfilling managers' expertise gaps, development of virtual incubator capabilities, development of day-to-day management practices, and design of sub-regional venture capital instruments. Location-specific rural entrepreneurship prerequisites could be also analysed further and the framework could be used to benchmark the incubator with other similar incubators to identify new best practices and rural entrepreneurship challenges and opportunities.

	Strategic objective	Management model	Business model	Services
Best practices	*Not-for-profit, public missions* • Development of local (rural) entrepreneurship capabilities • Sub-regional employment • Growth *Not-for-profit, indirect operation profits* • Increase of local SMEs' innovation capabilities	*Hybrid incubator model* *Regional incubator characteristics* • Regional interests • Secured funding through development project provides a safe-haven for starting incubatees • Lose screening of incubatees • Incubator managers with general business development skillsets, specific knowledge has to be gathered externally *Virtual incubator characteristics* Function 1: Online matchmaking • Workshops materials • Private communciation channels • Public communciation and news channels • Special interest groups for competitions Function 2: Service aggregation • Access to workshops experts for professional services • Access to NIHAK business development services	*Investor* Public funding from the European Regional Development Fund and NIHAK *Incubator (management)* NIHAK, 4 business developers *Incubatees* Individuals and SMEs, 64 in total *Key management practices* 1. Incubation charter • Clear main promise: "from idea to market" which is market diversly under VAU! Brand 2. Day-to-day-management • incubatees' individual needs and situations are tracked regularly • Workshops are designed according to incubatees needs 3. Optimizing leverage • Business developers with different skills are selected as managers 4. Optimizing synergy • Incubatees in similar situations are connected	*Incubator services* 1. Access to physical resources • Physical incubator spaces in municipality centers 2. Office support • Basic office support services such as printing and wifi access 3. Access to financial resources • No in-house venture capital • Incubatees are directed to external venture capital sources 4. Entrepreneurial start-up support • 38 workshops on various themes 5. Access to networks • Access to NIHAK business networks • Access to external networks through start-up competitions
Physical challenges	Small local market , high marketing costs & weak access to skilled workforce			
Physical opportunities	Entrepreneurs knowledge			
Social challenges	Over embeddedness to local social network & reserved attitude towards entrepreneurship			
Social opportunities	Strong trust among locals & local branding advantages			
Economical challenges	Skepticism towards digital technologies & slower creation and adoption of innovations			
Economical opportunities	Digital technologies			

Figure 2: Analyse of the incubator through rural business incubator best practice framework

5. Discussion

This study aimed to clarify best practices for rural business incubators to create a best practice framework for business incubators in the rural entrepreneurship context. This goal was achieved by forming the framework which combined Zedtwitz's (2003) incubator best practices and Stahopoulu et al (2004) environment-based grouping of rural entrepreneurship challenges and opportunities. The framework was then tested to describe best practices in VAU!HAUTOMO business incubator and suggestions were made on how the framework could be used to further develop VAU!HAUTOMO business incubator and compare rural business incubators with each other.

Business incubators aim to enhance the local entrepreneurial climate by focusing on the development of early-stage firms. Instead of measuring their performance according to individual practices, synergy among multiple practices, policies, and services should be emphasized to improve their quality. Growing business incubators make important contributions to their local environment and thus they can also help to improve entrepreneurship capabilities in rural contexts. Rurality and rural entrepreneurship can be defined and approached in many ways. Rural areas are often compared to urban areas in terms of social, population or geographical factors to identify specific challenges and opportunities for rural entrepreneurship. Its shown that both rural context and incubator capabilities impact the rural incubators which raises an interest to further study rural entrepreneurship challenges and opportunities, and business incubators' best practices. Zedtwitz (2003) and Stathopoulu et al (2004) were analyzed to identify best practices for incubators and environment-based grouping for rural entrepreneurship challenges and opportunities which were then populated with examples from the literature. This analysis led to the creation of the rural business incubator best practice framework which was then pilot-tested to analyze VAU!HAUTOMO incubator.

The analysis helped to identify practices in the incubator that followed and practices that didn´t follow the best practices mentioned in the framework. The framework also helped to separate different types of rural entrepreneurship challenges and opportunities that the incubator addressed. The framework was tested only in this one incubator and the analysis focused only on the results of the incubator which can be seen as the biggest limitation of this study. Further testing of the framework should be conducted to identify how the framework can be used to plan rural incubators and compare their results. This would help to identify the benefits of the framework and potentially help to clarify what kind of rural entrepreneurship challenges and opportunities are taken into account in rural business incubators and in which ways. This knowledge could be then further used to identify how rural context influences rural business incubators to improve understanding and development of entrepreneurial support activities in rural areas. Despite its limitations, this study provides a novel approach to rural incubator research which is still in its infancy (Nicholls-Nixon & Valliere, 2020, OECD, 2019; Barbero et al 2014), and helps to clarify antecedents for business incubators in rural environments and communities to fill

multi-level study research gap identified by Hausberg and Korreck (2021). Together with other models, the framework can be utilized to further clarify how rural context affects business incubator activities and vice versa.

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Exploring Product Development of Cyber-Physical Systems in Startups: A Status Quo Study

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Abstract: In the interconnected world of today, we experience the evolution of mechatronic systems into cyber-physical systems (CPS) through their connection to the Internet of Things (IoT). Despite their vast potential for groundbreaking applications already present, e. g. autonomous cars or smart production systems, startups face significant hurdles in developing CPS, primarily due to limited knowledge and resources. Currently, only few scientific contributions cover how hardware-containing products are developed in startups and what possible challenges can be expected. This gap highlights a pressing need for research into the specific challenges and methodologies of CPS development within the startup ecosystem. The research goal of this paper is to set an explorative foundation for understanding the product development of CPS in startups to enable further research and suiting support for future founders. This paper offers a first attempt to give a qualitative description of the status quo of the development of CPS in startups. It begins by establishing an understanding of the four main problem fields discussed in the literature on CPS development, entrepreneurship, and hardware development in startups: The impetus of entrepreneurs in CPS-developing startups (1), the ideation of the CPS in development (2), the prototyping of CPS in startups (3) and processes, methods, and tools used in CPS development in startups (4). They are discussed by semi-structured interviews. Due to the limited number of possible participants, the interviews are conducted with a sample of eight founders and employees from CPS-developing startups in Southern Germany. Their answers are used to deduce recurring patterns and contradicting positions in their subjective experience with CPS development. The result of this paper are twelve proposed characteristic aspects of current CPS development practice in startups based on the deduced patterns. With this first qualitative description of the status quo of CPS development, this paper identifies potentially relevant topics that occupy CPS founders, delivers connecting points to current research in established research disciplines and reveals current missing research activities.

Keywords: Cyber-physical systems in startups, Product development methodology in startups, Entrepreneurship with cyber-physical systems, Problems of product development in CPS-startups, Product development characteristics of CPS-startups

1. Introduction

Although European industries are known for their ingenuity in developing high-tech products in hardware-intensive industry sectors (European Commission, 2021), startups tend to focus more on the development of software-related products: Only a fifth of German startups identify technology development and production as their business model, while 65% of them identify an exclusively digital business model in their startup (Kollmann et al., 2023). This tendency to focus on exclusively digital or software-related business models and products in startups is also represented in established literature: Kollmann describes digital ventures mostly in the meaning of ventures creating exclusively software-related products (Kollmann, 2022). Although his collected description applies to many hardware-related digital ventures, he only describes the development of software products in startups. Blank and Dorf relate to technology risk as a risk easily avoided by simulations (Blank and Dorf, 2017). That statement is debatable considering aspects that cannot be simulated with reasonable computation efford, i. e. because of not fully understood design-function-relations in physical domains. The established perception of startup products as software fails to reflect the reality of hardware-intensive product development activities in startups. This is also displayed in the German Startup Monitor 2022, where product development is identified as the second biggest challenge after sales since 2020 (Kollmann et al., 2022).

We have identified a lack of scientific understanding of hardware-intensive development activities in startups, especially when describing cyber-physical systems (CPS). CPS are integration of computation with physical processes (Lee, 2010) expanding mechatronic systems through the possibilities of the Internet of Things (Graessler and Hentze, 2020). A CPS-example is a “smart toothbrush” including mechanics, sensors, actors, intelligent control systems and an internet connection to related services like a monitoring app.

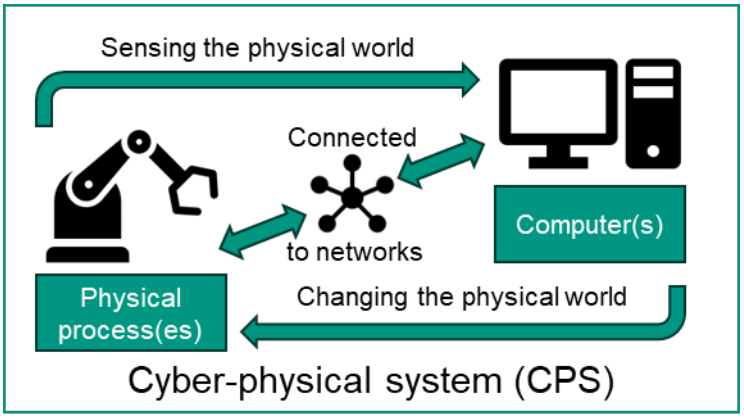


Figure 1: Definition of cyber-physical systems. Own illustration based on Lee, 2010

The character of CPS as enabling technology brings innovation potential for future applications and business models. However, the development of CPS has many potential risks in the interdisciplinary development of technology (Mosterman and Zander, 2016) and in the understanding of business relations, business models, and the self-conception as producer and client in an interconnected business ecosystem (Schneider et al., 2023). Current research is focussing on understanding requirements for agile development of CPS, but still is unclear about the boundary conditions, requirements and problems of established development environments (Albers et al., 2024). For startups, the threshold for developing complex systems like CPS coming with this uncertainty could be even worse.

Only a few publications investigate the development challenges of startups addressing complex technical hardware-related systems such as CPS. Therefore, we want to establish a first understanding of potential challenges and characteristic aspects of the development of CPS in startups with this paper.

2. Research aim, Research Questions, and Methodology

This study aims to exploratively investigate the status quo of current development practices in startups developing CPS to give a first qualitative understanding of the current situation of CPS development in startups. To achieve this, we want to answer the following research questions (RQ):

RQ1:What challenges and problems do CPS-developing startups face?

RQ2:What is the current development practice in CPS-developing startups related to those challenges and problems?

The first research question is answered in section 3 through an explorative literature analysis on publications from entrepreneurship and product development covering topics related to CPS- or hardware development in startups. They are selected by analyzing different literature search engines like *Google Scholar* or Web *of Science* by combining the following search keywords, i. e. “CPS”, “startup”, “hardware”, “IoT”, “Industry 4.0”, “development”, “challenges”, and “problems”. Papers are included when contributing to the questions described in Section 3. The resulting understanding is refined into proposed problem fields of startups developing CPS.

The second research question is answered in section 4. Based on the literature-based proposed problem fields from section 3, semi-structured interviews are conducted. Semi-structured interviews are chosen to achieve a certain level of reliability in acquiring comparable data but also allow individualised feedback from different interview participants. This is needed due to the explorative approach resulting in unpredictable outcomes.

The structure is oriented on Renner and Jacob (2020), including a brief introduction to the topic, followed by easy and intuitively answered questions in a quick-time question segment, one open question per problem field and a short breakdown at the end. Each interview takes about 30 minutes. Each interview was conducted in German. The interview guideline can be accessed on the following link:

https://bwsyncandshare.kit.edu/s/tQs6rcANmGZpFYc

A shortened and anonymised transcript of each interview based on a consensual recording is checked by the interviewees. Quotes from the interviews are allowed to be shared in this publication.

The interviews are conducted with eight participants from different startups located in Southern Germany. The selection was based on the following criteria:

- The startup is working on a CPS-idea.
- The startup does not only work on software.
- The participants have an insight into engineering and decision making processes.

Four out of eigth of the participants are involved as founders; the other half are involved as employees in the startup. The individual experience in the corresponding startup ranges from a few months to 10 years with an average of around two and a half years. The startups are active in different industries, i. e. production technology, mobility, financial technology, intralogistics and consumer goods.

The quotes derived from the interviews are clustered into reoccurring patterns related to the proposed problem fields. Those patterns are presented as the proposed characteristics of the status quo of CPS development in startups (see section 4).

3. Result of the Explorative Literature Review

To understand the possible challenges of CPS development in startups, literature is analysed by their contribution to answering three describing questions: Who participates in the development of CPS in startups (1), what describes CPS development in startups(2), and how do startups organise their development activites (3)?

3.1 Who Participates in the Development of CPS in Startups?

The participants in CPS development are entrepreneurs, employees, investors, and external stakeholders. Their role in startups is described in many publications, one is of particular interest: Zaheer et al. (2022) analysed the impetus of founders involved in multiple startups. They discovered that the work of founders on their system, the flexibility in working on the system in development (SiD) and the decision to pivot in their entrepreneurial and product development journey are key motivators for entrepreneurs. They identify an "entrepreneurial journey"-framework shown in Figure 2.

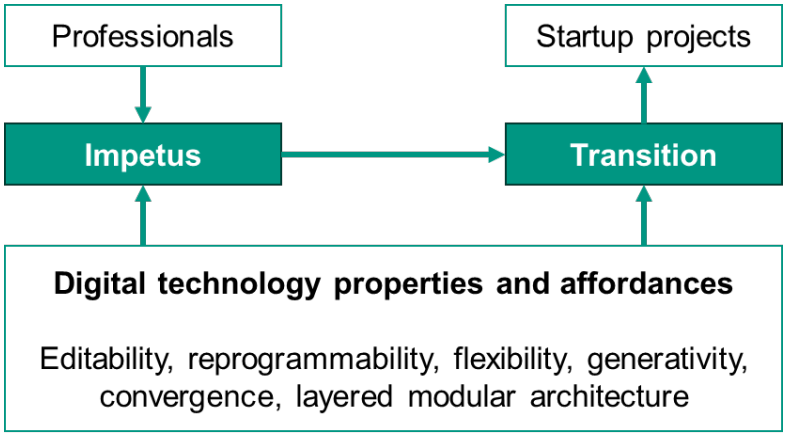


Figure 2: Digital Entrepreneurial journey framework. Own illustration based on Zaheer et al., 2022

Key enablers shown in Figure 2 are mainly found in software development environments. Complex constraints between engineering domains in CPS development are the strict opposite of these enabling factors, while generativity or layered modular architecture can be key aspects of CPS development activities. Thus, the motivation and impetus to get active in CPS-developing startups is questionable.

3.2 What Describes CPS Development in Startups?

The development of CPS in startups was not addressed in current literature. An answer has to be approached by the current understanding of related publications. This should include the driver of development (innovation), the development practice and related activities.

One of the main characteristics of startups is their *innovation orientation* (e. g. Kollmann et al. 2022, Kollmann et al. 2023, Steigertahl et al. 2018). Innovation can be described through many modeling approaches: Brown and Katz (2009) describe innovation as the overlap of the criteria "Feasibility", "Viability" and "Desirability", Albers et al. (2018) describe innovation as the combination of a demand situation (described in a product

profile), an invention (through an idea and technical solution) and a successful market launch (displayed in market presence).

Recent research has shown that systems are not developed independently but rather *in generations* leading to the development of the SGE – System Generation Engineering (Albers and Rapp, 2021). They are based on a reference system containing all planned and already realized elements from internal or external sources interacting with each other. The reference system is steadily changing as new knowledge and references are gathered during the product development process (Albers et al., 2019). The reference system is transferred to a new system generation through three types of variation: carryover variation addressing only small changes in interfaces (1), an attribute variation changing the attributes of a known principle (2), or the principle variation implementing a new solution approach (3) (Albers et al., 2020).

Berg et al. (2020b) identify the need for activities preceding or succeeding the core activities in software engineering when working on hardware products in startups (*remark: they understand hardware as the combination of software and electronics to embedded systems, this does not include mechatronic aspects of hardware development*). This includes the *development of prototypes*, the *production*, and *logistics*. Especially prototyping is described as the main time-consuming activity in hardware development in startups (Looney et al., 2022). The time consumed by prototyping activities is heavily related to the usage of evolutionary development approaches, Hardware-Software-Decomposing, and the usage of agile development approaches. (Berg et al., 2020b). The speed of development in startups mainly is limited by resources available for development and the quality trade-offs and technical debt occurring during development (Berg et al., 2020a). Using approaches such as the SGE in startups usually results in the development of a first system generation based on high shares of principle and attribute variation of external reference system elements which contains a huge development risk (Pfaff et al., 2021).

The core activity in startups (and startup support) is *validation on different levels*: e. g. the early validation of the risky main business hypothesis with minimum viable products (MVPs) (Ries, 2012) or the validation of customer needs through iterative customer hypothesis validation (Blank and Dorf, 2017), but also the validation of the feasibility and the management of risk identified within the development project (Pfaff, 2021).

3.3 How do Startups Organise Their CPS Development?

As implied by Berg et al. (2020b) and Pfaff et al. (2021), agile development processes are needed to develop hardware systems in startups. As agile CPS development in companies isn't scientifically described in industrial practice (as startups) (Ahmad, 2020). To describe startups organisation of development activities, related publications are used.

Agility is a challenge to hardware development in general, i. e. in the common understanding or view of agile development in physical products, in time restrictions in manufacturing processes, in physical restrictions or appropriate incrementation of the product (Atzberger et al., 2020). In startups, customized iterative practices, sufficient competence in teams, and collaborative decision-making are enablers for agility and quality (Berg et al., 2020b). Reference processes for hybrid approaches between planned and agile product development are proposed (e. g. Stock and Seliger, 2016), but not documented in practice.

Product development in the early stage of startups is characterized by the finding, the definition, and the realisation of the startup idea (Kollmann, 2022). In most cases, the idea for startups is already established. Many founders use accelarator or incubator programs to structure and develop their startup. Besides the structured environment, programs mainly contribute to enabling financing, help to validate the product idea and collaboratively work on the individual learning experiences (Crișan et al., 2021).

3.4 Proposed Problem Fields of CPS Development in Startups

Analysing the literature given above, four main problem fields of the development of CPS in startups arise:

Table 1: Proposed problem fields

Problem field	Explanation
I	*The unclear impetus for entrepreneurs and their ideas*: We cannot be sure how exactly ideas for CPS-developing startups come up and what motivates founders to work on CPS. Present literature mostly covers software-developing startups, the risks for developing CPS seem to be higher than for software-developing startups.

Problem field	Explanation
II	*Uncertainty in idea generation for and validation of CPS in startups*: Validation was identified as one of the main activities of startups in product development. This especially includes not only feasibility but more the viability and desirability of the startup idea. Typical methods of product engineering and entrepreneurship tend to not fully suit CPS-developing startups. The methods heavily rely on established knowledge (e. g. from SMEs' previous customer interactions) not present in startups or on boundary conditions not suiting hardware development (because of complications with potential intellectual property, i. e. Ries, 2012).
III	*CPS-Prototyping with limited resources*: Startups developing CPS rely on a fast product development process, cost-sensitive resource usage decisions and qualitative adequate results they can sell. Literature generally identifies prototyping as a key influencing factor on those objectives but does not propose sufficient support to deal with the challenges of technical debt, knowledge generation, and management, or development risk management.
IV	*Uncertainty in the acceptance and usability of processes, methods, and tools (PMTs) provided*: In a more general way, literature reported that neither established agile approaches nor classical project management methods fully satisfy the high demand for customized iterative approaches in CPS-developing startups.

4. Characteristics of the Status Quo of CPS Development in Startups

The following section will propose twelve characteristics of the status quo of CPS development in startups based on the results of the conducted interviews described in Section 2 and respective quotes underlining them. Each quote contains an identifier (letters A-H) and the actual quote in italics. They individually contribute to the initial clarification of the conducted problem fields.



Figure 3: Characteristic aspects regarding problem field I. Own illustration

Problem field I: the unclear impetus for entrepreneurs and their ideas

- *CPS founders are “Techies” searching for a challenge to learn:* Most of the participants describe themselves as technology-oriented rather than business-oriented with three of them identifying as “Techies” and three of them between both categories. They are driven by a will to learn (e.g. A: *“We wanted to manage something complex”*; D: *“After my studies I wanted to work in an environment I could learn the most”*). Also, CPS founders want to achieve the qualities of “generalists” working on many topics rather than expertise in one single field of action (D: *“I wanted to position myself broadly and act as a generalist rather than choosing the narrowness of a specialist.”*; G: *“I realise that I lack experience in certain tasks, especially in the execution of things and the various manufacturing techniques.”*, also H).
- *CPS founders regularly start with an idea:* Out of seven clear answers on the source of the vision or idea of the startups, six stated that the original idea was present way before the founder team for the startup came together. Only one participant stated that the team came together before the startup idea was found. This was due to the constellation as part of an innovation project in a student lab where students were joined together to openly search for an innovation idea. The most common source of ideas were personal needs rather than validated demand situations (e.g. B: “the co-founder had the given problem and has found no suitable solution on the market”) and existing technology from research (C based on the EXIST research transfer) or industry projects (E as an industry spin-off). Most of the ideas are technology-driven (rather than demand-driven) and are searching for a suitable business model.

- *For CPS founders, work on physical systems is a core benefit of CPS rather than software-only-systems:* The aspect of motivation in working on and shaping of software systems stated by Zaheer et al. (2022) could not only be confirmed but can be extended to the motivation of creation of physical and therefore touchable artifacts (H: *"My first internship was in a startup creating administrative software. That didn't work out. (…) For me, it's important to have something tangible, something I can touch. I am naturally talented with my hands and love building things."*). Contrary to our initial assumptions, this perceived benefit is not diminished by hardware-specific challenges such as hardware costs.
- *CPS ideas are motivated by single-domain views:* In the first section of the interviews conducted, one specific question addresses the self-understanding of the company and the product developed. Similar to the questions before and after, they could choose between two extreme statements: One the one hand software-driven development (Remark: *"the iPhone on wheels" if their company would develop a car rather than their actual product*) or a hardware-driven development (Remark: "the best *possible car with cool software features" if their company would develop a car rather than their actual product*). While in the other questions, many participants had problems deciding on one of the two extremes, this question has only extreme answers. Five out of eight participants identify software as the driving domain of their company. This leads to the hypothesis that current CPS development is mostly based on the view of one single technical domain as a dominant view rather than an integrated understanding of the interdisciplinarity of the system.



Figure 4: Characteristic aspects regarding problem field II. Own illustration

Problem field II: Uncertainty in idea generation for and validation of CPS in startups

- *Validating the CPS idea is the main challenge in CPS-developing startups:* Validation in general is already described as one key activity in startups by established literature. This is confirmed by the participants of the interview study (B: *"Finding the* right *idea is extremely difficult. (…) You have to try, test and watch things and have to evaluate if they work or not"*). Although difficult, only real customer contact is seen as the last instance of validation (D: *"Only the validation through concrete sales KPIs can give you an indication, if we are looking in the right direction"*).
- *An integrated view on feasibility, viability, and desirability is hard to find in CPS startup founders and workers:* CPS development needs interdisciplinary cooperation between technology domains, but its engineering in startups also needs an integration of technological and entrepreneurial thinking. Some of the most technologically trained founders do see the feasibility aspect as the most relevant for business. (C: *"There is no* minimal version *of hardware products"*, E: *"Answering the question of how the product can be monetized or how the business model fits into the overall image can be done later on."*). Business-oriented development aids, i. e. the Business Model Canvas (BMC), achieve mixed reviews by technology-oriented founders (A: *"Its usage was exhausting and annoying, but (…) many decisions [in hardware and software] do rely on this, especially what we are focusing on in our validation in prototyping activities"*, but also in D: *"I think there is no realistically filled BMC"*).

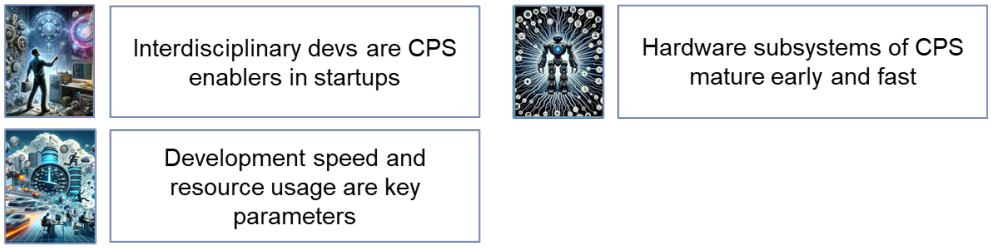


Figure 5: Characteristic aspects regarding problem field III. Own illustration

Problem field III: CPS-Prototyping with limited resources

- *Interdisciplinary developers are enablers for CPS development:* Developers who not only understand themselves as generalists in their respective domains but also look at different domains, are key resources for development activities and efficient prototyping in startups. (D: *"After my studies, I*

wanted to learn as much as possible. (…) I wanted to have a broader knowledge and become a generalist rather then a specialisit, [so I decided for a startup to work in].”, F: *“I have to few experiences in certain domains”*). Their ability to easily overcome communication burdens and inefficiencies is a major benefit for startup development activities (E: “*Our Electronics engineer has a very good understanding of software, (…) the resulting smooth communication was very helpful*.”

- This is also seen in the according competences of a CPS startup founder identified by a serial entrepreneur, Interviewee B: “*A good CPS founder has a systems talent* (meaning a combination and coordination ability) *and a development talent* (meaning a good problem understanding and a bond to software and hardware)”.
- *Hardware subsystems of the CPS have to mature early and fast:* Hardware in startup is a big factor for risk assessment. Therefore the hardware has to mature a lot earlier than software features (C: *“After 10 years in the market we have released the second generation of our product.”*, G: *“There are fewer adjustments in the hardware. We make continuous improvements, but there will be no radical redesign of the concept.”*). The early validation of the overall feasibility is the most relevant task in the early stages (A: *“This was our proof-of-concept: Our idea is possible, the rest is a question of money invested”*). Besides that, the desirability has to be validated through mock-ups centered on customers and investors (G: *“We first worked on the aspects customers and users would get in touch with, the technical details came later.”*, D: *“We first checked if the customer matches with the vision of the product.”*). An interesting observation was made in the description of Interviewee H: They are developing CPS for in-house solutions selling a product produced on their own CPS. Without their contact with customers, H describes that hardware and software changes can be implemented much faster and easier which would not be possible if they used their CPS directly with customers.
- *Speed and resource usage are the most important development parameters in Prototyping:* The relation of prototyping speed, resources, and achieved quality for hardware startups focused on embedded systems can be confirmed for CPS. Hardware availability and resource consumption is important for prototyping (A: *“Our [student] projects budget was 500€ while needed sensors cost about 100€. (…) The development focus has to slim down!”*). The focus on achieved quality in prototyping highly differs through the interview sample (B: *“If a too high-quality focus is set, the development becomes too slow. The optimum has to be readjusted over time!”*, E: *“Quality of prototypes is not important. Functionality is the centre of attention.”*, G: *“Quality is no problem for us, it's more the available resources and the achievable speed”*, but also D: *“In our industry, quality has to be fulfilled. It must be externally validated and approved, especially due to product liability.”*). Technical debt is a relevant factor but results in inefficient usage of resources (A: *“You mess around a lot, which you later regret. We could not reuse any of our prototypes.”*). That collides with the stated positive effect of evolutionary approaches in hardware design stated by Berg et al. (2020a).

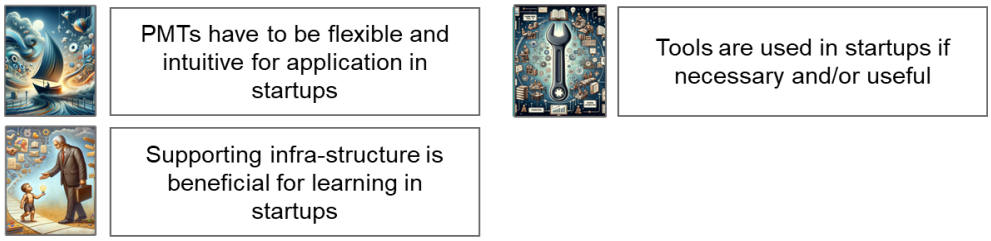


Figure 6: Characteristic aspects regarding problem field IV. Own illustration

Problem field IV: Uncertainty in the acceptance and usability of PMTs provided

- *PMTs have to be flexible and intuitive:* Seven out of eight s describe their development processes as very agile. Most of the participants are aware of the usage of methods and processes but describe a strong individualised (and sometimes repurposed) way of using them. (B: “*I would never use the method I developed as an expert in its entirety in a startup. In the thinking process of course, but in its entirety, we do simply not have the resources for that.*”, H: *“I do not use the methods learned in university in my everyday business in the startup, but I take a methodical approach based on them”.*) Most of the s describe their PMT usage as mostly intuitive, not as rigid following. (G: “*Our approach is so agile and free, we do not use an agile framework for our processes.*”, “*There are rough targets we are working on, but we do not formalize everything or structure it in a process”,* D: *“We are using kind-of SCRUM, but do not rigidly. (…) It is suited to our needs”*).

- *Tools are used if necessary and/or useful:* Especially tools for development activities are the most relevant tools used in everyday business (G: *"Without such tools [as e. g. CAD systems] the amount of work would not be realisable and it would not be up-to-date."*). Besides that, tools are used for collaboration and knowledge management (D: *"We use Miro or OneNote to collect ideas [and communicate our thoughts]."*).
- *Supporting processes and environments are beneficial for organising and learning startups:* Especially inexperienced founders and startup employees tend to benefit from supporting processes and environments like incubators, accelerators, or student labs. Key aspects are the transfer of needed basic knowledge on entrepreneurship and product development not present as well as the given structure through deadlines or workshops (A: *"All of us are Techies, we look at the system with our nerdy view, not a business view. Because of that our participation in the lab was good."*, C: *"What has given us a big benefit was an accelerator program. Many of our foundations were build up there.",* E: *"Student startup competitions where a good structure we could orientate ourselves on."*).

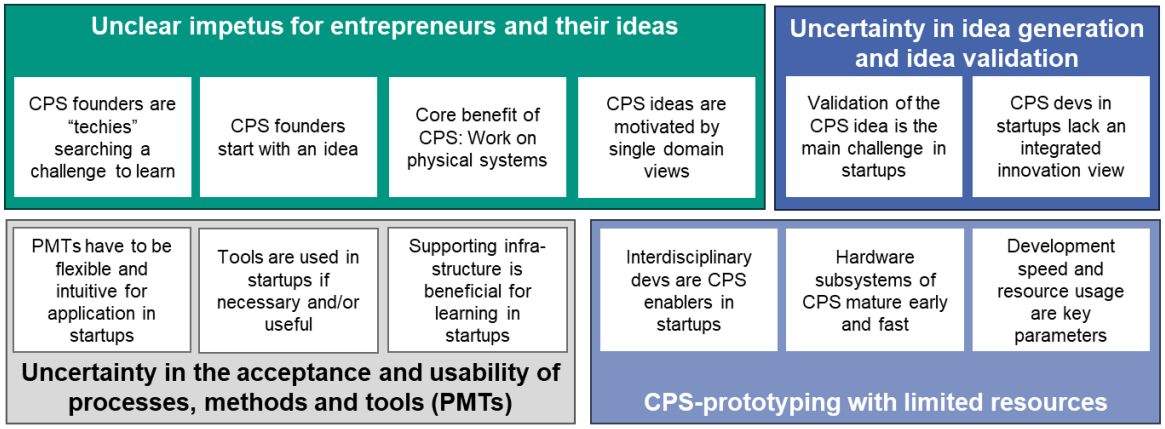


Figure 7: Twelve proposed characteristic aspects of CPS development in startups. Own illustration

5. Discussion

This paper is a step into describing and understanding the CPS development in startups. With the explorative approach of the study based on eight interviews, a qualitative overview of the perceived status quo of startups is proposed.

The validity of the results is influenced by many factors due to the explorative approach used. The broad, but not deep analysis of the respective literature in section 3 leads to the possibility for not included aspects and conceptions of hardware development in startups. Also, the number of interviewees and the diverging background of the participants leads to the possibility of a non-representative sample.

Because of these limitations, the proposed problem fields and characteristic aspects of CPS development in startups are first qualitative descriptions of the status quo of CPS development in startups and are open for discussion. Nevertheless, this study builds up an empirical dataset on CPS development in startups and a foundation for future research activities.

Future studies should verify the proposed problem fields with a systematic literature review and conduct more interviews in specific target groups (e. g. specific industries, in the same complexity levels of the SiD or with entrepreneurs with comparable backgrounds). In the long term, the development of suited support for CPS development in startups is needed. It should consider current research findings in product development as well as in entrepreneurship. A strong cooperation of both research disciplines is needed to generate a positive impact on the future entrepreneurship ecosystem for CPS startups.

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Commercialisation Tools in Network Research Organisations

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Abstract: The paper aims to identify which commercialisation tools (CT) are employed in network research organisations as exemplified by the Łukasiewicz Research Network, Poland. The authors analyse the state of the art by studying publications in the Web of Science database and present a longitudinal case study. The commercialisation tools identified as a result of the literature review are classified according to an original approach proposed by the authors. Then, the proposed classification is applied to indicate the commercialisation tools used in the Łukasiewicz Research Network, one of the largest recognised research networks in Europe. A longitudinal single case study is used. The data is analysed at two points in time, i.e., for periods before and after the establishment of the Łukasiewicz Research Network. Namely, the tools used by individual research institutes before and after their inclusion in the network as well as the joint use of tools by the institutes making up the network are examined. The presentation is followed by a discussion of the contexts of applying commercialisation tools in the network organisation and individual institutes. Suggested future research includes analyses of the relationship between the use of specific commercialisation tools and commercialisation effectiveness measured by means of a set of commercialisation performance indicators.

Keywords: Commercialisation, Commercialisation tools, Network research organisation, Infrastructure, Infostructure, infoculture

1. Introduction

Technological development and innovation play a highly important role in long-term economic growth. Not only the development of innovative solutions but primarily their effective market introduction are crucial. The commercialisation of research results is a key way universities and research organisations demonstrate their impact and the value they add to industry and society as a whole. Commercialisation is important for this group of organisations not so much as it generates income, but because: 1) they have a responsibility to transfer their research results into society for its benefit and 2) it increases industry engagement, which helps to find new R&D avenues, collaborators and funding, and enhance career prospects (Pesonen et al., 2008).

Commercialisation is treated as the design, development, making, and marketing of products based on new technologies to launch them in the market (Poteralska, Walasik, 2021). This a broad approach to commercialisation that includes its subsequent stages from concept to actions aimed at a practical application in the economic activity. It converges with the approach presented in literature, which identifies the stages key to the commercial success of a new solution (Bhasin, 2023). Products, services, and new technologies are listed among such new solutions (Meredith & Shafer, 2002, Atvare et al., 2022).

The paper focuses on commercialisation by research organisations. Their role involves providing services to firms in order to support innovation and enhance industry competitiveness (Pesonen et al., 2008). Organisations that are parts of networks are special cases. Network is defined as 'an institution facilitating innovative processes through cooperation that consists of (a) a set of measures enabling entities to realise joint projects and (b) a group of entities that creates, gains, processes, integrates, and utilises knowledge and skills for a technologically complex, economically viable, and socially acceptable innovation/change' (Blażlak, 2010). In this paper, network is a research organisation established within a formal network which is a cluster of its parts.

The authors are interested in commercialisation tools employed in network research organisations. They are understood as tools to support the commercialisation process (Huang et al., 2018). Specialist literature uses a similar concept of activities supporting commercialisation. The authors mean commercialisation tools as sets of specific rules, practices, methods, techniques, strategies, means, platforms, and systems serving to realise the process of commercialisation. They are practical elements supporting planning, implementation, and monitoring, a kind of navigation around the technical, regulatory-organisational, business, and marketing aspects of the process.

This paper aims to identify commercialisation tools employed by network organisations like the Łukasiewicz Research Network. It is structured as follows: firstly, the research methodology is presented, including the proposed approach to the analysis of commercialisation tools, the scope of the Web of Science analysis and the assumptions for a longitudinal single case study. This is followed by an analysis of the state of the art, focusing on the identification of commercialisation support tools, and the presentation of a longitudinal case study to compare the commercialisation tools used in the Network's individual institutes before and after the formation of the Łukasiewicz Research Network. The data used in the case study came from internal reports produced within the Łukasiewicz Network and from interviews with staff in units responsible for commercialisation processes in the Łukasiewicz Research Network institutes. The paper then discusses the diversity and effectiveness of commercialisation tools. The paper is summarised with conclusions and future research directions.

2. Method

An original approach to analysing commercialisation tools is applied. Their classification is based on (1) the definition by Bressand and Distler (1995), which says a network is a set of measures (infrastructure) and rules (infostructure) that enable entities that have access to them to undertake joint projects, provided these measures are appropriate to their needs and suitable for common use (infoculture) by the network (Ziółkowska, 2019) and (2) commercialisation assessment criteria in 4 areas covering the whole activity of entities analysed, namely: a) technological, b) market, c) economic, d) legal and organisational (Belina et al, 2013, Lipkova 2016). Infrastructure is an existing set of means, i.e., equipment, technology, system, and a cooperation network operated by specific principles; infostructure is a set of principles, that is, regulations, contracts, and an established method of operation, while infoculture comprises a set of resources, good practices, attitudes, values, trust.

Our analysis began with a Web of Science review to identify tools supporting commercialisation processes. The search criteria of ‘commercialisation tools’ and ‘activities supporting commercialisation’ were applied. Tools identified by the literature and employed by various entities, including research organisations, are classified along the following dimensions: infrastructure, infostructure, and infoculture.

The review provided the starting point for examining the Łukasiewicz Research Network and its commercialisation tools. Both all the Network's institutes (22 entities as of 31.12.2023) and the Network as such were studied. The case study method was selected because it helps answer ‘How?’ with reference to a contemporary set of events over which the investigator has little or no control (Yin, 2014). A longitudinal single case study was used. At the initial stage, data were collected from grey literature, or internal reports generated within the Łukasiewicz Network. Data on the use of commercialisation tools are collected continuously starting from 2019, when the Łukasiewicz Research Network was created. They are collected at least once a year. For the purposes of the paper, the authors used data from reports produced in 2020 and 2024 with information for the years 2019 and 2023, respectively.

The staff of units charged with commercialisation processes (directors, managers, specialists) in the Łukasiewicz Research Network Institutes were then interviewed. Data were analysed at two points in time, i.e., for periods preceding and following the establishment of the Network, which meant examining variables for individual research institutes before and after their inclusion in the Network. The use of a longitudinal single case study enabled 1) identifying the type of commercialisation tools applied by the Network as a whole and 2) comparing the use of commercialisation tools by the individual institutes before and after the formation of the Łukasiewicz Research Network. Commercialisation tools were designated with reference to infrastructure, infostructure, and infoculture and the areas of technology, market, economy, and law and organisation.

3. State of the art

The review focused on identifying tools assisting commercialisation. To this end, the Web of Science was searched using the criteria of ‘commercialisation tools’ and ‘activities supporting commercialisation’ (Table 1).

Table 1: A selection of articles in the Web of Science

Search criteria	Web of Science	Database after reading abstracts	Final database (after reading whole papers)
Commercialisation tool (topic)	249	20	11
Activities supporting commercialisation (topic)	154	40	16
Total	402	60	27
Total – on eliminating repeated publications			26

Source: The authors.

This analysis helped to identify commercialisation tools used by various organisations developing or implementing innovative solutions, including network research organisations. The tools identified were classified with regard to 3 dimensions: infrastructure, infostructure, infoculture (Table 2).

Table 2: The classification of commercialisation tools

Tool	Description	Author
	Infrastructure	
Prototyping and testing system	• Testing the readiness of technology through prototyping and tests • Products developed on campus can be built up as prototypes, then manufactured in small volumes before being transferred to a large-scale manufacturing facility	Huang et al., 2018, Youngleson & Jacobs, 2008
Structured product planning and marketing	• Creating a well-structured product planning and marketing exercise for technology, including major milestones and timeframes in the operational framework	Moncada-Paternò-Castello, et al., 2003
Innovation Radar	• The Innovation Radar is used as an intelligence platform providing insights on innovation activities in large collaborative projects	Napelski & Van Roy, 2021
Structured system for information compilation	• Maintaining a well-structured and updated system for a regular compilation of information to disseminate to likely interested users, collaborators and industry (information on: project advancements, new projects, research results, applications, etc.)	Moncada-Paternò-Castello, et al., 2003
Tools for uncertainty management	• Developing tools and procedures for uncertainty management supporting decision making already at early phases of front-end work, e.g., a tool called Opportunity Balance Matrix, an application of a known method called Potential Problem Analysis	Paasi et al., 2010
Established collaborative networks	• Virtual networks enabling greater collaboration between researchers and industry in the exchange and sale of Intellectual Property (IP) • Collaborative networks become the business ecosystem • Creating partnerships of existing or potential value network with an active role in different elements of fuzzy front end, new product development and commercialisation stages • Selecting business partners, nurturing healthy relationship with business partners, facilities and supports • Networking of appropriately skilled teams	Huang et al., 2018, Ismail et al., 2015, Cervantes & Meissner, 2014 Paasi et al., 2010, Taylor & StJohn, 2002
Open access journals	• Open access journals providing a channel for diffusing scientific results and open research data initiatives making research available for further investigation or innovation	Cervantes & Meissner, 2014
	Infostructure	
Standard contracts / agreements	• Introducing the Intellectual Property Framework, a set of online standard contracts to increase university-industry collaboration and research commercialisation, and the IP Toolkit • Creating standard licensing agreements often involving 'model' technology cooperation agreements that limit the potential of IP-related conflicts and disputes • Exchanging knowledge embedded in IP documents and contracts, particularly with industry	George &Tarr, 2023, Cervantes & Meissner, 2014

Tool	Description	Author
	Infrastructure	
Access to information on IPR	• Providing scientists with accessible information on Intellectual Property Rights (IPR)	Moncada-Paternò-Castello, et al., 2003
Formal technology transfer mechanisms	• Presence of formal technology transfer mechanisms, generally positively related to commercialisation	Perkmann, et al., 2013
Promotional and testing campaigns	• Promotional and testing campaign - providing enterprises with information on technical performance and requirements, alternative financing options and potential economic benefits	Moncada-Paternò-Castello, et al., 2003
Using external sources of information, including support of recognised experts	• Diffusing tailored information using the support of recognised experts • Designating and identifying an expert representative within the inventor's host institution, which has capacities to support and guide the inventor during commercialisation phases • Using external sources of information such as technology watch databases, foresight exercises, market databases and EU funding schemes that permit extending knowledge for positioning technology in the market	Moncada-Paternò-Castello, et al., 2003
Open innovation practices	• Using specific open innovation practices (open innovation information exchange and open innovation collaboration) impacting commercialisation enablers of high-tech SMEs	Pustovrh et al., 2017
Developing a technology evaluation plan, including ex-ante evaluation	• Developing an evaluation plan at an early stage, analysing the economic viability and commercial potential of technology • A prospective ex-ante evaluation of the economic value of technologies	Moncada-Paternò-Castello, et al., 2003
	Infoculture	
Post-Project Reviews	• Reviews at a research organisation consist in bringing "multifunctional and multilevel participants together at the end of a knowledge-creating project to discuss the application and commercialisation of project results" or become the basis for innovation or further research by industry	Bout et al., 2009
Involving a set of diverse actors	• Involving all necessary actors for the successful commercialisation of technology at an early stage, namely: inventor, host institution representatives and possible interested companies. • Sharing technology opportunities with possible interested parties • Involving suppliers and manufacturers in the new product development process • Creating partnerships of companies, universities and public research institutions to use external competences for fostering innovation	Huang et al., 2018, Cervantes & Meissner, 2014, Moncada-Paternò-Castello, et al., 2003
Personal contact	• Keeping repeated personal contacts and exchange of information	Cervantes & Meissner, 2014
Early linkages with industry	• Establishing early linkages with industry to prevent technology supplier from developing unrealistic expectations about the market potential and success of technology transfer process	Moncada-Paternò-Castello, et al., 2003
Corporate brand and reputation	• Corporate brand and reputation around efficacy based on legible measures of performance	Riep, 2019
Corporate culture	• Corporate culture and the innovation culture of a company as important factors affecting uncertainties related to radical innovation development	Paasi et al., 2010
Social media	• Social media fostering communication, connecting people and companies, and representing a vehicle for developing customer insights, accessing knowledge, co-creating ideas and concepts with users, and supporting new product launches	Bhimani, et al., 2019

4. Case Study

The study covers the Łukasiewicz Research Network, a network of institutes working with and for business and supporting the innovative development of Polish firms, with more than 7,000 staff, 4,500 researchers and engineers with 22 research institutes in 12 Polish cities. It is one of the largest research networks in Europe after the German Fraunhofer Gesellschaft and Finnish VTT (Technical Research Centre of Finland). Łukasiewicz's revenue is ca. EUR 400 m at present. The Łukasiewicz Network as a whole undertakes a range of actions to support commercialisation. Its flag activities include: the Challenge System (a tool to work with enterprises looking for solutions to technological or process problems), actions to expand participation in international projects (e.g. financial incentives for researchers), brand management (e.g. visual resources and contents like brand name, logo, slogans), and image actions like participation in fairs, conferences, congresses or an acceleration programme fostering the creation of spin-offs.

The longitudinal case study relates to 2 aspects:

- Designating the commercialisation tools used in the Łukasiewicz Research Network, including such dimensions as: infrastructure, infostructure, and infoculture and the following areas: technological, market, economic, legal and organisational (Table 3: columns 1-6).
- Comparison of the commercialisation tools used in the Network's particular institutes before they joined the Network and in the Network as a whole (Table 3: columns 7, 8).

Table 3: Classification of the commercialisation tools used in the Łukasiewicz Research Network addressing 4 areas of activity (columns 1-6) and indicating the tools used by Institutes before (column 7) and after joining the structure of Łukasiewicz Research Network (column 8)

No	Commercialisation tools	Technological area	Market area	Economic area	Legal and organisational area	Tools used by the individual Institutes before joining the Network	Tools used by the Institute after joining the Network
INFRASTRUCTURE							
1	Start-up and testing of the CRM customer support system in Łukasiewicz Institutes	☒	☒	☐	☐	Simple CRM systems functioned in 14% of the Institutes.	23%, the target is 100%
2	Łukasiewicz's technological range (catalogues of technological projects and of the Institutes)	☒	☒	☐	☐	100%	100%
3	Projects realised as part of subsidies aimed at commercialising results	☐	☐	☒	☒	Depending on competitions announced by intermediary units, e.g. POIR Fast Track – implementation/ commercialisation 60%	100%
4	Cockpit (aggregated management data on intellectual property, sales agreements, KPI and revenue monitoring in terms of commercialisation)	☐	☐	☒	☒	Reporting at the level of Institute directors using an excel tool – 60%	100%
5	Science and popular science, specialist or business journals issued by the Institute	☒	☒	☐	☐	23 journals, 9% Institutes have their own scientific publishing houses	No changes
INFOSTRUCTURE							
6	Rules for management of copyright and related rights and industrial property rights	☐	☐	☒	☒	18% Institutes had regulations in this area	100% - standard documents

No	Commercialisation tools	Technological area	Market area	Economic area	Legal and organisational area	Tools used by the individual Institutes before joining the Network	Tools used by the Institute after joining the Network
INFRASTRUCTURE							
7	Remuneration rules, including for sales and commercialisation	☐	☐	☒	☒	100% Institutes had remuneration rules	100% - standard principles of remuneration, including for sales / commercialisation
8	Model of indirect intellectual property commercialisation in the Łukasiewicz Research Network (guidelines)	☐	☐	☒	☒	9% Institutes had indirect commercialisation (companies)	14% Institutes had indirect commercialisation (companies)
9	Good practices of intellectual property protection and management in Łukasiewicz for authors and staff	☐	☐	☒	☒	Procedures of intellectual property management in 23% Institutes	100% - standard documents
10	Good practices for Łukasiewicz companies – key rules and processes for indirect commercialisation, preparing a legal structure for future startups and their market entry	☐	☐	☒	☒	Procedures of intellectual property management, including company foundation, in 14% Institutes	100% - standard documents
11	Preparation of standard agreements necessary for intellectual property commercialisation, e.g., joint rights to patent agreements	☐	☐	☐	☒	A variety of agreements were in place, 9% Institutes had joint rights to patent agreements	100% - standard documents
12	Sales model in Łukasiewicz - sales strategy and standards for the Łukasiewicz Network and Institutes	☐	☒	☒	☒	27% Institutes had regulations in this area	100% - standard documents
13	Production model (the project to improve effectiveness of production areas, their separation and transfer to third-party companies).	☒	☒	☒	☒	Production-related areas in 18% Institutes	The model implemented to all Institutes having production, production areas were separated and transferred to third-party companies in 5% Institutes.
INFOCULTURE							
14	Łukasiewicz Brand project (identify Łukasiewicz researchers and products, technologies and services with media potential)	☐	☒	☐	☐	18% institutes declared occasional media contacts	100% at the level of the whole Network and its Institutes
15	Conference with Polish emigre community – co-organise a regular international conference	☐	☒	☐	☐	Participation in conferences (100%), their organisation (32%)	Participation in conferences (100%), their organisation (50%)
16	Innovatorium – a regular internal event (staff integration, making and maintaining contacts with business partners	☒	☒	☐	☐	Occasional events for the Institute's staff and business partners (50%)	100%
17	A coherent image of the whole Łukasiewicz with clients and partners	☐	☒	☒	☒	Institutes had their logotypes, websites – 100%,	Coherent image – logo, website www, stationery: 100% Institutes

No	Commercialisation tools	Technological area	Market area	Economic area	Legal and organisational area	Tools used by the individual Institutes before joining the Network	Tools used by the Institute after joining the Network
INFRASTRUCTURE							
INFRASTRUCTURE, INFOSTRUCTURE, INFOCULTURE							
18	Pimcore-based Product + Service (P+S) and intellectual property databases aggregating Łukasiewicz institutes' products, services, and intellectual property rights (infrastructure – IT system, Infostructure – data aggregation/base, infoculture – procedure/dissemination)	☒	☐	☒	☒	Excel database – 100%	Web application 100%
19	Łukasiewicz accelerator: a project supporting indirect commercialisation, or formation of startup capital companies (infrastructure – programme, Infostructure – acceleration model, infoculture – demoday)	☐	☒	☒	☒	No part in the acceleration programme, but 14% Institutes realised indirect commercialisation (companies)	100%
20	Participation in key fairs, meetings with clients, presentation of products, services, and technologies (infrastructure – a modular exhibition stand, Infostructure – data aggregation/base, infoculture – procedure/dissemination)	☒	☒	☒	☐	Individual Institutes participated in selected fairs and other events, meetings with enterprises, 100% (smaller exhibition spaces, higher costs)	100%
21	Łukasiewicz's P+S challenges – solutions to problems reported by business to be offered within 15 days (infrastructure – IT system, Infostructure – data aggregation/ base/challenge hosts, infoculture – procedure/dissemination)	☒	☒	☒	☐	Offers presented at the Institute level (100%)	100%

Source: The authors

Our research implies all the CTs used by the Łukasiewicz Research Network now were operated by independent Institutes, too, though to a far lesser or more limited extent (often by a mere few of the 22 Institutes). This changed considerably after the Network's creation. Advanced infrastructure tools began to be extended to all the institutes. As far as infostructure is concerned, documents were standardised and implemented to all the institutes as guidelines (e.g., standard commercialisation rules and agreements, remuneration rules, e.g. for commercialisation, etc.). Infoculture was least affected, though the actions there relate to the crucial area of constructing the Network's coherent image and had already been undertaken by individual Institutes.

Interviews with several dozen commercialisation staff (directors, managers, specialists) of Łukasiewicz Institutes help to identify 3 groups of commercialisation tools depending on the scopes of their application:

- Basic tools – (7) CTs already used by all the Institutes before joining the Network, including product and service ranges, catalogues of technological projects completed, and a bulletin presenting the core fields of particular Institutes' activities, participation in fairs, websites, logotypes, training, remuneration rules. The changes on joining the Network standardised the regulations and layouts.
- Advanced tools – most (12) tools applied by some Institutes only. Joining the Network helped expand the range of tools, implemented to all the Institutes as guidelines (e.g. standard commercialisation rules and agreements). What is noteworthy, the larger the staff and revenue of an Institute, the longer the list of its tools.

- Specialist tools – (3) specific tools dedicated to several Institutes only. After joining the Network, their ranges were standardised only, not expanded (e.g. for Institutes running companies or production areas).

The Institutes continue reporting their needs for a continual improvement of their tools and development of their functionalities. No tools were identified used by isolated Institutes and then discontinued once the structures were formalised. Conversely, the growing numbers of tools employed by individual Institutes after joining the Network's structures, combined with rising commercialisation revenues and net profits after 1 April 2019 (Walasik, Poteralska, 2024), demonstrate their application is effective.

5. Discussion

Our state-of-the-art review helps to identify diverse commercialisation tools, most used in practice by the Łukasiewicz Research Network, the subject of this paper. The literature review failed to find a single publication, however, that would address the dimensions of infrastructure, infostructure, and infoculture at the same time. Our case study indicated this approach is possible and used in practice by the Łukasiewicz Network. The extensive ecosystem (infrastructure, infostructure, and infoculture) no doubt encourages and facilitates research. Actions involving three dimensions and becoming parts of at least 3 out of 4 areas defined acquire extra significance as tools supporting the commercialisation processes of organisations in a network. These are tools of maximum impact and thus maximum effectiveness supporting the commercialisation process. They can be described as, if not foundations of success of the network organisation discussed, certainly its strong distinguishing feature that contributes to its positive image and brand.

The diversity and effectiveness of commercialisation tools are crucial. Once the Łukasiewicz Research Network was established, the number of commercialisation tools applied by its Institutes clearly increased. What is noteworthy, the larger the staff and revenue of an Institute, the longer the list of its tools. There are of course CTs that, due to their unique operation, are dedicated to a few Institutes and their application was not expanded after they became part of the Network's structures, but standardised in most cases (e.g. for the Institutes with companies or production areas). Some CTs were utilised in independent Institutes, yet to limited extents, and then designed and implemented to all the Institutes to support the management (Cockpit, Pimcore Base), business (Łukasiewicz Challenges, Accelerator) or image (shared exhibition stand) of the Network as a whole.

Assessing the effectiveness of CT is another important aspect. The Network's formation enabled the particular Institutes to increase the numbers of their CTs and transfer of work, e.g., the accelerator or the challenge system, to the network level, which directly translated into higher profits and commercialisation revenues in the period of the Network's operation, i.e., 2019-2023. Becoming part of the Network, the individual institutes gained access to knowledge, unique resources and infrastructure, and opportunities for close and consolidated cooperation, thus building competitive advantage. Measuring the effectiveness of actions involving three dimensions: infrastructure, infostructure, and infoculture, is of special significance. It should be a key element of the Network management which not only allows for evaluating the effectiveness of actions and tools implemented but also provides foundations for an accurate setting of short- and long-term goals for both the particular institutes and the entire Network.

6. Conclusion

Based on the classification of commercialisation tools available in literature, comprising three dimensions: infrastructure, infostructure and infoculture, those employed by the Łukasiewicz Research Network are identified. Using CT brings a number of benefits, improving productiveness (automation of recurrent tasks – contact management, e-mail communication, e.g., CRM system, project management system), sales (tailor-made solutions, potential customer management – collaborative networks), and customer support (efficient responses to customer queries and personalised assistance – P+S challenge system, MSteams), helps reduce errors (supply of precise data, use of tracking tools – social media, Google Analytics). Commercialisation tools are a necessary part of setting a model action path that leads to conversion of research results into market products. They not only facilitate the management of commercialisation process but also assure an ongoing information transfer and thus provide management support (impact on decision making).

The approach adopted by the authors adds a cross-cutting dimension to this discussion and foundations for more extensive research into commercialisation tools as an extremely important aspect of new technology commercialisation. The comparison of commercialisation tools of the institutes before and after inclusion in the Network is the novel element of the study. The results presented can be used for the needs of building a

commercialisation strategy. Depending on the commercialisation practices already in place in a particular organisation and the challenges it faces, a tailor-made set of commercialisation tools can be selected, taking into account the dimensions: infrastructure, infostructure, and infoculture, and the areas: technological, market, economic, legal and organisational.

Some research into the real contribution of commercialisation tools to improving effectiveness and how to measure it could be a good idea in future. Analysing which tools can be the most effective at the particular stages of the commercialisation process is another area for research.

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Inside the Entrepreneurial Mind: A Diary Research on the Evolution of Students' Entrepreneurial Intentions

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Abstract: The study focuses on examining the entrepreneurial intention of university students through the method of diary research. Specifically, the aim of this research is to investigate the factors that influence the entrepreneurial intention of students throughout the duration of a semester in which they attended the theory and exercises of the "Entrepreneurship and Innovation" course. Furthermore, this study seeks to gain an in-depth understanding of the evolution of this intention over time, and to further analyze students' thoughts and experiences related to entrepreneurship during the course. The sample consists of 85 individuals who have never attended an entrepreneurship course before and their participation was voluntary. They asked to complete a diary lasting 13 weeks from the first week of the fall semester starting on October 2023 until the last one on January 2024. Findings showed that students formed a positive entrepreneurial intention over time and that their involvement in projects and exercises in groups regarding the formation of a virtual business were the two most important factors that increased their entrepreneurial intention. The factors that inhibited the entrepreneurial intention of the students were the understanding of the elements of the dark side of entrepreneurship and the increased risk taking as well as some specific course contents. An important originality of the research is the use of the diary research tool, which is still at an introductory stage in the social sciences. The analysis of the responses was carried out through content analysis. It is expected that the research will provide a deep understanding of how students perceive, develop, and implement their entrepreneurial over time while attending an entrepreneurship course. The findings are important for educators and curriculum planners as they will highlight the determinants and elements that positively or negatively influenced the formation of students' entrepreneurial intention, allowing the introduction of innovative teaching methods that will enhance individuals' entrepreneurial intention and mindset.

Keywords: Entrepreneurial intention, Determinants of entrepreneurial intention, University students, Diary research, Content analysis

1. Introduction

One of the greatest predictors of entrepreneurial behavior is thought to be entrepreneurial intention (Liñán and Chen 2009; Shirokova et al. 2016). Among many determinants of individuals' intention to be self-employed, entrepreneurship education has been recognized as a significant driver of people's intention to start their own ventures (Tsaknis et al. 2022; Kefis and Xanthopoulou 2015). A significant number of studies share the common finding that entrepreneurship education develops students' entrepreneurial skills and emphasizes the entrepreneurial path as a career option, by increasing their awareness of entrepreneurship and allowing them to further develop their entrepreneurial mindset (Shahid and Ahsen 2021).

The aim of this research is to explore the process of Entrepreneurial Intention of undergraduate students who attended a thirteen-week course of "Entrepreneurship and Innovation" as well as related activities including entrepreneurship videos, business canvas creation for their own entrepreneurial ideas etc., with a view to better understanding the effect of all these activities and theory in the development of their entrepreneurial intention, but also to understand their feelings or views on the entrepreneurship over the weeks. The originality of this study mainly lies in its methodological innovation, utilizing reflective diaries as a primary tool for observing students' entrepreneurial intention (EI) over time. This approach distinguishes it from the broader body of research within the field of entrepreneurship education, where such longitudinal, qualitative methodologies remain underexplored. Notably, only a handful of studies, such as Hägg (2021), as well as "An entrepreneurial-directed approach to teaching corporate entrepreneurship at university level" by Heinonen (2007), have ventured into similar territories. The diaries provide as a rich, longitudinal data source by forcing students to methodically explain their ideas, reflections, and experiences throughout the semester. This approach offers a lens through which changes, trends, and critical junctures may be identified, enabling a thorough understanding of the developmental trajectory of entrepreneurial identity and ambitions among students (Morrison 2002). Within this framework, the study's novel use of reflective diaries adds to the body of literature by presenting new perspectives on the acquisition of emotional intelligence (EI) and by providing a

scalable methodological framework for further research in the field of entrepreneurship education and beyond.

2. Literature Review

The economic success of national economies and employment are significantly impacted by the choice of careers in entrepreneurship. Consequently, governments have concentrated their efforts on encouraging entrepreneurship since it is essential. Furthermore, studies indicate that one of the major factors influencing entrepreneurial intention (EI) is entrepreneurship education (Fayolle and Gailly 2013; Xanthopoulou and Sahinidis 2022). People can thrive in society by acquiring the information, skills, attitudes, and values that education normally imparts. Many academics have attempted to address the fundamental topic of what drives someone's purpose to become an entrepreneur and why they choose to do so (Sultan et al. 2016). As a result, "intention" is the essential term for understanding human behavior, according to Sheeran (2002), and studies have revealed that EI is present in many of the factors that affect a person's readiness to launch a new company. According to several writers of papers and publications, Hernández-Sanchez et al. (2019) noted a rise in interest in the study of Entrepreneurship Education (EE) and its impact on EI.

2.1 The Conceptual Definition of Entrepreneurial Intention

The idea of entrepreneurial intention (EI) is the self-admitted belief that starting a new business is a good idea, as well as the deliberate preparation to make this goal a reality at some point in the future. According to Thompson's (2009) definition, emotional intelligence (EI) is a crucial component in the shift from intention to concrete entrepreneurial activity. Neneh (2014) supports this interpretation by highlighting the pre-venture phase of entrepreneurship. Numerous factors are identified in the academic debate as supporting entrepreneurial intention. These are personal characteristics that both encourage and mold the process of making decisions toward entrepreneurship. Along with demographic factors like education, gender, and familial history, these features might include, but are not limited to, personal views, value systems, and psychological traits (Bae et al. 2014).

A large amount of research suggests that education is a crucial factor in boosting emotional intelligence (EI), and that people who have completed more school have a higher tendency to take advantage of business opportunities (Neneh 2014). Entrepreneurial Intention (EI) is a behavioral antecedent that is based on a basis of consistent and logical knowledge about entrepreneurial actions that may be enhanced by different forms of reward (Barringer 2015). The field of entrepreneurship studies has experienced a notable surge in the investigation of emotional intelligence (EI), characterizing it as a person's inclination to participate in entrepreneurial endeavors, such as starting new businesses or working for themselves (Xanthopoulou and Sahinidis 2023). This aspect plays a crucial role in demystifying the entrepreneurial process and explaining why some people are more likely than others to start a business (Soria-Barreto et al. 2017). It also acts as a crucial lens through which the development of new ventures and the phenomenon of entrepreneurship can be understood. The information gained from secondary and higher school might lead to increased levels of entrepreneurial attitudes (Sánchez 2013). Each educational level tends to have a different influence on entrepreneurial decision due to its unique techniques, aims, and resources, in addition to the fact that its drivers frequently differ (Jiménez et al. 2015). According to some arguments (Passaro et al., 2018), entrepreneurship intention is positively impacted by the availability of entrepreneurship education. In this research, we examine the relationship between students' entrepreneurial purpose and the components of the theory of planned behavior as influenced by entrepreneurship education provided by university programs.

2.2 Entrepreneurship Education

The hypothesis that entrepreneurial intention precedes entrepreneurial activity was verified by Kautonen et al. (2015). Therefore, policy makers, practitioners, and educators should consider what factors impact entrepreneurial intention (Maresch et al. 2016). Education in entrepreneurship has changed significantly to date. A number of academic fields, including technical studies, management, finance, and education, gave rise to the topic of education (Bae et al. 2014). According to the literature, schooling may influence a person's personality, abilities, and competences. An entrepreneurship education program should raise students' awareness of entrepreneurship, give them the chance to hone their entrepreneurial skills, teach them how to put theory into practice, and highlight entrepreneurship as a career option, according to researcher (Fayolle and Gailly 2013; Bae et al. 2014).

Giving students the foundational information and support they need to acquire the skills they'll need to start their own businesses in the future is imperative right now. Even while entrepreneurship education is becoming

more and more popular, there are still not enough generally accepted teaching resources and methods (Matlay 2005). In their study, Asghar et al. (2016) examined the relationship between antecedents of entrepreneurial intention and components of entrepreneurship education. They found that course activities, their mode of design, discussions of entrepreneurial success stories, role-playing exercises, interaction with other participants, and additional discussion and presentation enhanced students' intention to become entrepreneurs and gave them more confidence (Asghar et al. 2016). Entrepreneurial intention and self-efficacy were shown to be positively impacted by Puni et al. (2018) findings that entrepreneurial knowledge acquisition and opportunity identification are components of entrepreneurship education. Ojogbo et al. (2016) state that while perceived attractiveness intention and entrepreneurial education are positively correlated, perceived feasibility and self-efficacy are not. The same writers contend that in order to foster student creativity and innovation, educational reform is required. Marire et al. (2017) assert that many prospective entrepreneurs are lost because higher education institutions have not yet provided students with sufficient instruction about self-employment as a career alternative (Barba-Sánchez and Atienza-Sahuquillo 2018).

Overall, the positive effect of entrepreneurship education on individuals' intention has been confirmed in a plethora of research (Bae et al.2014; Fayolle and Gailly 2013; Kefis and Xanthopoulou 2015; Barba-Sánchez and Atienza-Sahuquillo 2018; Otache 2019; Lavelle 2021; Xanthopoulou and Sahinidis 2023). These studies largely reported findings supporting that entrepreneurship education improved people's perceptions of their abilities to start new businesses.

3. Methodology

The present research took place during the 2023/2024 academic year, focused on second-year (third semester) undergraduate students enrolled in the “Entrepreneurship and Innovation” course at the Department of Business Administration at the University of West Attica, Greece. This specific cohort was chosen due to the scarcity of research on the formation of Entrepreneurial Intention (EI) during this pivotal educational phase, as highlighted by Nabi et al. (2018). The selection was underpinned by the hypothesis that the entrepreneurship education as well as the activities in which students were involved plays a significant role in their entrepreneurial intentions and mindset development. Adopting a social constructivist lens, this research recognizes EI as a subjective and evolving socio-cognitive construct, which, according to Leitch and Harrison (2016), is inherently unstable over time. This perspective informed the qualitative methodological approach of the study, which incorporated the use of reflective diaries to capture a diverse range of perspectives on students' entrepreneurial intentions. Data collection was facilitated through online Google Forms, with participants responding to a consistent set of questions weekly over the 13-week semester.

According to Xanthopoulou and Sahinidis (2023), obtaining well-written responses is a quick and effective way to collect rich, descriptive data. Written responses provide data that is easier to understand and evaluate since qualitative research involves a lot of transcription of verbal interviews into written texts and then abstracting important themes from these texts (Zdrowski and Letherby 1995). The primary data was analyzed using the QSR NVivo program. NVivo is increasingly used by researchers as it covers three major aspects of the research process, specifically the data analysis, the theoretical development, and the presentation of findings (Dalkin et al. 2021; Nabi et al. 2018). Students were informed that their participation was voluntary, with assurances provided that non-participation would carry no penalties in their studies. A total of 85 participants engaged in the process, completing diaries on a thirteen-week basis.

These diaries included the critical reflection model of “What So What Now What” to encourage a structured approach to self-assessment and reflection on their entrepreneurial journey. With a primary focus on the development of their intention to be self-employed, this model facilitated the exploration of their experiences during the course ('What'), the feelings, thoughts and implications of these experiences after attending each week of the course ('So What'), and the potential entrepreneurial actions they might take in the future in response to these reflections ('Now What'). The purpose of this reflective practice was to help students better understand their own identity development and entrepreneurial aspirations in relation to their academic and personal progress. Throughout the study, the research team offered guiding sessions to participants as a kind of support.

Our study primarily relies on self-reported data, which is subject to several biases and limitations. Self-reported measures can be influenced by social desirability bias, where participants may respond in a manner they perceive to be more favorable or acceptable. Additionally, memory recall issues can lead to inaccuracies in participants' responses. Moreover, the voluntary nature of participation may introduce a selection bias, as

individuals who choose to participate might be more motivated or have a stronger interest in entrepreneurship than the general student population. This could result in an overrepresentation of motivated individuals, potentially skewing the study's findings. To mitigate these biases, we assured anonymity and confidentiality to participants and recommend future studies to consider using additional data collection methods to validate self-reported data.

4. Results

To present the findings the authors structured the following Table 1 which showcases the evolution of students' entrepreneurial intention (EI) over the 13-week course period. This approach combines statistical analysis with indicative responses to highlight both the quantitative and qualitative dimensions of the study. Given the answers provided in students' diaries, the findings are presented below. The final percentages have been calculated by dividing the number of students whose EI increased or decreased by the total number of diary entries analyzed for each week, then multiplying by 100 to get a percentage.

Table 1: Evolution of Entrepreneurial Intention Over 13 Weeks

Week	Percentage of Students with Increased EI	Percentage of Students with Decreased EI	Notable Student Responses
Week 1	20%	5%	"I feel more empowered to set up my own business venture with the knowledge I have gained through my degree."
Week 2	25%	3%	"The case studies, like that of McDonald's, have significantly influenced my perception of persistence and adaptability in entrepreneurship."
Week 3	30%	10%	"Understanding the dark side of entrepreneurship made me rethink if I'm cut out for this journey."
Week 4	35%	8%	"This week's reflection made me realize the importance of timing in launching a business."
Week 5	45%	7%	"Ideas are buzzing; feeling incredibly inspired to innovate."
Week 6	40%	15%	"Financial planning week was overwhelming but crucial."
Week 7	35%	20%	"Legalities in business feel daunting but necessary to understand."
Week 8	60%	4%	"Marketing strategies week reignited my passion."
Week 9	65%	3%	"Pitching my idea built my confidence substantially."
Week 10	70%	2%	"Networking and mentorship have opened new doors for me."
Week 11	75%	1%	"Weighing the risks and rewards more meticulously now."
Week 12	80%	0.5%	"Stressed but more determined than ever for my final project."
Week 13	85%	0.25%	"Reflecting on my entrepreneurial journey has solidified my intention to pursue entrepreneurship."

Table 1 provides a statistical perspective of the students' changing engagement with the idea of entrepreneurship by tracking the percentage of students whose intention to start their own business either rose or decreased each week. These percentages show how students responded to particular learning objectives or topics that were addressed each week. Furthermore, the table contains student quotes verbatim, which act as qualitative data to give the figures context and depth. These answers are crucial because they express the students' individual experiences and show how they are responding both emotionally and mentally to the readings. Table 1 and Figure 1 show a general pattern where a greater proportion of students feel more oriented towards entrepreneurship as the course goes. Overall, the EI of students was increased during the course except from the Weeks 6 and 7, where for Week 6, the percentage of students with increased EI has been reduced from 50% to 40%, and the percentage with decreased EI has been raised from 6% to 15%. Similarly, for Week 7, the percentage of students with increased EI has been further reduced from 55% to 35%, and the percentage with decreased EI has been increased from 5% to 20%. This can be attributed in the content of these two weeks, as week 6 discussed "financial planning" and week 7 discussed legal issues, in which business management students were not very familiar yet.

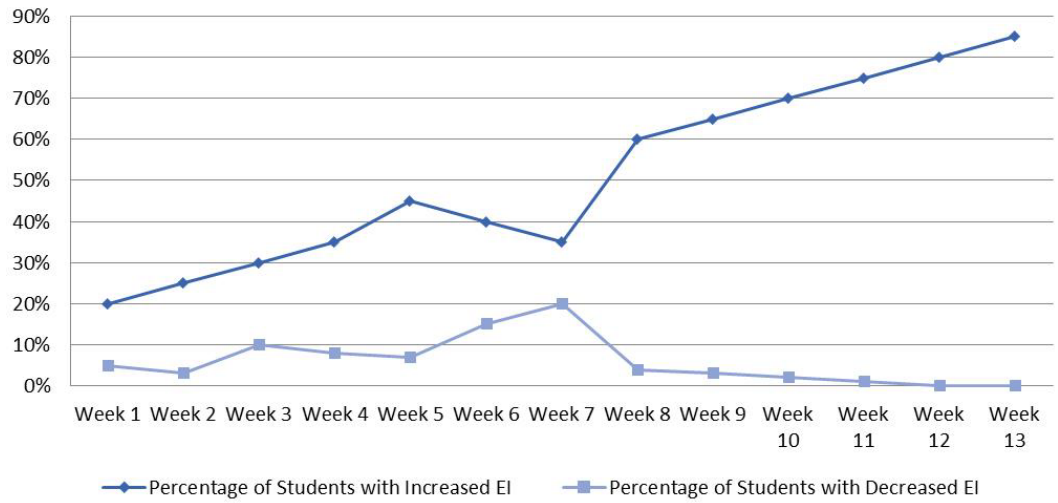


Figure 1: Evolution of EI over 13 weeks

The diary study was conducted from Week 1 to Week 13. A structured description of the students' progression of entrepreneurial intention (EI) during the course of the 13-week course is provided in Table 2, which combines qualitative observations with statistical analysis. The major ideas or crucial insights that arose from the students' weekly reflections are referenced in the "Key Insights" column. These conclusions are drawn from the qualitative data, which consists of the written reflections and conversations of the students. These insights emphasize recurring themes, key takeaways, difficulties encountered, and entrepreneurial discoveries. Based on the qualitative data, a developed metric called the "Average EI Score" will show how the course's effect may cause students' entrepreneurial intentions to change over time. Based on the replies, an overall score is calculated, and a higher score indicates a stronger desire to pursue entrepreneurship. On a scale of 1 to 5, “5” represents the strongest intention and “1” the lowest one.

In order to calculate the average EI score from the student responses, the first step was to sign a numerical value to each student's expression of their entrepreneurial intention, using a Likert scale where 1 represents the lowest level of entrepreneurial intention and 5 represents the highest one. This process was repeated for each week. Then, the authors divided the total score by the number of students (85) to get the average EI score for that week. The elements that constitute this score system include the students' self-assessed readiness, enthusiasm, commitment, and any other signs that they exhibit an entrepreneurial attitude. Finally, the third column “Highlighted Response” presents a particularly representative and powerful statement made by the students. This column captures the spirit of each week and its main theme as emerged from the thematic analysis of data. This offers an overview of the students’ experience or response with reference to EI in connection to the course's development.

Table 2: The "Average EI Score"

Week Number	Key Insights	Average EI Score	Highlighted Response
Week 1	Introduction to entrepreneurship; initial excitement	4.0	Excited about the potential of starting my own business.
Week 2	Exploring entrepreneurial traits; self-reflection	4.0	Realizing the importance of personal traits in entrepreneurship.
Week 3	Case studies of successful entrepreneurs; motivation boost	4.5	Inspired by the success stories of notable entrepreneurs.
Week 4	Understanding market needs; realism sets in	4.0	Starting to understand the real challenges in the market.
Week 5	Ideation and innovation; creativity peak	4.5	Feeling very creative and full of ideas for new ventures.
Week 6	Financial planning; realization of complexity	3.5	Overwhelmed by the financial complexities of starting a business.
Week 7	Legal aspects of business; awareness of	3.0	Concerned about the legal hurdles in

Week Number	Key Insights	Average EI Score	Highlighted Response
	challenges		entrepreneurship.
Week 8	Marketing strategies; renewed enthusiasm	4.0	Energized by learning effective marketing strategies.
Week 9	Pitching ideas; confidence building	4.5	Gaining confidence through pitching exercises.
Week 10	Networking and mentorship; understanding value of connections	4.5	Appreciating the importance of networks and mentors.
Week 11	Balancing risk and reward; cautious optimism	4.0	Weighing the potential risks and rewards more carefully.
Week 12	Final project preparation; stress and determination	3.5	Feeling stressed but determined to finalize my project.
Week 13	Course reflection; mixed feelings but overall positive outlook	4.0	Reflecting on the course, I feel more prepared yet cautious.

Table 2 summarizes how the students' entrepreneurial intentions evolved through the course, highlighting the fluctuating confidence and realization of the complexities involved in entrepreneurship. The average score of students' entrepreneurial intention (EI) throughout a 13-week period is displayed in Figure 2 below. The average EI score for a particular week is shown by each point on the line; scores are likely to range from 1 to 5. It is evident that the EI ratings across the weeks start at about 4, which suggests a rather high level of entrepreneurial ambition at the outset. EI scores fluctuate as the weeks go by, with a decline occurring between Weeks 6 and 7, which is then followed by a recovery. The scores exhibit a little declining trend toward the conclusion before stabilizing. Drawing from the influence of various course materials or activities each week, Figure 2 offers insight into the general patterns of the class's entrepreneurial mood as it fluctuates week to week. Additionally, it draws attention to how students' views and participation with entrepreneurship change throughout the course of the academic program.

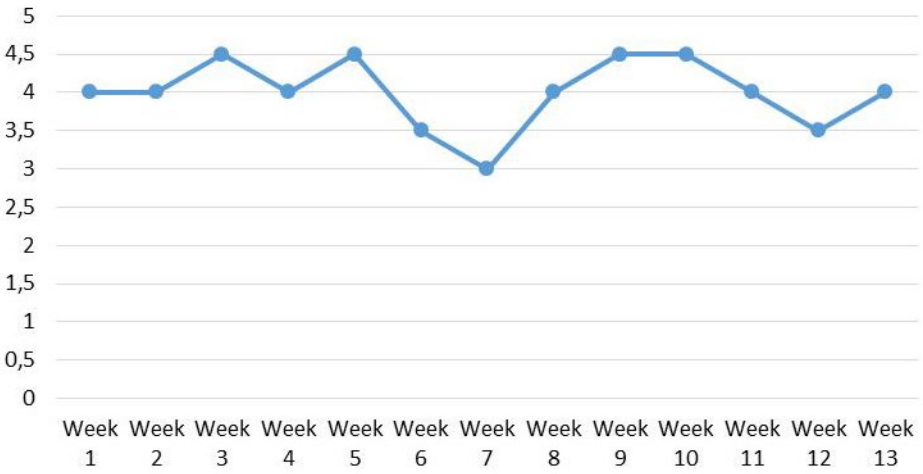


Figure 2: Average EI score

5. Conclusions

The present research aimed to shed light into the dynamics of entrepreneurial intention (EI) among university students, using a diary research as a research method. The selection of diaries contributes to methodological novelty of the study as this research tool is still relatively new in social sciences. The study was conducted during the third semester of studies where students attended the “Entrepreneurship and Innovation” course. Central to the findings is the revelation that students experienced a progressive development of their entrepreneurial mindset and intention mainly when started to attend entrepreneurship activities. Their active involvement in exercises such as the analysis of entrepreneurs’ profiles and the group creation of a business canvas of their personal entrepreneurial ideas, were major factors in their EI's upward trajectory, highlighting the importance of these activities in fostering their entrepreneurial intention. In some weeks, students showed

a decline in their intention to be self-employed, a trend which is attributed to students' theoretical exposure in the "dark side" of entrepreneurship and to their concerns about taking on more risk.

The empirical analysis produces various conclusions about how students' entrepreneurial intention (EI) changed during the 13-week course. Totally, the percentage of students displaying an increased intention to start their own business was shown to be usually increasing. This encouraging development confirms the literature regarding the positive impact of entrepreneurship education on students' intentions to become entrepreneurs. The week-by-week analysis identifies distinct points during the course when changes in emotional intelligence were more noticeable. For instance, the significant increase of entrepreneurial intention after Week 5, corresponds with the content of ideation and innovation. It was also observed a decrease in entrepreneurial intention in Weeks 6 and 7, due to the curriculum's emphasis during these weeks on the legal and financial sides of business. Responses provided insights into the emotional and cognitive spectrum from first elation to moments of uncertainty to final confirmation of the choice to pursue entrepreneurship. The students' answers through diaries allowed the recording of their experiences throughout their interaction with the course material and activities. Overall, the study draws the conclusion that entrepreneurship education is crucial in influencing students' intention to pursue entrepreneurship, especially when it includes experiential and reflective activities.

Future research could build on this work by exploring similar methodologies in different cultural or educational contexts to broaden the applicability of the findings. Different cultural and educational contexts can offer unique insights into factors influencing entrepreneurial intentions. Future research in these diverse contexts can significantly enrich entrepreneurship education and provide a comprehensive understanding of the factors driving entrepreneurial intentions. The reliance on self-reported data introduces potential biases such as social desirability and memory recall issues. Additionally, the voluntary nature of participation may result in a sample that is more motivated than the general student population, potentially skewing the results. To address these limitations, future research should consider using mixed-method approaches to validate self-reported data and ensure its accuracy. Expanding the demographic profile of participants to include a more diverse range of backgrounds will also improve the generalizability of the findings. Furthermore, incorporating a control group in the study design can help isolate the specific effects of the entrepreneurship course from other variables, providing a more robust analysis of its impact. By addressing these limitations, future studies can build on our findings and contribute to a more comprehensive understanding of the factors influencing entrepreneurial intentions across different contexts and populations.

The study acknowledges limitations despite its contributions, most notably that its environment is limited to a small group of Greek students. This acknowledgement creates space more research to duplicate the findings in various educational settings and cultural contexts, expanding knowledge on how entrepreneurial intentions are formed in various circumstances.

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Entrepreneurship and Happiness: Exploring the Nexus Between Lifestyle, Job Satisfaction and Subjective Well-Being

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Abstract: The present study delves into the less explored relation between entrepreneurship and happiness and aims to deepen our understanding on entrepreneurship, entrepreneurial activities and lifestyle, and subjective well-being. A sample of 13 interviews conducted with entrepreneurs in Portugal was analyzed by a combination of qualitative interviews. By relying on self-reports to gauge the entrepreneurs' perception of their own emotional state, the research has found that happiness extends beyond the traditional scope of objective well-being and is closely linked to their cognitive and emotional experiences, such as life satisfaction and emotional balance. The results show that entrepreneurs scored higher on happiness levels than the country average, even spending most of their week, weekends and holidays at work. Despite the long hours, more than half of the entrepreneurs did not feel they were missing valuable time with family and friends. However, they did acknowledge not having the most balanced and healthiest lifestyle reflected in a higher propensity to experience stress that could have further implications in mental health. These insights are central to understanding the nexus between entrepreneurship and well-being when factors such as on lifestyle, motivation and job satisfaction come into play, and the broader implications for entrepreneurial success.

Keywords: Entrepreneurship, Happiness, Job satisfaction, Life purpose, Lifestyle, Subjective well-being

1. Introduction

Everyone pursues their own version of happiness, a concept that has been deeply explored and whose definition has significantly evolved throughout history. Philosophers often recognize two interpretations of happiness: the first is a state of mind characterized by satisfaction, pleasure, or a general sense of positive emotion, and the second as overall life well-being or good fortune in general (Haybron, 2020; Szczygiel, 2020). For the purposes of this study, we have adopted the definition of happiness as described by Lyubomirsky in her book *The How of Happiness*. She defines happiness as "the experience of joy, contentment, or positive well-being, combined with a sense that one's life is good, meaningful, and worthwhile" (Lyubomirsky, 2007).

In fact, many entrepreneurs are driven by a sense of purpose and the desire to create something meaningful, whether it is innovative products or services, or generating social value. Entrepreneurs also pursue business ventures to gain greater autonomy over their work and personal lives. According to Ryan and Deci (2000), the ability to make decisions and control one's destiny is a significant contributor to well-being and growth. Nowadays, the main motivations that drive entrepreneurs to develop entrepreneurial activities are either necessity (when they have no other options to turn to), or opportunity (to exploit a business opportunity by setting up a company) (GEM, 2012). However, whatever the reason for undertaking an entrepreneurial activity, characteristics, and skills that an individual must possess or develop in order to achieve the desired goal are substantial and not always easily attainable.

In exploring the intersection of happiness and entrepreneurship, it is crucial to assess their relationship critically. The pursuit of lifelong happiness is a common human interest, raising the question: Are we chasing an elusive ideal, or is happiness a transcendent concept that eludes simple definition? This study will utilize the data to delve into these questions and determine to what extent happiness and entrepreneurship are interlinked. Therefore, this research aims to explore the relationship between entrepreneurship and individual happiness in Portugal, contributing to the literature by bringing interdisciplinary insights such as implications of public policy implementations, and integrating concepts from psychology into the studies of entrepreneurship. Hence, entrepreneurs' perceptions on their lifestyle, job satisfaction, purpose in life and overall well-being are investigated qualitative techniques.

The structure of the paper is organized as follows: Chapter 2 reviews relevant literature; Chapter 3 outlines the methodology, data collection methods, and analysis techniques used; Chapter 4 discusses the results of the empirical study and Chapter 5 concludes the study, offering final thoughts and suggestions for future research.

2. Literature Review

Entrepreneurship involves recognizing and acting on opportunities to create products or services, driven by innovation and a keen understanding of market needs. This proactive approach not only fulfils personal ambitions but also significantly benefits families by fostering financial stability and job creation. On a larger scale, entrepreneurship stimulates economic growth, enhances community development, and contributes to the global competitiveness of counties and nations (Shane and Venkataraman, 2000). Levels of entrepreneurship vary from country to country. These differences can be attributed to several reasons, among the most notable: the motive for entrepreneurship, whether out of necessity or opportunity, and product and labour market regulations imposed by the government. For instance, the analysis of the regulations implemented in Portugal, it was found that in 2018 the government launched the "Startup Portugal+ Program" which added new measures to the original "Startup Portugal Program". Its main objective is to encourage and support entrepreneurs in Portugal (ePortugal Government n.d.). Also, Ardagna and Lusardi (2010) observed that regulations affect levels of entrepreneurship through social networks, work status, business skills and attitudes towards risk.

According to the study on entrepreneurship in Portugal in 2012 and 2016 carried out by the Global Entrepreneurship Monitor (GEM), which studies entrepreneurship levels on a global scale, in 2012, Portugal had an entrepreneurial activity rate (TEA) of 7.7% (GEM, 2012). Put differently, out of every 100 people, between 7 and 8 are involved in the initial stages of entrepreneurship. Additionally, the number of male entrepreneurs in Portugal is 50% higher than the number of female entrepreneurs (GEM, 2012). Likewise, in 2016, Portugal had a TEA rate of 8.2%, that is, approximately 86% higher than that recorded in 2010 (4.5%) (GEM, 2016; GEM, 2010). Furthermore, in 2019 the registered TEA was 12.9%, showing a growth of more than 50%, as opposed to the TEA in 2016 (GEM, 2019). In this sense, emphasizing the holding the Web Summit in Lisbon, which is a joint initiative between Startup Portugal and Web Summit, strengthening the national entrepreneurial ecosystem is continuously important.

It is recognized that entrepreneurship occurs in a specific context of economic, political and environmental factors that shall be considered to understand the entire entrepreneurship process (Baron and Henry, 2011) which is why a holistic approach rather should be adopted by policymakers (Ács et al. 2014). However, the dynamic nature of entrepreneurial ecosystems does not diminish the role of entrepreneurs or the importance of understanding what their motives, skills, perceptions and attitudes are in the entrepreneurial process (Baron and Henry, 2011). Several theoretical approaches have been used to explain entrepreneurial motivations, one of which is Ryan and Deci's (2000) self-determination theory (SDT). SDT is a framework that explores the motivation and personality of individuals through the examination of interactions and dependence on social environments. SDT posits that humans have three innate psychological needs: autonomy, competence, and relatedness, and differentiates between intrinsic motivation, which is driven by internal satisfaction, and extrinsic motivation, which is driven by external rewards. The theory also underscores the significant role of social and cultural contexts in either supporting or hindering these basic psychological needs, affecting people's sense of self-direction, performance, and overall well-being (Ryan and Deci, 2000).

Well-being is generally categorized into two distinct yet interrelated concepts: objective well-being and subjective well-being. Objective well-being evaluates tangible resources available to individuals that enable them to meet their fundamental needs for life and security. Subjective well-being, on the other hand, focuses on personal perceptions and evaluations of one's own life. It comprises emotional reactions and cognitive judgments, including life satisfaction, fulfilment, and positive emotions, reflecting how individuals experience and assess their own happiness and quality of life (Matamá et al, 2017).

Subjective well-being is regarded as a pivotal concept across various domains, particularly due to its significant influence on human behavior (De Neve et al, 2013). It is essential to explore how subjective well-being has been examined, especially within workplace settings. In analysing the work environment, researchers often focus on alternative – negative - constructs such as burnout or stress, which can overshadow the role of subjective well-being (Siqueira and Padovam, 2008). However, a better understanding of subjective well-being in the workplace can provide critical insights into employees' motivation, engagement, general performance, and job satisfaction, which are crucial for both individual fulfilment and organizational success (e.g., Bryson et al, 2017).

Higher subjective well-being is associated with the accumulation of positive emotional experiences and less negative emotional experiences. These experiences are not just related to certain aspects of life, but to life in general. It is expected that individuals' moods, emotions, and perceptions change over time and through individual experiences; thus, well-being is not something constant, but rather varies from individual to individual, and throughout everyone's life (Daniels et al, 2017).

At a country level, there are several indices that attempt to quantify its happiness. The World Happiness Report (WHR) and the Better Life Index are just two of them. These indices specifically, instead of focusing only on Gross Domestic Product (GDP) and economic statistics, also consider measures of well-being and quality of life (both with a direct impact on happiness levels). In 2020, WHR reported that Portugal had a score of 5,768 out of 10, placing it as the 57th happiest country among the 149 countries ranked (Helliwell et al, 2021). On the other hand, looking at the results of the Better Life Index, the average Portuguese person claimed to have an overall life satisfaction rating of 5.4; being almost one point below the average (6.5) of the countries studied in this index (OECD, 2020). In short, the average happiness of the Portuguese seems relatively low (OECD, 2020).

The analysis of the literature on entrepreneurship and happiness offers several key insights. For instance, van Zhao et al (2020) found that entrepreneurial decision-making and experience have a direct positive impact on family happiness, suggesting that families involved in entrepreneurial activities generally experience enhanced well-being. And although salary is often considered a crucial metric for assessing well-being, the financial outcomes for entrepreneurs do not consistently surpass those of employees. However, a study across 25 European countries by Schneck (2014) found that entrepreneurs tend to be happier than employees in most of these nations. One explanation for this fact could be entrepreneurs' psychological flexibility. Van Hugten et al (2021) argue that psychological flexibility is a significant factor in entrepreneurs' job satisfaction and, consequently, happiness. In their study, provided empirical evidence that entrepreneurs who have greater psychological flexibility tend to report higher satisfaction levels.

Of course, the daily demands and responsibilities inherent in entrepreneurship often lead to stress and anxiety, which can negatively affect overall well-being. Consequently, it is crucial for entrepreneurs to understand better the factors that have a triggering impact on their functioning and to develop effective coping strategies. These strategies, encompassing both cognitive and behavioural efforts, are essential for managing stress and maintaining mental health in the face of ongoing business pressures (Uy et al, 2013).

3. Methodology

3.1 Design

The study used a qualitative approach what allowed to get an insight into motivations, lifestyle patterns, job satisfaction and overall perceived happiness of the participants, while allowing to yield some descriptive data that could be compared to indicators available for the general population. Also, allowing the interviewees for responding open-ended questions was considered methodologically appropriate and relevant, and provided the research team valuable information on their perceptions and experiences.

Some potential obstacles that required special attention were identified. These included, for example, ensuring the participants did not feel judged so that they could talk openly about what they had in mind. The interviewer was trained to guarantee the questions were asked objectively and that the interviewees were not guided towards providing specific answers.

3.2 Collection Method and Data Composition

In order to achieve the study objectives, data collection was based on semi-structured interviews accompanied by descriptive data collection. For this purpose, a detailed interview guide was developed to steer the direction of the narrative and to allow for a complete answer to be dissected. The study was carried out in the last quarter of 2021, with a sample consisting of 13 entrepreneurs who work in Portugal in different sectors of the economy. For data collection, a structured interview consisting of 7 socio-demographic questions, 20 open-ended questions, and 4 questions measured by a Likert scale from 1 (lowest) to 10 (highest), separated into 4 blocks (lifestyle, job satisfaction, purpose in life and subjective well-being), was used. In addition, the recording of responses was simultaneous, and each interview, on average, lasted 30-45 minutes.

Socio-demographic information was collected to identify possible fluctuations in entrepreneurs' perceived happiness levels, which are not directly attributed to their entrepreneurial roles. Socio-demographic data were measured in terms of gender (0=male, 1=female, 2=other), age (categorized into 5 ranges), nationality (0=Portuguese, 1=other), marital status (0=single, 1=married, 2=other), number of children, highest level of education, and the type of business (start-up, partnership, LCC, etc).

Furthermore, in order to determine the degree of happiness from the entrepreneurs, as previously stated, four different question blocks were created. Since happiness is an emotional state with a variety of different definitions, we sought to find questions that complemented one another. These building blocks were: (i) job satisfaction, which directly correlates the happiness level of entrepreneurial work; (ii) lifestyle, which tells us on

how healthy (physically and mentally) the entrepreneur is, which also influences their perception of how happy they are; and (iii) purpose in life and (iv) subjective well-being, which provide an insight into people's thought processes and sense of accomplishment and fulfilment. Within these blocks, participants were able to give a more detailed description of their ideas. In addition, having a linear numeric scale question per block was used to measure the perceptions.

3.3 Data Analysis

The data was analysed in a manner that ensured participants' anonymity. No specific information that could identify the participant were included in the transcripts. Through the data analysis, it was possible to first quantify the frequency of occurrence of certain answers, and then proceed with further qualitative analysis. Consequently, each thematic block was carefully examined and compared with one another, in order to determine how entrepreneurs perceived their own well-being.

4. Results and Discussion

4.1 Sociodemographic Characteristics of the Participants

Eleven participants of the study were male, while only two were female. Four entrepreneurs fell within the 50-59 age range, and another four belonged to the 20-29 age group. The remaining five entrepreneurs were classified into two age groups: 30-39 and 40-49, with just one entrepreneur in the 60+ age group. Furthermore, four participants were married, six had between 1 and 3 children. In addition, it is worth noting that the highest level of education completed by most participants was a bachelor's degree. Interviewees reported having either a partnership or sole proprietorship as their type of business. Three participants were still in the early stages of the business venturing.

While analyzing the data, it became clear that demographic factors such as gender, nationality, a higher level of education and type of business did not affect the entrepreneurs' levels of perceived happiness. While this may be accounted for the size of the sample, some diversity of the answers was clearly the case.

On the other hand, variables such as age, marital status and number of children seemed to have an impact on the subjective well-being of entrepreneurs. As shown in Figure 1, for each of the age groups the average happiness goes up by 0.5-1 point. Similarly, people who are married and/or have children are on average ~1.4 points happier than entrepreneurs who are single and/or have no children. The latter did not come as a surprise, given that many entrepreneurs mentioned that their main motivation was the need to support their family. These results are consistent with previous ones. For instance, Peltzman (2023) has found that the married population tends to be happier than unmarried individuals.

Interestingly, when asked if they considered themselves successful, based on their own definition of success, which they had given previously, and how long it took them to achieve it, most of the positive responses came from older entrepreneurs who said it took them "a long time" or "their whole life" to achieve it; as opposed to younger participants who claimed they were "not yet successful", but seemed to believe they have a long life ahead to do more.

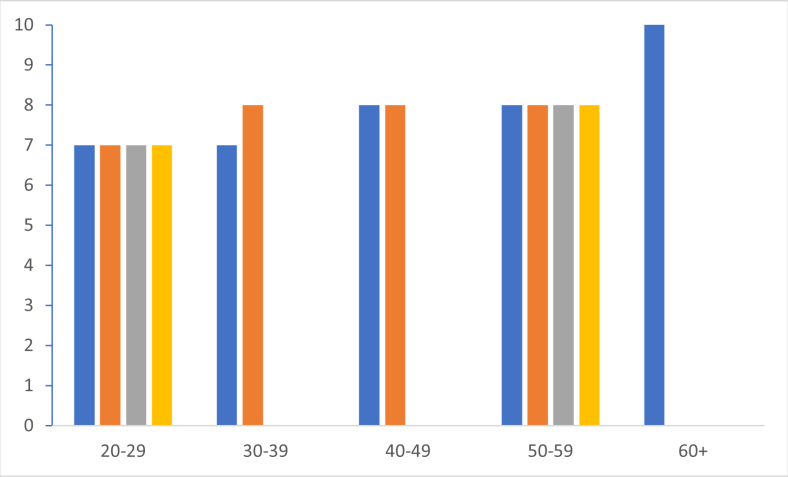


Figure 1: Perceived happiness as per participants age group (on a scale from 1 to 10)

4.2 Lifestyle

When examining the lifestyles of the entrepreneurs, it became evident that they share remarkably similar daily routines. All participants, when asked to describe a typical day, unanimously reported that they dedicate most of their time to work, including most weekends and holidays. To illustrate, one entrepreneur said: "I don't work all day like on a weekday, but there are always things that need to be done and cannot be left for the next working day". Another one claimed to enjoy working much more at weekends and on holidays, as he was not interrupted by various phone calls or meetings, "overall I am much more productive", he added. In this regard, evidence has shown that people who are more satisfied with their jobs work harder and are less likely to quit, and those who are mentally and physically healthy are more likely to work (Andersson, 2008).

Despite the long working days and weekends, more than half of the participants did not think that they were missing out on valuable time with family. Even though their schedules were similar, and they all used to go from "home to work and back home", they believed they could make up for the time in other ways. In Chinese context, Zhao et al (2020) conducted a study aimed at answering the question "How can entrepreneurship bring happiness to the household?" and concluded that entrepreneurial families were happier than non-entrepreneurial families and achieved a greater sense of well-being. Conversely, only two participants did not believe that their goals at work were somehow related to their goals in life. In addition, most interviewees agreed that they did not have the most balanced and healthiest lifestyle (Figure 2). While all entrepreneurs in the present study seemed quite satisfied with their daily routine and achievements, Andersson (2008) has noted that the self-employed find their jobs more stressful and mentally taxing because they work longer hours, have less free time and more responsibility for their own work and income. For the same reasons, the self-employed are thought to have more mental health problems and poorer general health. Numerous other studies have shown that long working hours are generally associated with health problems, such as physical health and fatigue (Klofsten et al, 2021; Van der Hulst, 2003).

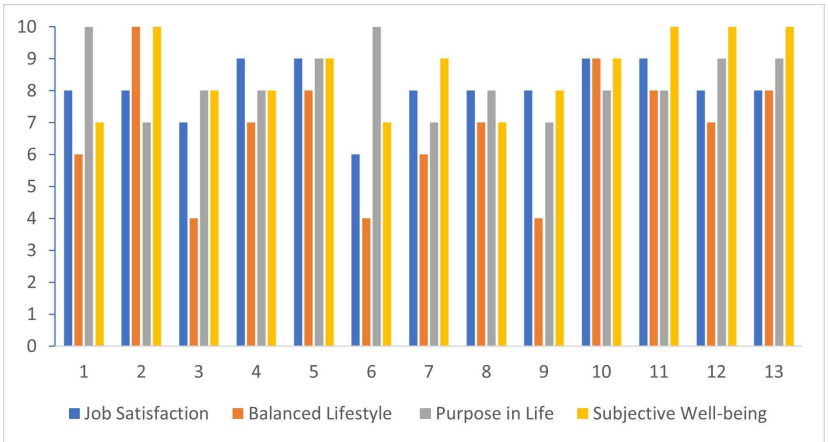


Figure 2: Ranking of participants' perceived job satisfaction, lifestyle, subjective well-being and the following of their purpose on a scale from 1 to 10)

Still, participants seemed to have some relevant personal resources such as social support they both received and provided. When asked what motivated them, six of them said that their friends and the need to support their family were the main drivers, while the others agreed that their main motivators were the love of what they do, the challenges that come with running a business, and the desire to become a better person and make the world a better place. And while some studies such as that of Hanglberger and Merz (2011), have argued that entrepreneurship is not associated with long-term happiness, the buffering role of social support may be one of the reasons for such findings. Therefore, although the general lifestyle of the entrepreneurs seemed to lack some healthy and balanced habits resulting in mean low value of only 6.46 / 10 (Figure 2), this did not affect their subjective well-being (Figure 3).

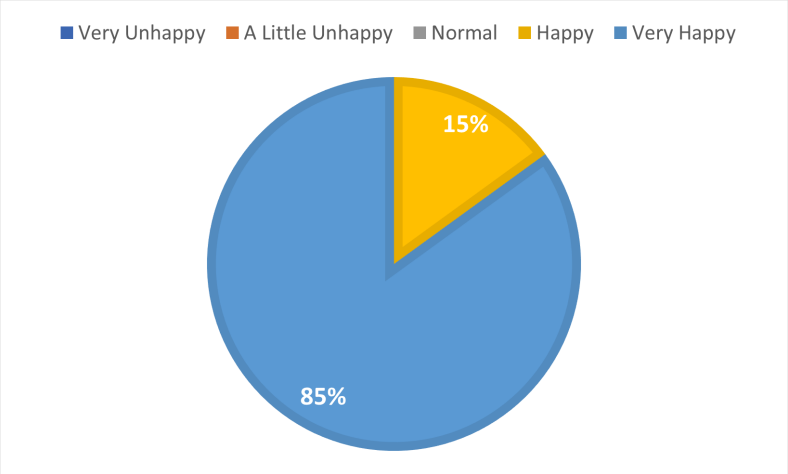


Figure 3: Entrepreneurs' subjective well-being

4.3 Job Satisfaction

The findings regarding job satisfaction were largely positive, which aligns with the inherent characteristics of entrepreneurs who generally pursue what they enjoy and, thus, remain motivated (Collins et al, 2004). Most participants owned their businesses, which likely influenced their high job satisfaction scores, with answers ranging from 6 to 9 out of 10. Interestingly, every entrepreneur surveyed reported working during holidays. Moreover, when asked if they worked on holidays, all respondents, without exception, answered in the affirmative. This might reflect the challenges of managing a small business with limited or no additional staff and limited financial resources, often compelling entrepreneurs to juggle multiple roles and extend their working hours into holidays to sustain and grow their ventures.

In terms of day-to-day tasks and responsibilities, interviewees affirmed they felt they managed the pressure well. However, when it came to compensation, entrepreneurs expressed that their earnings could be higher, considering the extensive hours dedicated to work. To our surprise, these results had no impact on their levels of happiness (Figure 3). This suggests that the entrepreneurs' happiness does not come from their earnings. Some scholars would obviously not agree with these findings. For example, Zhao et al (2020) have argued income is a very important factor in measuring well-being of entrepreneurs. According to Fowle (2019), entrepreneurs are attracted by the promise of freedom and autonomy, but many find that they have lost control of their personal, social and professional lives. Projects often involve high levels of risk, loss of control, fractured relationships, and damaged identities. These, combined with extreme lifestyles, lack of sleep and exercise, and poor diet, create extraordinary physiological and psychological distress. To understand this better, Su et al's research (2020) has explored how entrepreneurs sustain their motivation through apparently more positive emotions rather than financial gains and found that entrepreneurs persist in highly uncertain environments by deriving happiness and satisfaction from the entrepreneurial process itself, rather than from monetary rewards. Moreover, Chen et al (2018) have found that entrepreneurs' satisfaction is more influenced by personal creativity and strong social ties than by the financial performance of their business suggesting that entrepreneurs' happiness stems more from non-material aspects of entrepreneurship. This evidence could partially explain why our interviewees, when inquired about their career progression, seemed pleased with having achieved some status in the labor market. Ultimately, their happiness seemed positively related to job satisfaction rather than to the financial aspects of their work.

4.4 Subjective Well-Being

Interviewees' responses regarding their subjective well-being were consistent with the theoretical conceptualization of happiness. Participants felt satisfied and motivated because they worked on what they enjoyed. As they believed the goals of their companies were linked to their personal lives, they perceived that their work was meaningful. According to Zhao et al (2020), entrepreneurs choose to start their own business only when it is useful to them and those they care about, although this has a positive impact on creating a better life for others and promoting the harmonious development of society.

Harbi and Grolleau (2012) distinguish between the direct and indirect effects of entrepreneurship on life satisfaction, separating the impact on per capita income from the subsequent impact on life satisfaction, and suggest that entrepreneurship may inhibit household happiness. Specifically, they propose that while

entrepreneurship can increase individual income, it may not necessarily enhance (and might even diminish) the overall happiness within an entrepreneur's household due to factors such as increased stress and workload. In fact, our research has clearly identified some manifestations of stress and anxiety in entrepreneurs. A large proportion of the analyzed sample felt stressed, anxious, or worried at times. This is a natural emotional response, considering their decisions have significant implications not only for their own lives but also for their families, company employees, and the employees' families. According to Stephan et al (2023), entrepreneurs live between two emotional states, fluctuating between very happy or very stressed. This emotional imbalance is fueled by constant stressors like uncertainty and high workload, which are inherent in entrepreneurship and can significantly impact the individual's health.

When questioned about happiness (as for the question "are entrepreneurs happy?"), 85% of participants said that they were very happy, while the remainder 15% claimed to be happy. Overall, the happiness levels of the entrepreneurs averaged 7.769 (Figure 2), significantly exceeding the Portuguese national average of 5.4 according to the Better Life Index (OECD, 2020), and 5.768 as reported in the World Happiness Report (Helliwell et al, 2021). This high value underscores the exceptional well-being experienced by these entrepreneurs in comparison to the general population in Portugal. In general, a substantial body of research seems aligned with the idea that entrepreneurs have greater satisfaction than salaried workers (Andersson, 2008; Seva et al, 2016) and are happier (Oswald, 1997) but a clear consensus is yet to come (e.g., Hanglberger and Merz, 2011).

Interestingly, many participants expressed a desire to alter their lifestyles. Among various suggestions for change, the most prevalent was a wish for more time, highlighting a common struggle among entrepreneurs to achieve a better (and healthier) balance between their personal and professional lives what underscores the ongoing challenge entrepreneurs face in managing the demands of business ownership while maintaining personal well-being (Dijkhuizen et al, 2018). Time was therefore the most needed and lacking resource. Still, and despite this study carried out amid a pandemic situation, where the instability experienced has been much discussed, entrepreneurs felt confident and optimistic about the future.

5. Conclusion

5.1 Final Considerations

This study sought to explore the relationship between lifestyle, job satisfaction, and subjective well-being among entrepreneurs. Through interviews, we gathered insights into the lives and behaviors of entrepreneurs, enabling a thorough cross-sectional analysis. The findings show that despite long working hours, entrepreneurs find significant personal fulfillment in their work, which they deem meaningful.

The results align with the core principles of Self-Determination Theory, which posits that fulfilling the psychological needs of autonomy, competence, and relatedness enhances intrinsic motivation and well-being (Ryan and Deci, 2000). The findings suggest that entrepreneurs, despite the demanding nature of their work, experience high levels of subjective well-being largely due to the meaningfulness and personal fulfilment they derive from their ventures. This supports the idea that entrepreneurs' high autonomy - being able to make decisions and control their work environment - significantly contributes to their overall happiness. The reported happiness score of 7.769, well above the national average, underscores the importance of autonomy and competence in their perceived well-being.

Interestingly, our study also found that remuneration does not play a significant role in influencing entrepreneurs' elevated happiness. This is consistent with SDT, which emphasizes that intrinsic motivations, such as personal growth, the achievement of life goals, and the fulfilment derived from meaningful work, are more critical to well-being than extrinsic rewards. The positive relationship between job satisfaction and adherence to personal life goals highlights the role of relatedness, where entrepreneurs find a sense of purpose and connection through their work. These intrinsic motivators appear to outweigh the potential stresses and long hours associated with entrepreneurship, reinforcing the notion that when individuals are engaged in activities that resonate with their core values and aspirations, their overall well-being is enhanced.

However, despite recognizing the lack of a balanced lifestyle as an area for improvement, this did not negatively impact their overall well-being. This resilience can be attributed to their strong intrinsic motivation and the support structures they might have in place, which buffer the potential negative effects of stress and long working hours. Many entrepreneurs expressed a desire for more time for personal care, exercise, and family activities, indicating areas where enhancements could be made to further improve their well-being. This suggests that while their current lifestyle supports their psychological needs to a great extent, addressing these gaps could provide a more holistic improvement to their quality of life, supporting both their mental and physical health.

Moreover, the results highlight a potential area for policy intervention. By creating environments that support work-life balance, such as offering flexible working conditions and promoting health and wellness programs, policymakers and business support organizations can further enhance the well-being of entrepreneurs. This aligns with the broader implications of SDT, which emphasizes the need for social and cultural contexts that nurture individuals' psychological needs. Encouraging a more balanced lifestyle could mitigate the long-term risks associated with chronic stress and overwork, leading to more sustainable entrepreneurial practices. These insights not only contribute to our understanding of entrepreneurial well-being but also suggest areas for further research and potential interventions to support entrepreneurs in achieving a more balanced life.

5.2 Limitations

Despite the contributions of the study, some limitations must be pointed out. The study took place during the time of the Covid-19 pandemic and in one country only, what at the time of data collection resulted in difficulties in reaching out to the interested participants and does not allow for generalization of the results.

5.3 Paths for future research

Future research could examine how different sociodemographic factors (age, gender, socioeconomic status, stage of entrepreneurial venturing) influence the relationship between lifestyle, job satisfaction, and subjective well-being. For example, investigating gender-specific experiences in entrepreneurship could shed light on whether men and women face different challenges and rewards in their entrepreneurial journeys. This research could explore how gender impacts motivation, stress management, job satisfaction, and overall well-being, leading to more targeted interventions. Moreover, understanding the role of social support networks, including family, friends, and professional associations, in enhancing entrepreneurs' well-being could provide insights into how these networks buffer against stress. This could also highlight the importance of community and peer support in entrepreneurial success.

From the methodological point of view, future research could benefit from longitudinal designs to track changes in entrepreneurs' subjective well-being over time. Longitudinal studies would help establish causal relationships and observe the long-term effects of lifestyle changes on subjective well-being and job satisfaction, what could offer a better understanding of how various stages of business development, from startup to established enterprise, impact happiness and stress levels. It would also help identify any long-term effects of entrepreneurial activities on personal well-being.

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Uncollected Solid Waste Detection and Reporting Using Machine-learning and Geotagging

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Abstract: Uncollected solid waste has become an ever-growing threat to our livelihoods, posing many problems that span health risks, environmental pollution, and unpleasant aesthetics. Traditional methods of reporting uncollected solid waste have proven ineffective and we struggle to keep pace in addressing the growing volumes of waste. This study focused on developing a solid waste detection and reporting system based on machine learning and geotagging. The developed system sought to enable solid waste management entities to obtain verified solid waste reports and accurate location details of the uncollected waste instances. A ResNet model was trained on commonly used solid waste image datasets from online sources. The model achieved a provisional accuracy beforescore of seventy percent (70%) though this statistic can be improved by adjusting model parameters. A rapid iterative design approach was employed to facilitate the development of the crowdsourcing app. This enabled the researchers to swiftly build, evaluate, and refine functional prototypes of the system before finalization. The resulting system receives solid waste images together with their location data and verifies the correct image reports using the trained model, before finally visualizing the reports on a map. Overall, the system provides a platform for the general public to collaborate with solid waste management bodies in combatting uncollected solid waste. In the future, the system may be diversified to allow reporting other amenity issues besides uncollected solid waste.

Keywords: Solid waste detection, Solid waste reporting, Geotagging, ResNet, Machine learning

1. Introduction

The growing use of technology has not spared the solid waste management sphere as a growing number of studies have sought to develop smart systems based on emerging technologies to aid in waste management in cities (Mihai et al, 2019). The Swachh Bharat Mission launched in India has also driven the development of solid waste reporting systems. The mission launched the Swachh Technology Challenge, a competition that encourages entrepreneurs and innovators to develop new technologies for waste management (Anitha et al, 2022). This has led to the exploration of multiple avenues and resulted in the emergence of innovative solutions focusing on waste management. The annual volume of solid waste generated in sub-Saharan Africa is pegged at one hundred and seventy-four million (174 000 000) tonnes as of 2019 and only forty-four percent (44%) of it is collected (Adedara, 2023). The volume of solid waste produced is expected to triple by 2030 while the percentage of solid waste collected drops. Uncollected Solid Waste refers to waste that is generated but which remains uncollected due to lack of collection services (Mas, 2019)

In 2021, the World Health Organization underscored the significant health hazards associated with uncollected solid waste and indicated the seriousness of the issue. These included gastrointestinal infections with symptoms such as diarrhoea and vomiting stemming from the consumption of contamination of food and water, respiratory conditions induced by toxic pollutants released by burning solid waste, and vector-borne diseases like malaria and dengue fever-transmitted disease vectors like mosquitoes and flies. Local governments are obligated to facilitate the collection of both solid waste in bins and isolated waste, however since most of this waste is dumped in discrete areas, local municipals rely on citizens' reports to know about these areas. Taggio et al. (2022) allude that existing systems for citizen reports are ineffective in that they fail to provide meaningful location details of reported waste instances and there is no metric to guide what is worth reporting and what is not. The goal of this research, therefore, is to create a crowdsourcing mobile app that can be used to detect and report uncollected solid waste. To do this the following objectives were formulated:

Objectives

- To capture and submit images of uncollected solid waste
- To filter out valid submissions using a machine-learning model

- Tag and display the location of valid reported solid waste instances

According to Njiru & Takeuchi (2018), Sustainable Development Goal (SDG) 11 focuses on making cities and human settlements sustainable, while Target 11.6 specifically aims to reduce the adverse per capita environmental impact of cities by improving the management of municipal and other waste effectively by 2030. By providing details for reporting uncollected solid waste, the application supports waste collection leading to cleaner, healthier, and more resilient urban environments. The crowdsourcing approach particularly leverages the power of community involvement as the app ensures comprehensive coverage and timely reporting of waste accumulation and reduces its environmental impact on communities and cities. Ultimately, the system intends to simplify the reporting process, enable prompt waste collection, and eventually support more effective waste management strategies.

2. Literature Review

This section looks at the commonly used machine learning algorithms, datasets used to train models, and commonly used techniques for collecting uncollected waste.

2.1 Commonly Used Machine Learning Algorithms

Convolutional Neural Networks (CNN) are a type of machine learning neural network that is suited for image recognition and classification tasks and have gained adoption in the detection and classification of waste in images (Majchrowska et al, 2021). Across the reviewed studies, three types of pre-built CNN models were used for solid waste detection, and from their findings, each had its trade-offs which are explored below.

The first type, *AlexNet* was used by Susanth et al (2021) to identify solid waste objects and detect the type of waste from images while Majchrowska et al. (2021) used it to detect and classify waste in images. Findings from both studies concur that the *AlexNet* model performs fairly well in both detection and classification but is outperformed by other models. Its lightweight model makes it suitable for use in limited processing resources. The second, *ResNet* was proposed as a solution to challenges faced by the increase of convolutional layers in VGG Ziouzios et al.(2020). Rajakumaran et al.(2023) leveraged it for real-time identification of solid waste by a drone camera. They obtained a 95% accuracy score while Susanth et al.(2021) obtained a 93.5% score when using *ResNet50* to detect and map out solid waste in drone-captured and satellite images. Both studies concur that the model performs well with poor-quality images, is computationally efficient, and has a small memory footprint. This poses ResNet as an ideal image detection algorithm to be used on a solid waste detection mobile application. Majchrowska et al. (2021) compared our third type, *EffiecientNet,* with *AlexNet* and *ResNet* and they elucidated that it was more adopted for solid waste detection tasks while the other two are optimized for waste classification. This is contradictory to the findings of Mudemfu & Wayne (2023) who argue that this model is suited for image classification tasks. This contradiction might be due to the different scholars focusing on a different task as the first study focused on detection tasks while the second focused on classification tasks. Their contradictory findings may also be an indication that *EfficientNet* is well suited for both tasks. Mudemfu & Wayne (2023) compared it with *VGG, AlexNet, ResNet*, and *DenseNe*t and concluded that this is the best model to implement as it can be altered to outperform any other CNN-based model in any metric. By allowing the alterations to its architecture to achieve the desired balance between computational resources and detection accuracy, EfficientNet also becomes another prebuilt model that may be used in solid waste detection mobile applications although its performance may be greatly affected by the limited processing resources on mobile devices.

2.2 Datasets Used to Train Models

In all the studies reviewed, none created a new solid waste image dataset as all the studies used pre-created solid waste image datasets. Niu et al. (2023); Rajakumaran et al. (2023); Taggio et al. (2022; Ulloa-Torrealba (2023) used the *Trashnet* dataset to train CNN-based models in tasks of solid waste detection in aerial images. These studies managed to obtain acceptable performance metrics with this dataset that is suited for solid waste image classification though they hinted that different datasets could have guaranteed better performance. It is more suited for classification tasks as it spans six classes: glass, paper, cardboard, plastic, metal, and trash; this explains why Ma et al. (2020) obtained higher performance scores than all other waste detection studies as they used the *Trashnet* dataset for classification tasks. Majchrowska et al. (2021); and Mudemfu & Wayne (2023) created their custom datasets by extracting images from various public image datasets including *Trashnet, Open Litter Map, "Wassste", and TACO-Trash-Dataset*. According to Mudemfu & Wayne (2023), combining images

from different settings helped reduce overfitting. This poses the practice of merging different datasets as a possible solution to obtaining a reliable dataset for training a solid waste image detection model.

2.3 Commonly Used Techniques for Reporting Uncollected Solid Waste

Verma et al. (2022) , and Torres & Fraternali (2023) developed uncollected solid waste reporting systems based on images captured from an aerial flying craft that included drones and satellites. The architecture of these systems was similar to that of Wang et al. (2020) though it harnesses images captured from mobile phones in place of drones, in this architecture, the device capturing images acts as a client while the facility carrying the model acts as a server. Shahab & Anjum (2022) attempted to deploy both client and server on a mobile device and they reported that the algorithms required great processing power while mobile devices have limited processing power. To counter this, a choice has to be made between either scaling down the algorithm and reducing performance levels in the process or simply deploying the algorithm on the web end. This ultimately puts the former architecture ahead of the latter as the architecture of choice in solid waste reporting systems

To successfully add location details to images in their systems they integrated Map APIs. Wang et al.(2020) used a *Gaode API* which is presented fully in the Mandarin language making it unusable in non-Mandarin speaking regions. The other three studies used *Google Maps API* and they pointed out that it is easier to use and has a wide range of features compared to *OpenStreetMap API*. Ndlovu et al. (2023) used the Google Maps API to mark locations of reported potholes in a pothole reporting system and highlighted that it displays different levels of detail about reported potholes based on the zoom level used. Another added advantage of using Google Map API is that it allows free access to all features as long as the project is not yet commercialized. With this in mind, Google Map API can be utilized to locate uncollected solid waste

3. Methodology

The Rapid Application Development (RAD) methodology was chosen for the development of the uncollected solid waste detection and reporting system. Its focus on building and testing functional prototypes in short, iterative cycles aligns perfectly with this approach (Sooni, 2023). Each iteration concentrates on a specific component of the system, such as the mobile application's user interface or the server-side image detection model. This allows for independent testing and refinement of each component, ensuring optimal functionality before integration with the entire system.

3.1 Tools and Technologies Required to Develop the System Were Also Identified

Table 1: Required Tools

	Tool	Use Case
1	Python	Programming language for training the solid waste detection model.
2	Google Collab	Development environment for training and testing the solid waste detection model.
3	React Native	JavaScript framework for mobile app interface development.
4	Google Maps API	Map service for geotagging identified solid waste instances
5	SQLite	

3.2 Data Collection and Preprocessing

Using a pre-created solid waste image dataset, the study leveraged *Trashnet, "Wassste", and TACO-Trash-Dataset* datasets*.* The resulting dataset was then meticulously annotated and split into training, validation, and test sets. During the preprocessing phase, images were resized, normalized, and augmented to improve the model's robustness.

3.3 Selected Model

A *ResNet* pre-trained model was adopted as it yielded a good balance between accuracy and efficiency in five (5) previous studies reviewed in the literature review. In the developed system, the *ResNet* model would be trained in solid waste image detection rather than classification tasks as the system focuses on uncollected solid waste. The model's architecture comprises 50 layers, enabling it to capture intricate features within images. It uses residual blocks as its core building blocks as they ensure information flow throughout the network by adding

the input directly to the output of convolutional layers. The pre-trained model comes with weights already learned on a massive dataset for image classification, necessitating adjusting to enable object detection tasks.

3.4 System Design

The design was constructed as the blueprint of the developed system, defining the structure and interactions between different system components.

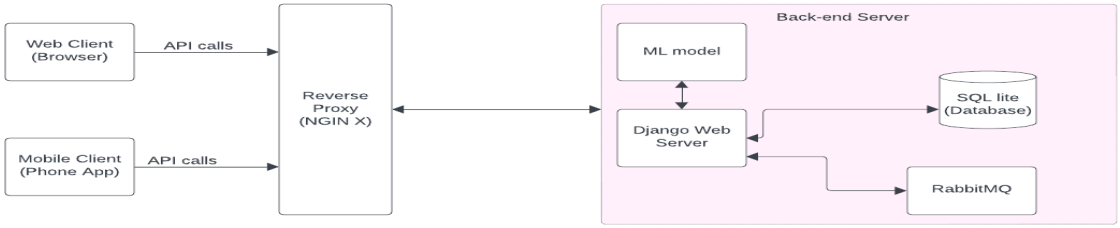


Figure 1: System Architecture

From the system design, the system would have two possible points of interaction with the back-end services; the Web Client, for use by the system administrators, and the Mobile Client for use by general users as highlighted in Figure 1. This was to ensure that the mobile end (for the contributing public) remains minimalistic and uncluttered to foster usability and hence boost adoption rates.

Solid Waste Reporting Sequence

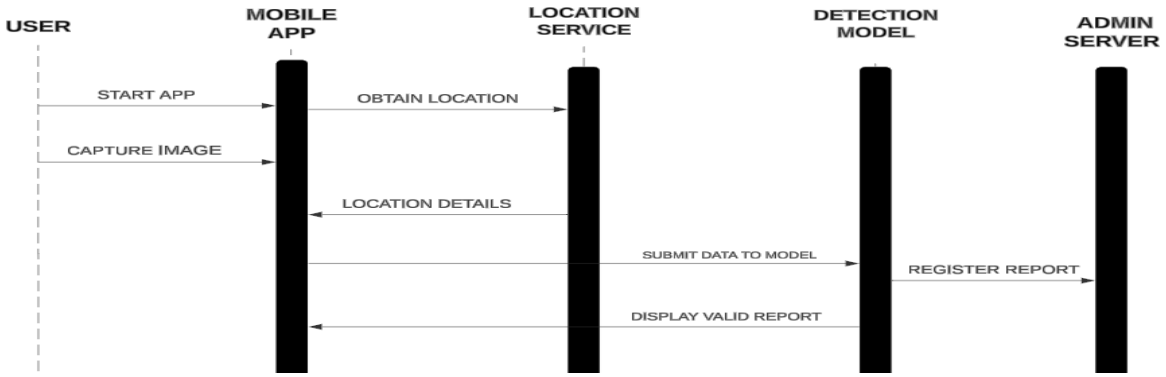


Figure 2: Solid waste reporting sequence diagram

Users initiate the solid waste image reporting process by launching the Mobile App, which allows them to capture an image of the solid waste they encounter together with the device's location and timestamp. Users are then prompted to fill in their details including their email address for purposes of user identity and future messages as highlighted in Figure 2. The is bundled together with the user's email address and sent to a central Django Web Server. The server then invokes the pre-trained *ResNet* algorithm and runs the image through the algorithm to detect any waste present in the image. If the reported image is detected to have solid waste, the server extracts the submitted location data (latitude and longitude). It makes a *Google Maps API* Call, that is, the server makes a request to the *Google Maps API* using the extracted location, and the API plots a point (marker) on the map at the specified location, visually representing the waste sighting.

4. Results and Discussion

The following section discusses the completed system that was achieved following the system architecture outlined in the previous section and also sheds details on the ResNet model.

4.1 Model Performance Statistics

Matplotlib and Pyplot tools (sub-modules of Matplotlib) were used for visualizing and analyzing the performance of the machine learning model's accuracy during the testing phase. It is important to note that this model was trained and deployed as an incremental learning model. This means it is a type of machine-learning model that can continuously learn and improve as it receives new data.

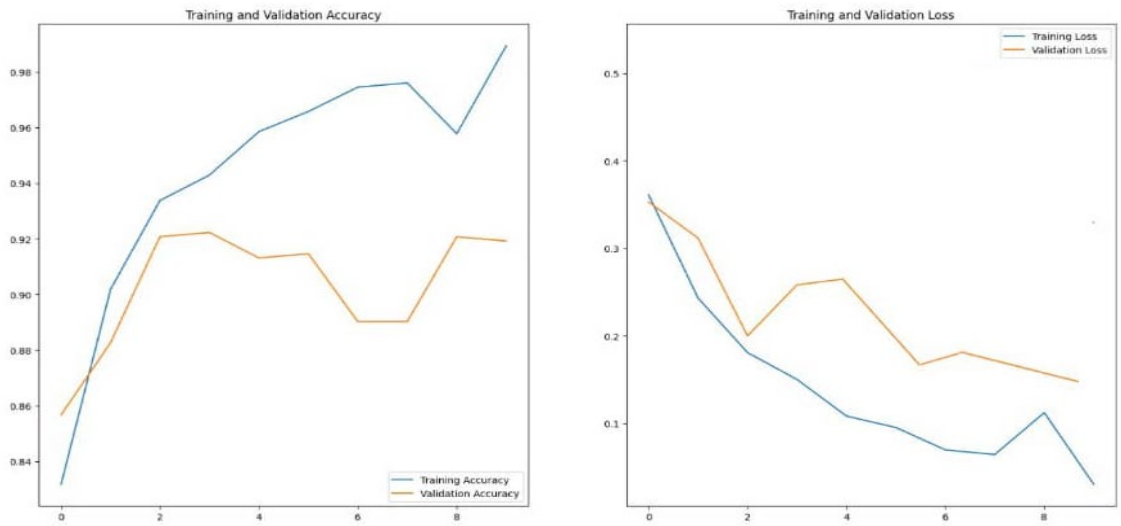


Figure 3: Training and Validation Accuracy Graph (left), Training and Validation Loss Graph (right)

The *training accuracy* increases steadily across epochs, indicating the model is progressively learning to classify images during training correctly. Ideally, this value should reach a high plateau (close to 1) as training progresses. The *validation accuracy* also increases thus indicating that the model is generalizing well and is not simply memorizing the training data. The *training loss* generally decreases across epochs, which is a positive sign as this indicates that the model is learning to reduce its errors and improve its performance on the training data. The *validation loss* generally decreases thus depicting that the model is generalizing well and is not overfitting to the training data. Overall, the metrics shown in these graphs indicate that the *ResNet* model is likely performing well during training.

The training accuracy is increasing, and the training loss is decreasing, indicating that the model is learning to classify images correctly. Throughout the training process, we monitored the model's performance on the validation set and made necessary adjustments. To measure the accuracy of our model, we employed early stopping. This technique involves halting the training process once the model's performance on the validation set ceases to improve, thereby avoiding overfitting and ensuring that the model generalizes well to unseen data. As a result of these efforts, our ResNet model achieved a significant milestone, attaining a 70 percent accuracy rate in detecting solid waste. This accomplishment marked a major step forward in the development and effectiveness of our image detection system.

4.2 Mobile App Interface

The app interface is simplified to guarantee usability for the general public who might have limited digital literacy skills. The app is solely for submitting solid waste reports without requiring user accounts which simplifies the user experience significantly. Users can simply open the app, capture and submit images of uncollected solid waste, and fill out their necessary details hassle-free. Since there are no user accounts involved, there's no need for users to remember login credentials or go through a registration process, making it more accessible to a wider audience. Additionally, this approach potentially encourages more people to report waste, as it removes barriers to entry such as account creation.

Mobile App Upload Flow:

1. The user clicks "Gets Started" and opens the mobile app camera
2. The user is prompted to grant access to the device location
3. User captures an image of suspected waste and
4. To complete the report the user is prompted to fill in their details (name, surname, email address, phone number)
5. Report is submitted for processing
6. App displays the validity of the report



Figure 4: Solid Waste Detection Status, Garbage Detected (left) No Garbage Detected (right)

Upon submission, the image is relayed to a web server which then runs the ResNet model to detect the presence of solid waste in the image. The resulting status together with the waste detection model's confidence level and error margins metrics are displayed to the user. The *confidence level* in an image detection model indicates the likelihood that the model's prediction is correct. *The error margin*, also known as the margin of error, quantifies the uncertainty or potential inaccuracy in the model's prediction. It is also often expressed as a percentage. Showing these metrics helps build trust with users by providing transparency about the detection process. Users can see how confident the system is in its detections, which can help them understand and trust the app's decisions. Using the two metrics developers can identify specific types of waste or scenarios where the model struggles, benchmark the model's performance over time, and a whole lot of aspects that need to be revised to improve the model.

4.3 Map of Reported Uncollected Solid Waste Instances

Only admin users on the web-side interface can access the valid submitted solid waste reports and their location details. This page displays a map showing the accurate location(s) of the reported uncollected solid waste reports. This allows the waste collection entities to traverse to the exact points where uncollected solid waste has been reported and conduct clean-ups. The accurate locations are obtained when the user submits an image of suspected solid waste. The map is facilitated by a Google Maps API. Once a report has been attended to, the admin notifies the user. The email addresses submitted by contributing users are used for real-time notifications whereby the users about informed about the progress of their reports. This fosters transparency and trust in the system.

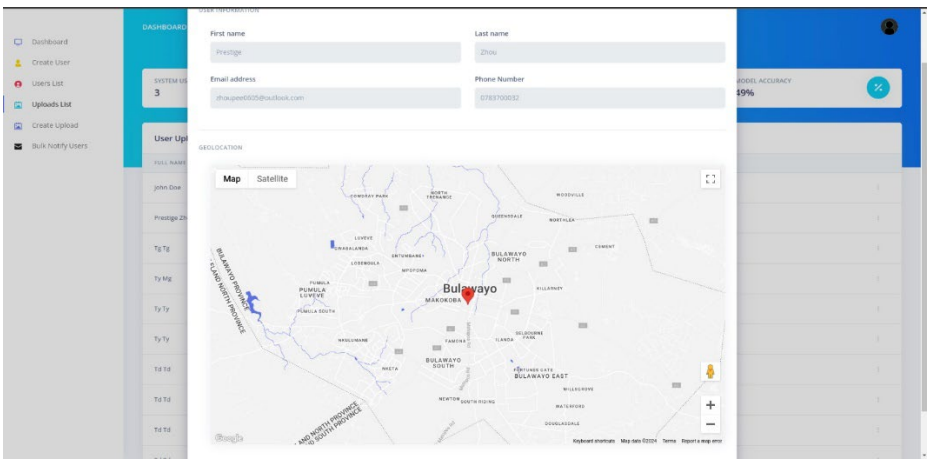


Figure 5: Map showing the location of a reported uncollected waste instance

4.4 Proposed Improvements

Zimbabwe, like other global counterparts, is grappling with the challenges posed by electronic waste (e-waste) in an increasingly digital world (Tsiko S, 2024) . Future improvements for the app could involve expanding its functionality to include the detection and reporting of electronic waste (e-waste). The ResNet model could be trained on e-waste datasets to enhance the app's capability to accurately identify various types of e-waste from user-submitted images, ensuring precise classification and appropriate handling of electronic devices. This would streamline the e-waste management process, allowing for more efficient and sustainable handling of electronic waste. Integrating gamification into the uncollected solid waste reporting app could affect its usability but has the potential to significantly enhance user engagement. Gamification features like points, levels, and leaderboards incentivize users to actively participate in waste reporting and community clean-up efforts. Challenges and badges further motivate users to contribute positively to environmental conservation, while virtual rewards offer recognition for their contributions. By combining these elements, the app transforms waste reporting into an engaging and rewarding experience, driving greater community involvement and fostering a culture of environmental responsibility.

5. Conclusion

This research explored the development of a crowdsourcing mobile application for solid waste detection and reporting based on machine learning and geotagging. The application aimed to address the growing challenge of neglecting solid waste by providing a user-friendly tool for waste identification and reporting. From this research, it can be concluded that machine learning models, particularly Convolutional Neural Network models, are effective for solid waste detection in images. By leveraging a binary classification pre-trained model, ResNet50, the application achieved high accuracy in identifying various types of solid waste in their natural environments. This backs all prior work conducted by scholars in the same field. Another takeaway point of note is the need to achieve a balance between model accuracy and computational efficiency. While complex models can offer higher accuracy, they might not be suitable for mobile devices with limited processing power. This research utilized a mid-range model and achieved good accuracy while maintaining efficiency for mobile deployment. Finally, in developing a system for use by the general public, user-friendly design principles should be adopted to achieve widespread adoption. This influenced the creation of two separate interfaces for the contributing users and for system admins to keep the interfaces clean, minimalistic, and uncluttered. To foster use, the app requires no sign-up for one to capture and upload an image but requires user details after the successful upload of a report. This research successfully demonstrated the feasibility of developing a crowdsourcing mobile application for solid waste detection and reporting using machine learning and geotagging. The application has the potential to empower citizens to participate in waste management efforts by facilitating waste identification and reporting.

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PhD Research Papers

Business Redemption in Recent Times: The Role of Dynamic Leadership, Digital Innovation, and Sustainable Performance in the VUCA World

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Abstract: Due to the evolution of firms from analogue structures to digital platforms, the digitalisation of SMEs has become necessary in the post-COVID era. Firms are diversifying their modulus Operandi to remain competitive in the market. This is due to the extrinsic and intrinsic factors mitigating the business environment. The growing Volatile, Uncertain, Complex and Ambiguous world known as VUCA in the business environment impacted by digital innovations, which entails the plague of war, and post-pandemic effects demands strategic research investigation to achieve a persistent sustainable business performance through dynamic leadership. This study harnesses a systematic review of the literature on digital innovations, dynamic leadership and sustainable performance in the VUCA world. The review utilises the SLR format reviewing articles from high-impact journals from 2018 to 2023 on ensuring sustainable business performance in VUCA, and the role of dynamic leadership. In effect, there is the need to develop strategic policies to guide businesses against unfortunate mishappening. This study seeks to explore a digitalised system with a dynamic leadership strategy to achieve sustainable firm performance. Digital managerial innovation policies and the influence of dynamic leadership will subsume sustainable business performance in the VUCA environment. The study outcome revealed that digital innovations and dynamic leadership significantly influence the current business environment in achieving sustainable performance and business continuity.

Keywords: VUCA, Digital innovation, Dynamic leadership, Sustainable performance

1. Background

Firms are currently facing the challenge of invigorating employees with digital skills to be highly competitive in the global business digitalization environment (Patra, A. K., & Dash, R., 2023), through dynamic leadership skills. This will allow the leader to sense, configure and transform to the changing work environment. For businesses to achieve sustainable performance, leaders must adopt dynamism and digital innovations aimed at quality, cost reduction or sustainable products and services. Most SMEs face a shortage of resources and technological adoption and usage challenges despite providing over 80% of jobs and cushioning the GDP of economies (Fang, G. G., Qalati, S. A., Ostic, D., Shah, S. M. M., & Mirani, M. A, 2022). Given the insurgency of wars in various continents (Africa, Europe, and rising tensions in Asia), the slow recuperating from the COVID-19 pandemic effect and the economic mis happenings, SME managers must adopt a dynamic leadership style to sail through the storm. Dynamic leadership style differs from the traditional leadership style which has dominated the work environment for some time (Khaliq, M., Usman, A., & Ahmed, A., 2021), however, the current evolving trends of digitalization and the exposure of firm to the global market demand a dynamic style to navigate the business to a sustainable performance. Organizations harness the capacities of digital equipment to grow their performance, innovation, and stakeholder involvement, thereby contributing to a more resilient and sustainable performance. Exploitation abilities permit corporations to optimize present market-associated knowledge to achieve sustainable performance. The current business environment is described as progressively dynamic, antagonistic and tumultuous known as VUCA. The continuous rise in hostility is attributed to heighten business competition, the entrance of new competitors, the merging of industries, and a decline in trust among competitors within various industries (D'aveni, R. A., & Ravenscraft, D. J. , 1994); (Hambrick, D. C., Davison, S. C., Snell, S. A., & Snow, C. C., 1998). In view of this, business must enact strategic policies to cushion their operation against any externalities and recover from economic distress conditions.

2. Problem Statement

Management of SMEs have been challenged with plethora of issues ranging from their low capitalization, poor managerial acumen, inefficiencies, ineffective managerial systems leading to frequent collapse and acquisition by large firms meanwhile they serve as the beckon of growth for most economies (Blake, 2022; Singh, 2022) by supporting the GDP with almost 80%, serving as source of employment to about 70-80% of the population. Business turbulence on the other hand, is primarily caused by the escalating pace of change and the disruptive impact of environmental and technological advancements. Given this, leaders need to exercise their strategic

plan to foster firm growth. Turbulent challenges are described as situations that arise unexpectedly, are hard to predict, irregular, and ambiguous (Ansell, 2021). Practically some businesses have enacted strategic emergency plan to help them sail through turbulence, but many others have non existing strategy to continuously remain sustainable. As such in times of losing a major customer, these firms will either wind up or cut operations by 50-70 per cent (Jiang, Y., Ritchie, B. W., & Verreynne, M. L., 2022). This re-echoes the imminent need for businesses through dynamic capability concept strategies to remain sustainable over the period.

Dynamic leadership skills require digital competence, planning skills and the ability to be innovative and manage people effectively (Gilli, K., Nippa, M., & Knappstein, M., 2023). Leaders without good followers are likely to fail in their pursuit. digital leadership competencies permit firms to include innovation using profound virtual capabilities and competencies. These capabilities include talent in digital literacy, strategic thinking, and adaptability. Dynamism in leadership necessitates leaders to implement swift modifications to enhance adaptability or marketing strategies to remain resilient and pertinent to the broader consumer base.

Additionally, for firms to be more resilient against economic and climate turbulence, there is a need to pursue this research. Dynamic leadership within an organization's management context is characterized by a leadership approach that emphasizes collaboration, teamwork, and strategic planning (Tucker & Lam, 2014).

3. Research Gap

Some researchers have recounted the impacts of leadership on SMEs sustainable performance and innovativeness. Whereas some perspective argues in support of innovation and digitalization in the SMEs segments, other loop on the nonexistence of sustainable performance measures in most of the SMEs firms in the developing context, mainly focused on business to business strategic measures(Profiteering oriented).The presence of a dynamic leaders in the business environment is crucial for promoting innovation and creativity, thereby improving the organization's resilience and competitive edge in the market, (Singh, S., Hong, P. C., & Jagani, S, 2023).Effective leadership involves a continuous cycle of validating, empowering, communicating, and interpreting actions that lead to diverse results (Brandt, E. N., Kjellström, S., & Andersson, A. C, 2019). A study by recommended future research to use the concept of entrepreneurial resilience to develop a synergic effect on effective crisis/disaster management at an individual level.

The objective of this study is to systematically review literature on business redemption strategy of dynamic leadership and digital innovation on SMEs sustainable performance. So, the specific objectives itemize to elaborate on this study is as follows:

- To measure the influence of dynamic leadership on the sustainable performance of SMEs
- To assess the relationship between digital innovation and dynamic leadership.
- To assess the digital innovation impacts on sustainable performance.
- To examine the influence of digital innovation, dynamic leadership, and sustainable performance on Business redemption.
- The outline of this research will revolve around the introduction, which will entail the research gap, research objective, of the research problem. the next section will be the literature review and then the methodology, result and conclusion.

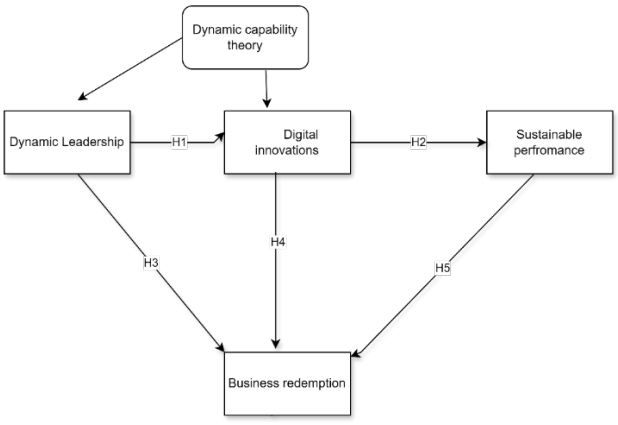


Figure 1: Conceptual Framework. Source: Authors source, 2024

Dynamic Leadership

Many scholars on leaders have enumerated various leadership style and their contribution to firm success and their defects. Some scholars have articulated that transformational leadership is the best however in the current business climate bereaved with increasing costs of goods and services, impacts from climate change and the impasse of wars. Dynamic leaders are leaders who aside interact and develop their followers to influence them and ensure the growth of their employees together (Basham, M. J., & Mathur, R. P., 2010). Dynamism in leadership necessitates leaders to implement swift modifications to enhance adaptability or marketing strategies to remain resilient and pertinent to the broader consumer base.

Additionally, for firms to be more resilient against economic and climate turbulence, there is a need to intricacies of leadership and its repelling effect on firms in this research. Dynamism in leadership in firms' management context involves leading with collaboration using digital systems, teamwork and strategic business environment analysis. (Tucker & Lam, 2014).

Digital Innovation

In the modern era of information technology, the process of digital transformation is seen as a crucial skill for organizations to thrive sustainably, (Xu, J., Yu, Y., Zhang, M., & Zhang, J. Z, 2023). A study conducted by (Gupta, S., Kumar, V., & Karam, E., 2020) illustrated that the implementation of Cloud-based Enterprise Resource planning (ERP) systems will significantly improve sustainable performance. Furthermore Raut, et al., (2021) highlighted the positive impact of big data analytics in enhancing the business performance of sustainable supply chains. in the pursuit of sustainable performance, business leaders should enforce strategies through dynamic capability of sensing and configuration to be sustainable in volatile, uncertain, conditions or means of diversifying an organization, either as a response to changes in the external environment or as a pre-emptive action to influence the business environment. Digital transformation in businesses helps provide significant advantages in tackling environmental challenges (Ghobakhloo, M., & Fathi, M., 2021); (Kiel,et al., 2021) Previous studies by Gupta et al., (2019) indicated a strong correlation between emerging technologies like big data analytics and artificial intelligence (BDA-AI) and positive environmental outcomes. This relationship has been substantiated by multiple research endeavours Nascimento, et al., 2019); (Queiroz, M. M., & Wamba, S. F, 2019). Digital transformation in businesses helps provide significant advantages in tackling environmental challenges (Ghobakhloo, M., & Fathi, M., 2021) ; (Kiel, et al., 2021). Previous studies Gupta,et al., (2019) have indicated a strong correlation between emerging technologies like big data analytics and artificial intelligence (BDA-AI) and positive environmental outcomes. This relationship has been substantiated by multiple research endeavours Nascimento, et al., 2019); (Queiroz, M. M., & Wamba, S. F, 2019) Researchers have emphasised that alleviating unprecedented sustainability challenges requires the deployment of innovative digital technologies and the cooperation of multiple actors (Pershina, 2022).

Sustainable Performance

Couched from the triple bottom approach of the sustainability index which encompasses environmental, social and economic factors. firms can better manage the volatile business environment by achieving sustainable performance considering the triple bottom line (TBL) approach (Bansal, 2005); (Elkington, 2013). Ensuring a safe, healthy, and humane working environment has been the target for multinational firms in achieving sustainable performance. This is because the effect of climate change is posing a devastating impact on food security, the co-existence of humanity, the effects of extremely low and high temperatures, and the emergence of various strange diseases as such the excellent mode of redeeming the universe (businesses and humanity) is through the implementation of sustainable and digital innovation paradigms.

Hypothesis

This systematic literature research is grounded on the under listed hypothesis to guide practice.

1. Dynamic leadership positively influence digital innovation.

Various studies have confirmed this hypothesis including Mihardjo, et al., 2019) who stated that digital leadership based on dynamic capability impacts directly and indirectly on firms developing innovation which leads firm owners to envision market sensing, seizing opportunities and reconfiguration of the business to ensure competitive advantage. Also, Benitez, et al., 2022) affirmed that digital leadership increases firm's innovation and performance by digitalizing the firm's platform and improving performance thus encouraging firms to imbibe into their organizational structure.

Digital innovation influences sustainable performance positively. However others articulated that in as much as digital leadership improve firm performance, they are also prone to disruptive technology effects and other challenges which SME firms much consider, (Brunner, T. J., Schuster, T., & Lehmann, C., 2023).

2. Dynamic leadership impacts positively on SMEs business redemption.

Redemption of businesses occur when firms are in distress situation of collapse if no intervention is employed, the term was formerly used in the religious aspect, till it veered off into the business management concept. Whereas some researchers attribute business redemption to the character traits of the employees (Cultural), others link it to financial distress situation and some leaders and management crisis, and the current business environment is polluted with several SMEs in this dire situation leading to their untimely collapse. However, some have stated that that utilizing a employee's redemptive approach could lead to greater loyalty and enhanced performance. Also cost reduction potential emanate in addressing turnover, hiring and potential litigation, and improved organizational commitment through greater performance (Bucci, J. J., & Bucci, J. J., 2016).

According to Bies, et al., (2021) redemption is defined as "the restoration of social identity, legitimacy, status, and/or reputation of an individual or firm, after the individual or firm has violated important moral or performance expectations that are publicly visible. Strategic policies are the best solution to redeem businesses image and restore customer confidence and ensure viability in these economically challenging times for some SMEs (Weaven, S., Quach, S., Thaichon, P., Frazer, L., Billot, K., & Grace, D., 2021).

Digital innovations impact positively on business redemption.

The theoretical concept of dynamic capability sort to enhance firm leaders' ability to sense business opportunities using digital innovations, reconfigure the business operations to align with market conditions for growth and ensure that distress firms recover. The application and effective use of digital innovation is expected to reduce firms' operational cost and ensure efficient raw material usage. The implementation of digital innovation reduces financial constraints on firms and ensure positive direction towards redemption (Ping, Y., & Li, Z., 2024).

Sustainable performance influences business redemption.

Business performance impacts on their current and future sustainability influencing the redemption rate of firms in distress. As Firms continue trajectory to remain sustainable over a period, there is the likelihood of been redeemed if strategic policies incorporate are followed o the latter. It is therefore important to hypothesis that firm's sustainable performance will influence their ability to redemption structurally, financially and leadingly.

4. Methodology

This article relied on the SLR systematic literature model to study on SME businesses could e redeemed through dynamic leadership and digital innovation in times of economic mis happenings.

A total of over 1,700 articles were identified after the first screening, in google scholar and finally 20 articles were selected from high impacts journals ranked either in web of science or Scopus.

After using keywords of VUCA, sustainable performance, dynamic leadership and a total of 21 articles were realised using the article keywords as related to the area of interest having scanned through the abstract.

Also, after the first review, some articles were eliminated due to time frame which was set from 2019 to 2024. The range took into inconsideration the intense effect of covid on humanity and the time that most businesses started the recovery processes.

Table 1: Literature review summary for 21 articles.

S/No	Author & journal	Topic/theme	Findings	Limitation
1	Norouzi, H., Nosrat Panah, R., & Barani, S. (2022). Journal of Business Management, 14(3), 445- 474. https://doi.org/10.22059/JIBM.2022.333405.4290	The Influence of Digital Leadership on Firm Performance in Dynamic Environments: The Role of Dynamic Capabilities, Business Model Innovation, and Sustainable Competitive Advantage	The study found direct and indirect relationship of digital leadership on sustainable performance through dynamic capability.	High interconnectedness of virtual teams could result in identity crisis for the firm.

S/No	Author & journal	Topic/theme	Findings	Limitation
2	Awwab, Y., & Fontana, A. (2022, July). In *Proceeding of the International Conference on Family Business and Entrepreneurship* (Vol. 3, No. 1).	Linking social media usage and SME's sustainable performance: The role of digital leadership and innovation capabilities	The results show that social media usage has a positive and significant direct influence on innovation capabilities and sustainable SMEs performance, and innovation capabilities also have a positive and significant direct impact on sustainable SME performance.	This study was carried out from the perspective of a developing nation, emphasizing mainly Study adopted a time-lagged data collection approach to avoid common method bias; however, this approach sometimes averts spontaneous interventions.
3	Asif, M., Yang, L., & Hashim, M. (2024). *Sustainability*, *16*(7), 2651.	The Role of Digital Transformation, Corporate Culture, and Leadership in Enhancing Corporate Sustainable Performance in the Manufacturing Sector of China	The findings suggest that corporate culture, transformational leadership, and digital transformation significantly affect organizations' sustainability.	Study exclusively recruited individuals from China's manufacturing sector for its sample, rendering its findings inapplicable to other industries or distinct production configurations heavy reliance on quantitative methodologies for data gathering.
4	Tian, H., Han, J., Sun, M., & Lv, X. (2023).. *European Journal of Innovation Management*, (ahead-of-print).	Keeping pace with the times: research on the impact of digital leadership on radical green innovation of manufacturing enterprises	Study's findings indicate that the four dimensions of DL can positively influence RGI and GOI partially mediates between the four dimensions of DL and RGI	this paper conducts a cross-sectional survey. In the future, longitudinal research can be considered to evaluate how DL, GOI, DT and RGI interact with each other over time.
5	Crossan, M., Vera, D., & Nanjad, L. (2008). . *The leadership quarterly*, *19*(5), 569-581.	Transcendent leadership: Strategic leadership in dynamic environments	have adopted a levels perspective for our study of leadership in dynamic environments, seeking to integrate streams of research that tend to be disconnected. Success in turbulent, high-velocity environments demands the exercise of emergent forms of strategy rather than entirely planned or designed approaches.	The scope of this paper does not include the societal level, a levels perspective lends itself well to expanding the model to incorporate the societal level Among the challenges in this context is the need to reduce complexity and uncertainty for people and provide a desirable picture of the future,
6	Sasmoko, S., Mihardjo, L., Alamsjah, F., & Elidjen, E. (2019). Management Science Letters, 9(10), 1633-1644.	Dynamic capability: The effect of digital leadership on fostering innovation capability based on market orientation	The results show that digital leadership had a strong direct and indirect relationship with dynamic capability.	limited by small sample size and the statistical tool used in the research.
	Chen, A., Li, L., & Shahid, W. (2024).Heliyon, 10(8).	Digital transformation as the driving force for sustainable business performance: A moderated mediation model of market-driven business model innovation and digital leadership capabilities	Results show that digital exploitation and exploration capabilities significantly enhance sustainable business performance	the study takes a small sample size for investigation. study only expands the knowledge of a few digital constructs leading to sustainable business performance.

S/No	Author & journal	Topic/theme	Findings	Limitation
7	Heaton, S., Lewin, D., & Teece, D. J. (2020). Managerial and Decision Economics, 41(6), 1126-1140.	Managing campus entrepreneurship: Dynamic capabilities and university leadership	the dynamic capabilities framework elaborated herein links academic entrepreneurship to value creation and capture. The framework also posits that academic entrepreneurship, per se, requires university leadership that is itself entrepreneurial	the primary data used herein are based on interviews that limit the generalizability of our findings and conclusions. this study is largely limited to research universities, which constitute a relatively small proportion of universities in the United States and abroad.
8	Gilli, K., Nippa, M., & Knappstein, M. (2023). *German Journal of Human Resource Management*, *37*(1), 50-75.	Leadership competencies for digital transformation: An exploratory content analysis of job advertisements	organizations seeking managers for their DT efforts consider general managerial and leadership skills more important than specific technological skills directly related to digitalization.	Electing one organizing framework over another will impact the results and their interpretation as the comparison with Klus and Müller (2020). Limited seletion of database used
9	Zahari, A. I., Abdul Manan, D. I., Mohamed, N., & Said, J. (2023).. *SAGE Open*, *13*(4), 21582440231212042.	Impact of Dynamic Leadership and Marketing Planning on Organizational Resilience During Covid-19: Higher Learning Institutions	The study impacted on flexibility work systems through dynamic leadership.	The small sample size: however, evidence suggests that data saturation was achieved. Triangulation of data from all the three phases supports the presence of the same themes discussed
10	Shafaei, A., Farr-Wharton, B., Omari, M., Pooley, J. A., Bentley, T., Sharafizad, F., & Onnis, L. A. (2023). *Public Performance & Management Review*, *46*(6), 1287-1317.	Leading through Tumultuous Events in Public Sector Organizations	Show that while deploying all the strategies is beneficial, the power of polyvalent knowledge together with dynamic leadership and governance structures within PSOs is one way that PSOs can continue to respond to ever increasing environmental uncertainty and resource constraints	Include the small sample size; however, evidence suggests that data saturation was achieve
11	Xu, J., Yu, Y., Zhang, M., & Zhang, J. Z. (2023).. *Journal of Cleaner Production*, *393*, 136278.	Impacts of digital transformation on eco-innovation and sustainable performance: Evidence from Chinese manufacturing companies	Find that digital strategy and digital capability significantly improve eco-process, eco-product and eco-management innovation. Eco-process, eco-product and eco-management innovation also improve sustainable performance.	Separate categorization for developed and developing countries, alfo framework cannot be generalize because it considered one nation.
12	Abid, N., Ceci, F., & Aftab, J. (2024). *Sustainable Development*, *32*(3), 2031-2048.	Attaining sustainable business performance under resource constraints: Insights from an emerging economy	The findings reveal a direct positive relationship of Enterprise (EO) orientation on sustainable performance. Also, innovation capabilities mediate the EO-sustainable performance relationship, while technology dynamism positively moderates the EO-innovation capabilities link	The data has been collected from SMEs, and it would be interesting to explore multinational and large firms to test the study model. Sample only focuses on one developing country, but a cross-comparative study with countries sharing similar or contrasting economic and social structures would be an interesting

S/No	Author & journal	Topic/theme	Findings	Limitation
				case. Recommend Mixed Method approach.
13	Alonso-Martinez, D., De Marchi, V., & Di Maria, E. (2021). *Journal of Cleaner Production*, *323*, 129145.	The sustainability performances of sustainable business models	Findings suggest that the implementation of most SBMs led to the prioritization of one sustainability dimension over the others, especially when it comes to economically oriented SBMs.	Although the size of the sample and the response ratio are like those used in previous studies replicating the analysis on a large sample, possible spanning various countries, would validate the results.
14	UGC Care Journal) Vol-43 No.03(IV) July - September 2020 CA Asma Sheikh,Karunesh Saxena	Redemption of Indian MSME Sector towards sustainability amid COVID 19 pandemic attack.	attempts to analyse the various support avenues for Indian MSME's amid COVID - 19 pandemic attack and to evaluate such relief measures.	Study was undertaken in one developing country at the neglects of others.
15	McCarthy J, European Business Organization Law Review 2020	A Class Apart: The Relevance of the EU Preventive Restructuring Directive for Small and Medium Enterprises	Class formation, confirmation of restructuring plans and creditor cram-downs are given particular attention since the Directive expressly includes safeguards for SMEs within these feature	The approach should be imbued with regard for not only the rights of the stakeholders at issue—debtors and creditors—but also the wider economic picture in guaranteeing that financial distress is no longer allowed to fester and expand the degree of legacy debt overhang.
16	org/10.1177/00472875211014960	A Resource-Based Typology of Dynamic Capability: Managing Tourism in a Turbulent Environment	Provides empirical explanations for each type of dynamic capability, using qualitative data collected from 40 in-depth interviews with tourism organizations and other stakeholders across two years.	this study combines the during- and short-term post disaster stage in creating the typology.
17	org/10.1016/j.tourman.2021.104374	Developing disaster resilience: A processual and reflective approach	new resilience element added to the existing list of resilience development, which illustrates disruptive changes of tourism facilitated by transforming dynamic capabilities, and (ii) a trial-and-error process used by tourism organisations to improve decision-making for future disaster events	Study examines resilience at the organisational level. this study did not explore the activities of tourism organisations that were temporarily or permanently closed after the disaster
18	Brahaspattie Annie Singh(digitalcommons.liberty.edu/doctoral/3675)	Leadership Failures that Lead to Poor Organizational Performance	the failure of leaders within the real estate industry in the northeastern United States to engage employee support regarding new critical change initiatives resulting in poor organizational performance.	

S/No	Author & journal	Topic/theme	Findings	Limitation
19	Cinnioğlu, H. (2020), Akkaya, B. (Ed.) Agile Business Leadership Methods for Industry 4.0, Emerald Publishing Limited, Leeds, pp. 1-23. https://doi.org/10.1108/978-1-80043-380-920201002	A Review of Modern Leadership Styles in Perspective of Industry 4.01	The study outlines the various leadership styles needed for firm transformation in times of environmental dynamism. The study found a positive relationship of leadership style with firm performance.	
20	Babatunji Samuel Adedeji, Tze San Ong, Md Uzir Hossain Uzir, Abu Bakar Abdul Hamid Journal of corporate governance vol 20, issue3,	Corporate governance and performance of medium-sized firms in Nigeria: does sustainability initiative matter?	CG has a significant positive effect on performance [financial performance (FNP) and non-financial performance (NFP)] and SI. SI has a mixed impact on performance	This study supports the assumptions of theories (institutional, stakeholder and agency) as the basis for the usage of multiple approaches to determine the outcome of hypotheses, especially in developing climes.
21	Matteo Mura, Mariolina L ongo, Sara Zanni	Circular economy in Italian SMEs: A multi-method study	Results indicated that several circular economy (CE) practices are simultaneously implemented by SMEs, thus supporting the notion that CE implies a systemic approach to company's value creation	sample focused on SMEs, as they are relevant players in the diffusion of CE practices due to their prevalence in EU countries, Also, analyses explored a limited number of industrial sectors (i.e. plant engineering, manufacturing, service-based firms, tourism and ICT)

Thematically, most articles dwelled on sustainable performance and digital innovation with less research on business redemption. Issues on business redemption were on VUCA situations in the research arena. most of the study considered the relevance of dynamic capability theory and resource-based view in establishing strategic policy for firms during uncertainty.

5. Findings

The study found that before the pandemic, most of the research reviewed failed to unearth some business redemptive strategies especially studies from 2021 to 2024 but articulated the need firm digitalization and for SMEs' sustainable strategies for their innovativeness as evidence form the table 2.5.Also sustaining firms' operation in a VUCA environment was adequately researched and many suggestions on sustainability as the way forward for firms, however there was no direct link with digitalization strategies to performance but present on the triple system (Environment, economic and social issues).

Most of the literature refenced from table 2.5 discussed digitalization of firms whilst others highlighted the challenges envisage during digitalization and alighted firm owners and managers to be weary. The effective management of these VUCA situations at the workplace demands effective dynamic leadership skills which will conduct environmental scanning and employ available data analytic resources to improve business fortunes. According to Zhang-Zhang, et al.,(2022), while leaders need to develop their dynamic capabilities to adjust to new contexts, transformational leaders will function better in a highly dynamic VUCA environment than transactional leaders. Developing management systems through dynamic leadership skills using technology, allows managers to rely on business information analytics to critically assess the current and future business arena (Ashrafi, A., Ravasan, A. Z., Trkman, P., & Afshari, S., 2019) and make the right intervention through sensing, reconfiguring the firm and transforming the firm especially those in dying need of redemption. Thematically, the various review topics were closely related to SME firm redemption in times of uncertainty but failed to suggest practical recommendations to deal with the situation. Also, recent studies suggested the need to consider the enterprise orientation principle of SMEs and suggest emergency strategies to strengthen the firm's existence (Herbane, 2015). Additionally, most of the studies relied on dynamic capability theory, Resource-based View which whilst a few others used Technology adoption theories

6. Conclusion

The review identified that various scholars' concentration before COVID-19 was on businesses recovering from the effect of the pandemic, however, in the post-research review the studies have little focus on SMEs' ability to develop strategic resilient plans to redeem their operations from any untoward. This could be sensing the ability to measure business outlook in the future and proffer solutions or their ability to use both internal and external resources to improve their knowledge of business management practices and develop strategic plans.

Redemption was delineated by some researcher as employee character change, while other stated that redemption involves delivering firms from financial scam, however the research amid at proffering solutions to SMEs in distress need in time of economic crunch and ensure SMEs remain sustainable and remain resolute against all situations due to enabled strategic policy instituted. There is still a limitation in terms of leadership research on SME management and recommend future studies to consider considering the current digital times. The various review outcomes indicate that schoolers were more profound on business sustainability in the wake of COVID-19 however, just after that, firms have been silent on having strategic emergency plans that could be relied on in times of economic difficulty which some researchers have anticipated to reoccur. This study was limited by the small number of literature used, and those literature eliminated could also hep to improve on the study.

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Sustainable Development Goals and Blockchain: A Systematic Literature Review from a Business Studies Perspective

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Abstract: This study reviews the state-of-the-art relationship between sustainable development and blockchain technology, which can be intertwined concepts within business language, enterprise structures, and managing processes. It explores further comprehension of concepts such as digital technologies, blockchain technology, and the United Nations' Sustainable Development Goals. A systematic literature review using the Prisma Protocol is conducted to identify the main researched topics and the most used sustainable development goals. In addition, the main articles, authors, and journals of the research field are identified. An analysis of the results is applied to acknowledge the findings' contribution. As an outcome, the study identifies 14 main subject research areas that can serve as a framework for the future, including 49 main topics relevant to blockchain technology's relation with sustainable development goals in business studies. This systematic literature review contains an extensively researched database about the subject, and its results and findings are valuable in the scientific and professional sectors for further studies in sustainable development using blockchain technology.

Keywords: Sustainable development goals, Blockchain technology, Business studies, Systematic literature review

1. Introduction

Blockchain technology (BT) growing interest is reflected in the accumulated use number of applications and research articles about the subject, with a particular focus on its relationship with sustainability and the circular economy from different industrial sectors emerging from it (Kouhizadeh et al., 2021; Saberi et al., 2019). Besides, distributed ledger technologies (DLTs), which BT is part of, not being new, the renewed interest grew, in 2008, with the publication of the white paper "Bitcoin: A Peer-to-Peer Electronic Cash System" (Nakamoto, 2008). Since then, this emerging technology has grown drastically regarding the number of intervenients. Its usage also supports decentralised transactions across various business fields, promoting disintermediation, authentication, data integrity, traceability, trust and transparency across different applications (Yadav and Singh, 2015).

However, the disparity of use cases and applications can lead to disconnected strategies and paths when addressing common causes such as sustainability. Therefore, as a framework, the United Nations Sustainable Development Goals (UN SDGs) can serve as a guideline for a renewed agenda to embrace organisations and individuals in an aligned sustainable development process until 2030. By substituting the old Millennium Development Goals and introducing a more complex approach, collaboration and engagement of the different intervenient is necessary (United Nations, 2023), and technology, in particular BT, can boost sustainability transition and must be considered vital to sustainable business models.

1.1 Importance of the Study

This research reviews the main concepts of BT and the SDGs in business studies to analyse their relationship. It also aims to understand the main applications of BT and how and in which particular topics and more extensive subject areas the technology addresses the SDGs.

The present systematic literature review (SLR) adds relevant research to the business studies literature and offers paths for further research. The present research addresses the question: "*What is the relationship between BT and SDGs and which topics are being explored in business studies?*".

1.2 Methodology

We developed an SLR based on Scopus and Web of Sciences (WoS) scientific databases to address this question and used the PRISMA protocol. We structured the article as follows: a) the next section presents the main concepts and the theoretical background of the SLR, presenting the SDGs and then the BT relationship with sustainability; b) afterwards, we expose the methodology used at the SLR, where the review focused on peer-reviewed articles published between 2008 and May 2024, resulting in a final selection of 441 articles after applying inclusion and exclusion criteria; c) then, we present and discuss our results by categorising the articles and analysing their contribution to the different SDGs and the business context they address; d) we finish the paper by addressing the conclusions and limitations of the paper.

1.3 Main Contributions

The study presents an extensive and comprehensive database of key articles, authors, and journals that can be used for further research on the intersection between BT and sustainable development. By bridging theoretical and empirical insights, it highlights BT as a promoter of sustainability across different sectors, emphasising supply chain, circular economy and smart cities subjects. These are included in a framework identification of 14 leading research areas and 49 topics addressing BT's impact on SDGs in business studies. They can serve for future research by outlining its potential research directions and exploring potential BT's applications to enhance sustainable practices within business models.

2. Theoretical Background

2.1 United Nations Sustainable Development Goals

The SDGs is a group of 17 interrelated goals and 169 associated targets representing a comprehensive and multidimensional approach to addressing the three pillars of sustainability – environmental, social, and corporate governance (ESG) - for today's world's challenges. The full SDGs list is shown below in Table 1. The UN General Assembly adopted them in 2015, and they were designated to be adopted as a framework to achieve a better and more sustainable future for all by 2030. The SDGs are a significative advancement from the previous Millenium Development Goals, as they integrate social needs and environmental limits in a more holistic approach to sustainable development (Howard-Grenville et al., 2019; Jägermeyr, 2020; Kleespies and Dierkes, 2022). These goals address global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice. They also recognise that ensuring health and well-being and providing quality education is essential for achieving proper development and sustainable prosperity, an inclusive and peaceful society and a global interconnected partnership (United Nations, 2023).

For SDGs' accomplishment, they must be perceived, accepted, and evaluated by people, but also by organisations worldwide, as their success depends on global engagement and commitment (Kleespies and Dierkes, 2022). Organisations play an essential role in achieving the 2030 agenda, and they need to promote sustainable practices and foster this mindset among their employees to drive the transformation (Elias et al., 2023). Only active engagement of organisations and integration of more sustainable practices can help realise this transformative vision and ensure a more sustainable future for all.

Table 1: UN SDGs

UN SDGs			
Goal 1: No poverty	Goal 2: Zero hunger	Goal 3: Good health and well-being	Goal 4: Quality education
Goal 5: Gender equality	Goal 6: Clean water and sanitation	Goal 7: Affordable and clean energy	Goal 8: Decent work and economic growth
Goal 9: Industry, innovation and infrastructure	Goal 10: Reduce inequalities	Goal 11: Sustainable cities and communities	Goal 12: Responsible consumption and production
Goal 13: Climate change	Goal 14: Life below water	Goal 15: Life on land	Goal 16: Peace justice and strong institutions
Goal 17: Partnerships for the goals			

2.2 Blockchain Technology and Sustainability

BT is a decentralised, transparent, and safe distributed ledger that can maintain transaction history along its chain in all nodes through peer-to-peer operations (Hastig and Sodhi, 2020; Hughes et al., 2019). Unlike centralised databases, where verification of information transactions is the responsibility of a central authority, BT employs cryptography and an agreement mechanism for confirming and enrolling new deals into a shared registry and removing intermediaries. These records can be shared either publicly or privately amongst the agents that participate in the BT (Kouhizadeh et al., 2021; Saberi et al., 2019).

The decentralised peer-to-peer operational and smart execution way that BT works allows it to have more transparency and traceability, giving more visibility, data integrity, and accountability to its operations and further enhancing also sustainability by giving more monitoring and verification allowance on the sustainability-related performance indicators (Park and Li, 2021; Saberi et al., 2019). It also allows for potentially reducing costs and more operational efficiency of business models by reducing or eliminating intermediaries.

When addressing sustainability and the SDGs, we can find a potential direct linkage benefit of using this technology by contributing to a more sustainable approach where there is more visibility and audibility on areas such as resource consumption, emissions, traceability, waste generation, fair trade and wages, and many others that can promote a transformative vision for a more sustainable future (Kamble et al., 2020; Park and Li, 2021; Saberi et al., 2019).

3. Methodology

This study aims to provide an overview of prior research on the relationship between BT and SDGs. SDGs are a guiding framework to expand the study's scope, and they conduct a comprehensive examination of the available literature focusing on the multifaceted relationship between the domains where BT can enhance sustainability from a business studies perspective. To establish a knowledge base for exploring various research streams, suggesting future research directions, and identifying commonalities and differences in research approaches and methods, we accessed and compiled an extensive database of relevant articles to guide this research process and outcome. We made an effort to access and collect crucial and trustable information accurately, as inaccuracies could bias the research results and compromise desired quality standards. Therefore, we used an appropriate and well-designed methodology to synthesise the research systematically, transparently, and context-sensitively and to help overcome the bias in the results (Tranfield et al., 2003). The findings of this study serve as a solid foundation for future scientific research by academics and professionals, which could inspire the development of an evidence-based strategy for addressing the critical challenge of sustainable development.

3.1 Question Formulation

A clear review question, developed at the beginning of the review process, is a crucial driver for a successful SLR (Nguyen et al., 2018). After defining the search strings and the scientific databases to search, based on the preliminary theoretical study, we formulated the following research question: "*What is the relationship between BT and SDGs and which topics are being explored in business studies?*". This question leads the way for an exploration focusing on the interconnection of the UN guidance framework for a sustainable future and the emerging usage of BT across the different SDGs, thereby addressing and agglomerating main subject areas that are fast developing within the academic and professional communities.

3.2 Definition of the Review Protocol and Studies Evaluation

The SLR process and objectives, when guided by PRISMA's diagram protocol (Page et al., 2021), lead to more reliable and precise findings. The use of unambiguous and systematic procedures, such as clearly defining inclusion and exclusion criteria, is instrumental in the identification and validation of relevant studies. It also plays a significant role in reducing the potential for errors or subjective decision-making. The endorsement of PRISMA by editorial organisations and its adoption by researchers conducting SLRs it is key in promoting transparency, reproducibility, and confidence in the reported findings (Moher et al., 2009). It also provides a comprehensive and reproducible search strategy, which is vital for the reliability, by minimizing bias, and the validity of the review (Mengist et al., 2020). Figure 1 shows the complete applied PRISMA's protocol interaction process steps through identification, screening, eligibility, inclusion, and final records result. The subsections following Figure 1 describe in detail each step of the research review process.

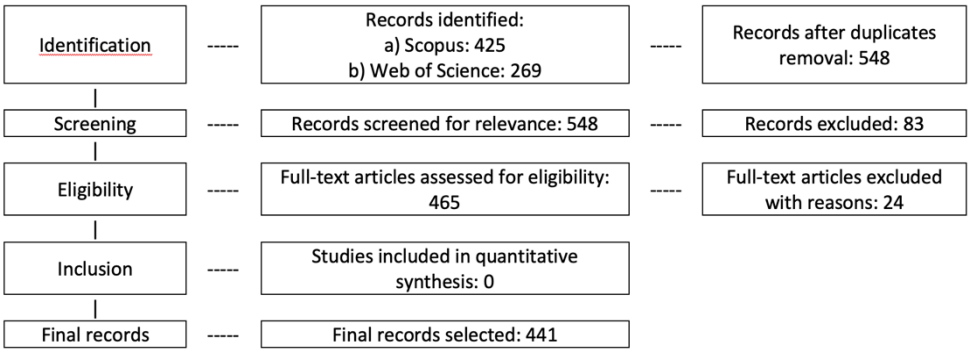


Figure 1: PRISMA's review process of the research

3.2.1 Database selection

We restricted the systematic review search to peer-reviewed journals listed in the Scopus and WoS databases. Both sources combine a vast range of results in business studies from top-level journals, which allowed search outcomes with the most important subjects' results.

3.2.2 Search and identification strategy

Given that the context of this review is about the relationship between BT and SDGs in business studies, our search started in 2008, because this was the published date of the Bitcoin paper (Nakamoto, 2008), and we ended it by May 2024. The search string applied in both databases used the mandatory search terms "sustainab*" and "blockchain", ensuring the relevance of the retrieved search results from titles, abstracts, and keywords. We only searched data in the subject areas of Business, management and accounting. All the documents' results were limited to peer-reviewed articles with a finalised publication stage and English language.

We exported the relevant articles to a reference management software package (Mendeley). After eliminating duplicates, the two databases combined contained 548 articles.

3.2.3 Screening and exclusion criteria

In the screening step, we defined the articles criteria for a full review eligibility. We analysed all the articles' titles, abstracts, and keywords to ensure they were directly related to the mandatory topics of sustainability and BT, both of which needed to be framed by the SDGs. From this screening, we excluded 83 documents with the following criteria: E1: Articles unrelated to BT; E2: Articles unrelated to sustainability; E3: Articles unframed within SDGs; E4: Articles unwritten in English; E5: Articles unpublished between 2008 and May 2024; E6: Articles from non-peer-reviewed scientific sources; E7: Articles unrelated with business, management and accounting subjects.

3.2.4 Eligibility and inclusion

In the eligibility phase, we analysed the text of the articles to ensure they were aligned with the pre-screening phase criteria, but now, in more detail. From this eligibility procedure, we excluded 24 articles and kept 441 records to include in the SLR's final selection. We decided not to include other documents from other sources and keep with the outcomes from the Scopus and WoS databases.

3.2.5 Data extraction, structuring and analysis

The final stage of our SLR involved data processing and creating data networks to extract meaningful insights from scientific publications. The data was exported to Microsoft Excel software to organise all the entries into a single database. The accuracy of the data was assured by verifying its reliability, and the articles' content information was categorised. Ultimately, we coded each article with the relevant search terms and the SDGs it addressed. This coding process allowed us to obtain specific outputs for a more focused analysis in each group later.

Furthermore, we processed and structured the data to enhance its legibility, which facilitated the extraction of results such: a) publications per year, b) top publishing sources and authors, c) journals' quartile distribution and h-index values, d) most researched subjects, and e) top-cited articles as well as the distribution of articles per SDG and the subjects they cover. Lastly, we generated a list of topics the SDGs address and grouped them into suggested future research subject areas.

4. Analysis of the Results

The selected articles mainly cover business, management, and accounting subjects as specified in the previous section and contribute essentially to the research area of business studies. Figure 2 also shows that the number of publications on the research subject has grown substantially over the past years, reaffirming its importance. Besides starting the search in 2008, we only have two first results in 2017, assuring this is a recent research area. We can identify a growing trend of publications until 2024. This trend continues in 2024 because we already have more than half of the publications by May compared with 2023.

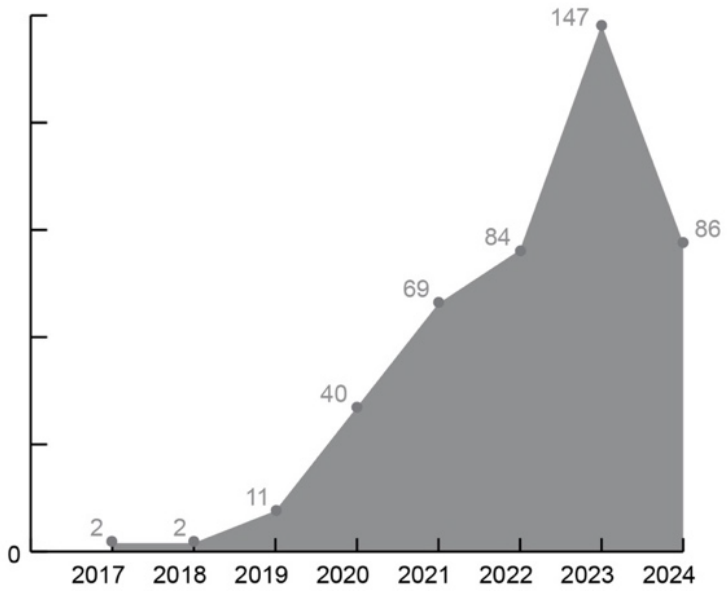


Figure 2: Publications by years

Table 2 presents a comprehensive summary of the most influential journals in our research. It details the number of published articles, the source, and the relevance. By utilising the Scimago Institutions Rankings, an internationally recognised ranking system for over 2000 research institutions and organisations (Dumay, 2014), we can identify that most articles integrate the first and second quartiles, except one journal classified in the third quartile. The outcome demonstrates the articles' scientific quality and relevance to the research field.

Three leading researchers are more active in the literature contribution: Kumar, Anil; Sarkis, Joseph; and Mangla, Sachin Kumar. Table 3 exhibits their significant contributions, detailing the number of publications, main research subjects, affiliation, and the h-index. This comprehensive view lets us disclose their impact on advancing knowledge in this field. Table 4 summarises the most cited articles in the research field, their publication source, quartile acknowledgement and the Chartered Association of Business Schools Journal Ranking 2021 positioning.

Table 2: Most contributing journals

Source	Documents published	Quartile	H-index
Journal of Cleaner Production	39	Q1	309
Technological Forecasting and Social Change	30	Q1	179
Business Strategy and the Environment	26	Q1	147
Operations Management Research	16	Q1	41
International Journal of Production Research	12	Q1	186
Transportation Research Part E Logistics and Transportation Review	11	Q1	144
IEEE Engineering Management Review	10	Q2	38
Logforum	9	Q3	14
Journal Of Business Research	8	Q1	265
International Journal of Information Management	7	Q1	177
Corporate Social Responsibility And Environmental Management	6	Q1	113
IEEE Transactions On Engineering Management	6	Q1	112
International Journal Of Logistics Management	6	Q1	94
Logistics	6	Q2	23
International Journal Of Production Economics	6	Q1	231

Table 3: Most contributing authors

Source	Documents published	Research subjects	Affiliation contributed	H-index
Kumar, Anil	13	Sustainability; Net zero/circular economy; Sustainable operations; Industry 4.0/5.0; AI/machine	London Metropolitan University	44
Sarkis, Joseph	12	Management; Operations management; Sustainability; Supply chain management; Environment	Worcester Polytechnic Institute	115
Mangla, Sachin Kumar	9	Circular economy and industry 4.0; Supply chain; Sustainability; Decision support system; Cross-disciplinary research in OM	University of Plymouth & O.P. Jindal Global University	66
Luthra, Sunil	6	Industry 4.0; Sustainable supply chains; Circular economy; Cleaner technologies; Sustainable societies	All India Council for Technical Education	65
Bai, Chunguang April	5	Sustainable supply chain; Carbon neutrality; Industrial 4.0	University of Electronic Science and Technology of China	38
Rejeb, Abderahman	5	Supply chain; Sustainable development; Blockchain	Széchenyi István University	29
Agrawal, Rohit	4	Business and economics; Environmental sciences and ecology; Engineering; Science and technology; Materials science	Indian Institute of Management Bodh Gaya	21
Dal Mas, Francesca	4	Sustainability; Digital transformation and new business models; Intellectual capital; Knowledge management; Healthcare management;	Ca Foscari University of Venice	28
Garza-Reyes, Jose Arturo	4	Operations Management, Business Excellence, Lean Manufacturing, Six Sigma, Supply Chain Management, Manufacturing Management, Sustainable Operations	University of Derby	54
Massaro, Maurizio	4	Risk management; Hazard and operability study; Intangible asset; Intellectual capital; Business model; Sustainable business	Ca Foscari University of Venice	29
Mishra, Ruchi	4	Supply chain; Flexible manufacturing system; Commerce; Cyber physical systems; Embedded systems; Industry 4.0	Institute of Rural Management Anand	20
Mubarik, Muhammad Shujaat	4	Supply chain; Sustainability; Management; Intellectual capital; Intangible assets; Human resources; Industry	Heriot-Watt University Edinburgh	29
Yu, Zhang	4	Supply chain management; Logistics management; Green supply chain management; Green practices	Chang'an University	16

Table 4: Most cited articles

Article	Source	Quartile	ABS Journal Ranking 2021	Citations
(S Saberi et al., 2019)	International Journal of Production Research	Q1	3	1943
(Kouhizadeh et al., 2021)	International Journal of Production Economics	Q1	3	624
(Kamble et al., 2020)	International Journal of Information Management	Q1	2	544
(Hughes et al., 2019)	International Journal of Information Management	Q1	2	542
(Hastig and Sodhi, 2020)	Production and Operations Management	Q1	4	471
(Wong et al., 2020)	International Journal of Information Management	Q1	2	427
(Bai and Sarkis, 2020)	International Journal of Production Research	Q1	3	385
(Upadhyay et al., 2021)	Journal of Cleaner Production	Q1	2	333
(Di Vaio and Varriale, 2020)	International Journal of Information Management	Q1	2	287
(Saurabh and Dey, 2021)	Journal of Cleaner Production	Q1	2	280

Figure 3 resumes the number of articles contributing to each SDG and the related topic addressed. Each article can contribute to more than one SDG and, therefore, be linked more than once to the same topic. The result is 49 articles' addressed topics, highlighting the "supply chain's traceability, transparency and trust through blockchain technology" as being, by far, the most addressed topic by the articles.

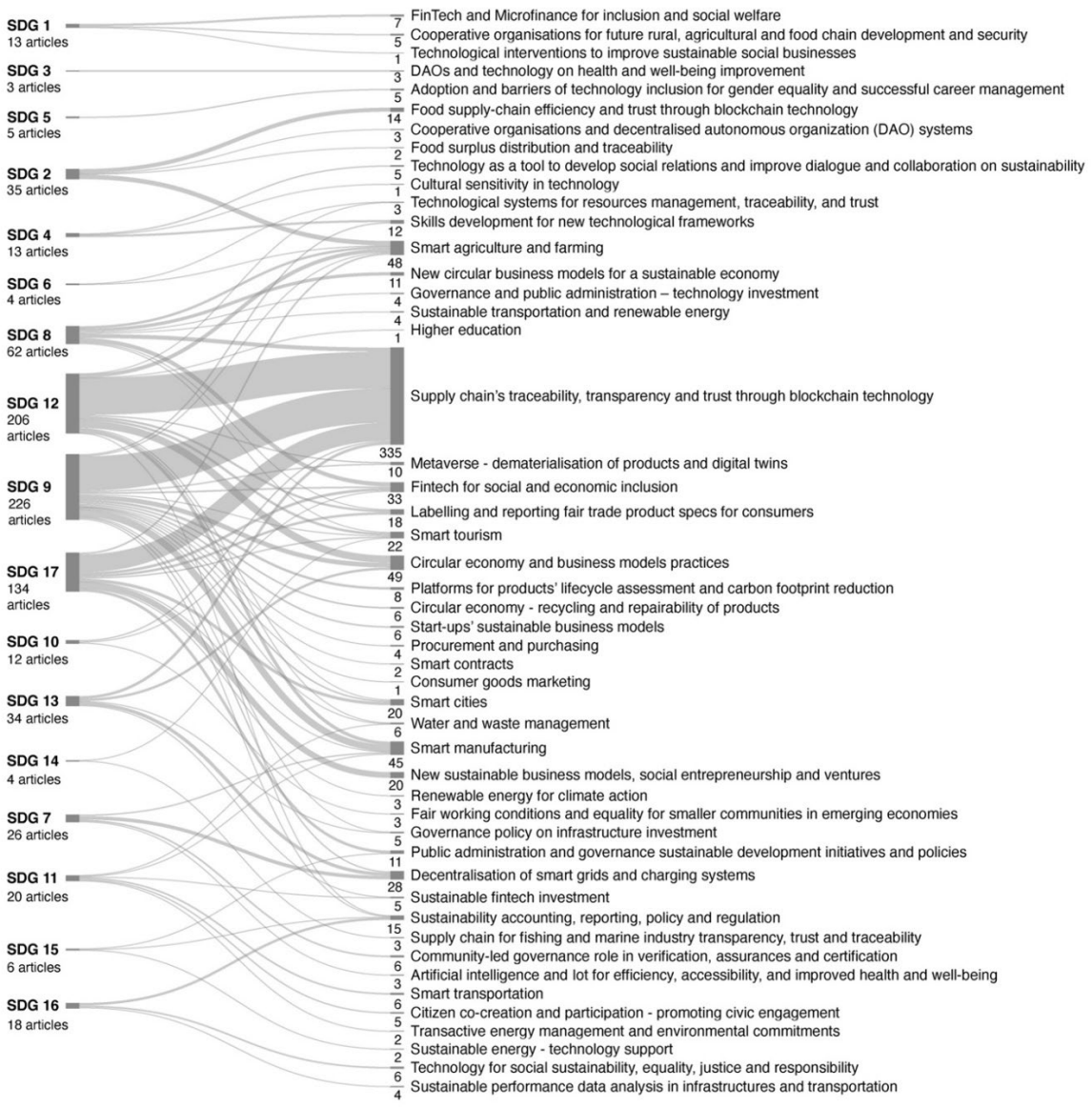


Figure 3: SDGs articles' topics

5. Conclusion and Future Research Directions

In this SLR, we analysed the main concepts, applications, topics, and subjects in which BT has intertwined with SDGs since 2008. The study's relevance and the information gathered allowed us to respond, along with the previous sections, to the initially defined research question: "What is the relationship between BT and SDGs, and which topics are being explored in business studies?". These insights resulted in acknowledging the growing trend of publications about the research area. We also gathered related information about the most contributing journals and authors and the most impactful articles crossing BT and SDGs in business studies. When using SDGs as a framework for BT in business studies, we found that SDG 9 and SDG 12 are the goals addressed the most, followed by SDG 17. The supply chain is, by far, the most addressed topic by the articles.

In order to foster future research areas in this field, we have identified 14 main subject research areas in which the explored topics are inserted. Figure 4 shows the exploration dimension of the overall research areas so far, and based on these, we describe what is addressed in each section. This information can inspire potential studies to shed more light on each and acknowledge new future research when crossing BT, SDGs, and business studies.

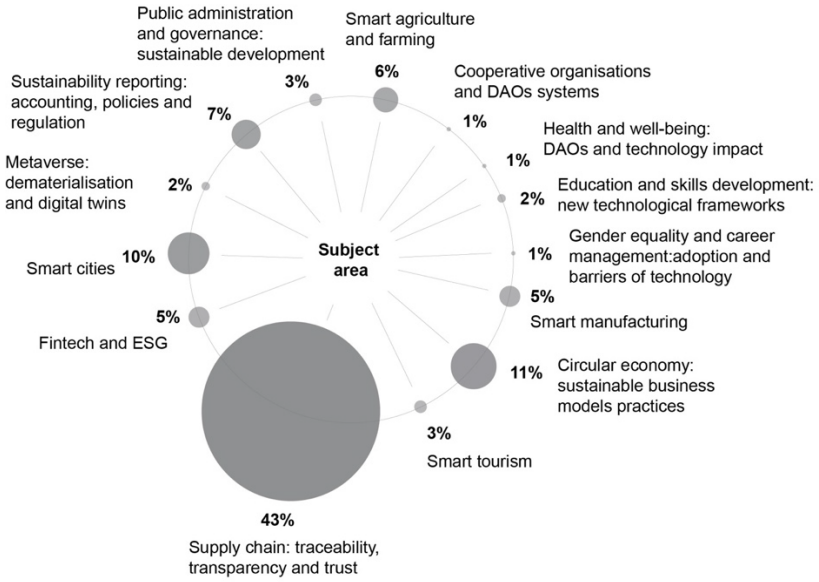


Figure 4: Subject areas

1. *Circular economy: sustainable business models practices (11%)*: with rising environmental concerns, innovative digital technology and circular business models enable a circular economy and enhance existing business models. BT, big data, Internet of Things (IoT), and other applications of digital technologies are all shaping different business fields and pushing them toward a transition with less resource consumption, less emissions, lower waste, and more organisational and private company performance and stability from an economic perspective (Khan et al., 2021; Saurabh and Dey, 2021).
2. *Cooperative organisations and DAOs systems (1%)*: although in many countries, organisations form cooperatives for business cooperation, a lack of formal mechanisms to enforce contractual agreements or other obstacles lead to decentralised autonomous organisations (DAOs) as an alternative form of governance independence (Amend et al., 2023).
3. *Education and skills development: new technological frameworks (2%)*: explores the sustainability determinants of adopting BT by higher education institutions and other stakeholders linked to the technology's growing popularity (Alshamsi et al., 2024). It also acknowledges that if we foster new technologies' knowledge and skills within organisations, this can turn into new forms of intellectual capital and have the potential to support value creation and realise SDGs (Al-Htaybat et al., 2019).
4. *Fintech and ESG (5%)*: fintech, powered by innovative technology, is driving a significant transformation in the financial industry by designing and delivering high-quality financial products and services. This transformation is being propelled by the key drivers of digitalisation and sustainability. The growing concepts of green fintech and financial inclusion prove this transformation and shape the industry's future (Mehrotra, 2023; Puschmann and Khmarskyi, 2024).
5. *Gender equality and career management: adoption and barriers of technology (1%)*: examines the role and potential of BT in promoting gender equality through the lens of new technology-oriented corporate governance models (Di Vaio et al., 2023). It also addresses financial inclusion and gender equality by exploring facilitating access to microfinance for female entrepreneurs (Kanegae et al., 2021).
6. *Health and well-being: DAOs and technology impact (1%)*: secure information holistically that can connect and assure its provenience and trustworthiness for the diverse stakeholders in healthcare, such as clinicians, scientists, and patients, and how to use technology to lead effective mechanisms for public administration (Jung and Pfister, 2020).
7. *Metaverse: dematerialisation and digital twins (2%)*: dematerialisation and digital twins, by substituting actual items for their digital counterparts, are adapting to consumer expectations (Schauman et al., 2023) and creating a relationship between the virtual and real world that can foster a more circular economy by promoting waste elimination and boosting continuous resource availability and traceability (Das et al., 2023).
8. *Public administration and governance: sustainable development (2%)*: the investigation is centred on the adoption of BT by public administration and governance in areas such as digital identity, social

provision, and innovative climate finance that can lead to more effective administrative mechanisms and decentralisation of power (Schulz et al., 2020). Besides the effort of the adoption, there are identified barriers to keeping BT as a support tool for sustainability, such as low dissemination and high cost, energy consumption and processing time (Bai and Sarkis, 2020).

9. *Smart agriculture and farming (6%)*: explores the design, development, and application of innovative methods to transform the field with more sustainable agricultural and farming practices where technology enhances food security and information (Leduc et al., 2021).
10. *Smart cities (10%)*: this area explores how to improve efficiency, transparency, accessibility, and quality of life in cities (Szpilko et al., 2023), from transport and logistics to smart grids and decentralisation of power energy (Said, 2023), BT enables sustainable future cities where there is empowered citizen participation and co-creation (Bagloee et al., 2021; Marsal-Llacuna, 2020).
11. *Smart manufacturing (5%)*: it demonstrates how manufacturing can become more sustainable by balancing ESG goals. To do so, it also includes explorations about digitalisation and the disruptive combination of technologies with BT, such as artificial intelligence, machine learning, the IoT, and big data (Agrawal et al., 2023).
12. *Smart tourism (3%)*: promoting new and innovative business models, improving the efficiency of the tourism service value chain, having a positive impact from a sustainable perspective, and enhancing the quality of the service provided to the end customer, mainly in related areas such as marketing, logistics, and smart business models (Prados-Castillo et al., 2023).
13. *Supply chain: traceability, transparency and trust (43%)*: BT has gained attention to ease global supply chain management issues. Managing and control have become complex in a globalised world where chains have gotten too long (Wong et al., 2020). Its sustainability is also challenging to track (Di Vaio and Varriale, 2020). However, with the pressure from local and global governments, in addition to the final consumers, BT and smart contracts are supporting a change with the potential to bring more efficiency, transparency and traceability to the chain (Upadhyay et al., 2021). The technology has seen rapid acceptance in food, healthcare, logistics, and other supply chains. However, there are still barriers keeping it from its potential, such as technological unpreparedness by the intervenient and the complexity of extensive supply chains. Besides BT being well-accepted and explored, inter and intra-organizational barriers also arise, and the true blockchain-led transformation is still in its early stages (Kouhizadeh et al., 2021; Saberi et al., 2019).
14. *Sustainability reporting: accounting, policies and regulation (7%)*: the pressure from authorities and supervisors on ESG reporting is demanding more consistency. Information unclarity can lead to different interpretations and non-comparability. BT addresses this area by creating frameworks for mitigation, automatisation, agility, and transparency either by publicly or privately undisclosing the data (Dario et al., 2021; Pizzi et al., 2022).

Academics and professionals can use the results of the present SLR as the starting point for elaborating new research and business strategies to foster the adoption of BT and promote sustainability, taking it into account within the SDGs framework to attain meaningful impact in achieving their objectives.

Finally, we shall consider the limitations of the SLR methodological approach since it can only give us a partial overview of the literature search from a limited number of databases. Other studies may also foster more profound content analysis research, particularly in this paper's outcome subject areas and topics list.

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“Whatever It Takes”: Socioemotional Wealth and Endowment Preservation in Failing Family Firms

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Abstract: Prior research has repeatedly highlighted the influence of socioemotional wealth (SEW) on decision-making processes in family firms, given that owner-managers seek to protect their SEW endowments and identity. Yet, little is known about how this influence unfolds in situations of firm failure and how far owner-managers will go to preserve their SEW and identity. Hence, this paper investigates the role of SEW in driving escalation of commitment to a failing family firm and the likelihood of reentering entrepreneurship after the firm’s failure. Furthermore, the role of fear of failure and attribution as moderators in the interplays are investigated. Two vignette studies leveraging 314 observations from owner-managers of family-owned craft businesses in Germany provide evidence for a positive impact of SEW on the degree of commitment escalation to a failing firm and the intention to reenter entrepreneurship after failure. Moreover, the results of the analysis suggest that fear of failure plays a moderating role in the interplay between SEW and escalation of commitment, reducing the extent of commitment escalation by owner-managers. Hence, fear of failure dispositions might either help fuel rationality in decision-making or trigger a “freeze” or “flight” coping strategy rather than direct failure avoidance via additional investments. The findings of this paper hold informative value for owner-managers seeking to reduce adverse or impulsive decision-making and governmental bodies trying to understand how economic wealth might be adversely influenced by a SEW-induced urge to protect failing family businesses. Furthermore, the underlying results enrich the current theoretical understanding of the dark side of SEW while clarifying manifestations of grief, attribution, and fear of failure in the family firm context. At last, this paper outlines various avenues for future research.

Keywords: Socioemotional wealth, Family firms, Escalation of commitment, Fear of failure, Attribution, Entrepreneurship

1. Introduction

Within the realm of family firms, owner-managers commonly form non-financial endowments and affective ties to their firms, which can range from emotional attachment and identification with the firm to a desire for dynastic succession (Berrone, Cruz, and Gomez-Mejia, 2012). Formally defined as socioemotional wealth (SEW), these non-financial considerations frequently put owner-managers in a position where non-economic considerations must be balanced with financial interests. In such situations, owner-managers have been found to protect their identity and SEW, even if non-economic decisions are required (Berrone, Cruz, and Gomez-Mejia, 2012). As their endowments and identity are tied to the firm’s destiny, owner-managers also tend to display a strong commitment to the firm’s survival (Sirmon and Hitt, 2003), which, however, can also escalate into a state of overcommitment. Escalation of commitment describes situations in which individuals stick to previous decisions and invest more resources despite contrary information regarding the viability of the course of action (Staw, 1976). However, even though further resources are invested, escalation of commitment often fails to solve the underlying issues and merely delays failure. Once the firm eventually fails, owner-managers thus lose their SEW and parts of their identity. In such situations, individuals share a tendency to try to recoup their losses, which could drive failed owner-managers to look for ways to restore or preserve their SEW and identity (Kahneman and Tversky, 1979). SEW and identity restoration, however, can usually only be achieved by founding a new firm. While researchers have made initial contributions to bring these interplays to the broader research agenda (e.g., Chirico et al., 2018; Hsu, 2013), both the phenomenon of escalation of commitment and the impact of SEW on the likelihood of founding a new firm after failure remain understudied fields in family firm research (Woods, Dalziel, and Barton, 2012). Hence, this paper conducts a quantitative analysis of the role of SEW in driving escalation of commitment to a failing family firm and the likelihood of reentering entrepreneurship after failure. Further, this paper answers prior research calls by assessing the role of fear of failure and internal attribution as moderating factors in the interplays (Cacciotti and Hayton, 2015; Costa, Ferreira, and Torres de Oliveira, 2023).

2. Theoretical Foundations

2.1 Socioemotional Wealth and the Desire for Endowment and Identity Protection

Family business researchers have long been captivated by the distinct behavior of family firms (Chrisman et al., 2010). On the matter, prior literature identified non-financial goals and affective endowments as key drivers for distinct decisions in family firms (Berrone, Cruz, and Gomez-Mejia, 2012). Formally defined as socioemotional

wealth (SEW) by Gómez-Mejía et al. (2007), these non-financial endowments comprise the "non-financial aspects of the firm that meet the family's affective needs" (p. 106) and span five dimensions ("FIBER"), including (F) family control and influence, (I) identification with the firm, (B) binding social ties with stakeholders, (E) emotional attachment, and (R) the renewal of family bonds through dynastic succession (Berrone, Cruz, and Gomez-Mejia, 2012). When owner-managers start to build SEW and identify with the firm, it transitions from a pure source of income to an extended part of the self and family (Gimeno et al., 1997). Consequently, commitment to the survival of the firm increases (Sirmon and Hitt, 2003), and protecting their endowment and identity becomes the ultimate objective for owner-managers, which takes priority over financial considerations (Berrone, Cruz, and Gomez-Mejia, 2012). Once the firm enters financial distress, however, balancing financial with non-financial interests becomes more challenging, as further resource investments to save the firm can lead to overcommitment.

2.2 Escalation of Commitment to a Failing Family Firm

Such overcommitment, called escalation of commitment, represents a phenomenon where individuals stick to a failing course of action and invest further resources despite mounting evidence that the course of action likely results in failure (Staw, 1976). Escalation situations commonly share three characteristics: (1) sunk costs, (2) feedback that a previous action resulted in failure, and (3) the choice of trying to recoup the loss via additional investment or complete withdrawal (Brockner, 1992). Escalation behavior, however, often only delays failure (Shepherd, Wiklund, and Haynie, 2009) and can have a severe business impact, particularly in situations of failure. In such situations, owner-managers frequently become trapped in a dilemma, torn between financial rationality and a strong commitment towards SEW (DeTienne and Chirico, 2013). As SEW preservation commonly prevails, owner-managers will likely try to keep the business alive, even if this requires further investments (Symeonidou, DeTienne, and Chirico, 2022). Among the theories that have sought to explain this phenomenon from a retrospective and prospective rationality standpoint, self-justification theory remains the most dominant retrospective theory (Schulz-Hardt, Thurow-Kröning, and Frey, 2009). According to self-justification theory, individuals continue to follow previous decisions to justify prior actions, show consistency, and prove their correctness (Brockner, 1992). In this regard, the feeling of responsibility plays a pivotal role. The more an individual feels responsible, the more likely the individual escalates commitment to protect his identity and self-image (Staw, 1976). While a tendency for continuity and persistence have been long-recognized traits of family firms (König, Kammerlander, and Enders, 2013), escalation of commitment remains an understudied field in family firm and entrepreneurial research (Nouri, 2023). To date, existing research in the family firm context remains widely limited to conceptual contributions (e.g., Chirico et al., 2018) and many of the proposed drivers of escalation of commitment, such as emotional attachment and SEW (Chirico et al., 2018), remain unassessed.

2.3 The Role of Fear of Failure in Escalation of Commitment

Beyond theories building on retrospective rationality, Whyte (1986) proposed prospect theory as an alternative explanation for escalation of commitment. According to prospect theory, individuals are loss averse, yet show a higher willingness to take risks when deciding between a certain loss and an uncertain one with the potential for a larger loss (Whyte, 1986). Hence, individuals tend to escalate their commitment in situations framed as a loss relative to their reference point to recoup their losses (Kahneman and Tversky, 1979). A related phenomenon that aligns with such prospective rationality and loss aversion is fear of failure. Cacciotti et al. (2020) define fear of failure as "a negative affective reaction based on cognitive appraisals of the potential for failure" (p. 1). Individuals experiencing fear will likely search for ways to reduce the likelihood of the feared event via three approaches: confrontation ("fight"), avoidance ("flight"), or paralysis ("freeze") (Cacciotti and Hayton, 2015). For failing firms, however, avoidance or paralysis often do not represent viable options, as they materialize failure or fuel the downward cycle. Thus, "fighting" often represents the most promising path. Fighting, however, usually comes with higher investments of time or money, hence fueling escalation.

2.4 Desire for Endowment and Identity Restoration After Failure

As previously outlined, escalation can delay failure but often not avoid it (Shepherd, Wiklund, and Haynie, 2009). When firms fail, owner-managers suffer the loss of their SEW while also losing parts of their identity (Gómez-Mejía et al., 2007). Consequently, owner-managers likely experience feelings of grief, especially as firm failure often translates into personal failure (Jenkins, Wiklund, and Brundin, 2014). To fully recover, owner-managers thus need to break the emotional bonds with the failed firm (Shepherd, 2003). On the matter, grief literature provides two approaches to grief recovery, comprising loss-oriented and restoration-oriented recovery. While loss-oriented recovery seeks to terminate emotional attachment by confronting and processing losses over time,

restoration-oriented recovery aims at avoidance and distracting oneself (Stroebe and Schut, 1999). Founding a new firm can thus often represent the most attractive restoration-oriented grief strategy, as it promises the recreation of SEW and restoration of identity. Further, it also enables a gradual way of parting with the old firm, allowing loss-oriented recovery along the way. Nevertheless, reentering entrepreneurship after failure might not always be rational. Rather, the desire for endowment and identity restoration could trigger impulsive decisions without objective validity, as the causes that led to the firm's demise often persist (Shepherd, 2003).

2.5 The Role of Attribution

In situations of failure, research has repeatedly confirmed responsibility as a key driver for self-justification and identity protection behavior. Nevertheless, most research has focused on the role of objective responsibility rather than subjective perception (Sleesman et al., 2012). However, this distinction is key, as perceptions differ between individuals (Block and Funder, 1986). Attribution theory offers a valuable framework to understand how individuals explain their own actions and the behavior of others (Yamakawa, Peng, and Deeds, 2015). In this regard, individuals either attribute the locus of causality to external (non-controllable) or internal (controllable) factors (Yamakawa and Cardon, 2015). How causes are attributed often depends on the outcome, specifically whether the outcome is positive or negative. As individuals often form biased attributions to self-enhance or self-protect (Rogoff, Lee, and Suh, 2004), they frequently attribute successes to internal factors and failures to external factors to negate responsibility. In case of internal attribution, individuals perceive a higher sense of responsibility, which can threaten their self-concept and thus trigger self-justification due to a stronger need for identity preservation (Luginbuhl, Crowe, and Kahan, 1975).

3. Hypothesis Development

As previously elaborated, ensuring the firm's continuity represents the paramount objective for owner-managers, given that the owner-manager's identity and SEW endowments are tied to its survival (Berrone, Cruz, and Gomez-Mejia, 2012). Concurrently, the desire for endowment and identity protection is likely amplified by a higher tendency for self-justification among owner-managers with higher SEW, given that a higher share of their identity and self-concept is at stake when the firm faces financial distress (Staw, 1981). Accordingly, owner-managers with higher SEW are expected to show higher levels of commitment escalation.

> ***H1:*** *Higher SEW is positively related to an increase in owner-managers' escalation of commitment to their failing family business.*

A key prerequisite for the need for self-justification and identity protection is the perceived responsibility of the owner-manager (Sleesman et al., 2012). When decisions lead to adverse outcomes, owner-managers will likely look for ways to attain self-justification by sticking to previous decisions and investing further resources (Staw, 1976). This justification need will be especially strong if internal attribution places responsibility on the owner-manager. Hence, attribution is expected to moderate the relationship between SEW and escalation of commitment.

> ***H2:*** *Internal attribution positively moderates the relationship between SEW and escalation of commitment.*

Moreover, as the owner-manager's identity, self-concept, and endowments hinge on the firm (Gómez-Mejía et al., 2007), exiting is perceived to be very costly (Zellweger and Astrachan, 2008). Therefore, picturing the consequences of failure in situations of financial distress will likely trigger a feeling of fear among owner-managers with a high fear of failure. Accordingly, these individuals will likely act to reduce the likelihood of failure by actively "fighting" against its occurrence, given that alternative paths to avoid failure rather accelerate the downward cycle (Cacciotti and Hayton, 2015). Consequently, fear of failure will fuel the protection and preservation behavior induced by higher SEW, thus acting as a moderator.

> ***H3:*** *Fear of failure positively moderates the relationship between SEW and escalation of commitment.*

If the firm fails despite escalation efforts, owner-managers face the loss of their SEW and parts of their identity (Gómez-Mejía et al., 2007). This loss will not only trigger a strong feeling of grief (Shepherd, Wiklund, and Haynie, 2009) but also a desire to restore and recover lost endowments and parts of their identity. However, this objective usually can only be achieved by founding a new firm, given that the foundation of a new firm enables owner-managers to recreate their previous state (Shepherd, 2003).

> ***H4:*** *Higher SEW is positively related to a higher inclination to find a new firm after the failure of the current firm.*

Once the firm fails, the cognitive, affective, and behavioral reactions of individuals likely depend on the attribution of its causes (Yamakawa, Peng, and Deeds, 2015). More specifically, attribution likely plays a central role in defining how strong the need for identity and self-concept restoration fueled by SEW will be after the firm's failure. If the causes for the failure are attributed externally, external justification will likely lead to a lower sense of responsibility (Luginbuhl, Crowe, and Kahan, 1975). However, if failure is attributed internally, owner-managers are expected to feel highly responsible. Consequently, they likely suffer a stronger detriment to their identity and self-concept. Therefore, they should also share a higher need to restore these parts of their identity and self-concept, which is best addressed by founding a new firm (Shepherd, 2003). Thus, attribution is hypothesized to take on a moderating role in the relationship between SEW and the likelihood of reentering entrepreneurship after the firm's failure.

H5: *Attribution moderates the relationship between SEW and the foundation of a new firm after failure.*

4. Methodology

Two vignette studies leveraging a between-subject design were conducted to investigate the interplays. As described in the following, internal vs. external attribution represented the manipulation in both vignettes. Each respondent completed both vignettes and was randomly allocated to one manipulation condition per study.

4.1 Sample

The focus of the sample collection was set on the German craft business sector due to its strong fundamentals regarding active companies, density of family firms, different firm sizes, and business sectors (Zentralverband des Deutschen Handwerks, 2023). Email addresses of 20,256 craft businesses were randomly collected from a public online directory. 405 complete responses were collected, yielding a 2.3% response rate, which is in line with other online surveys among small business executives (Seshadri and Broekemier, 2022). Subsequently, responses that did not fit the target group were discarded (e.g., family firm definition). Ultimately, 314 responses remained.

4.2 Design – Study 1

In Study 1, participants were confronted with a hypothetical scenario, which informed them that their current firm had been facing a steep decline in revenue and profits due to issues in client acquisition and satisfaction. Furthermore, the vignette stated the participant had already conducted an investment in measures seeking to improve client acquisition and satisfaction. This investment, however, had been ineffective, as profits declined further, even though the revenue decline was slightly alleviated. Subsequently, participants in the internal attribution group were informed that they attribute the low impact to internal causes. Contrarily, the external attribution condition defined a market recession as the key reason for the decline. Moreover, the vignette stated that the firm would need to be closed within the next 1-2 years if profits could not be improved substantially. Thus, participants faced a decision on how much additional funding they would be willing to commit. These funds would again flow into the initiatives they had already invested in, as these were deemed the sole means to potentially still avert the failure.

4.3 Design – Study 2

In Study 2, respondents were asked to imagine a situation where the profits of their current firm declined substantially and, despite efforts to save the firm, a closure of the firm was inevitable to avoid further losses and bankruptcy. Again, the attribution of the causes for the failure was manipulated. Consequently, participants were asked how likely they were to find a new firm.

4.4 Measures

4.4.1 Dependent variables

Escalation of commitment (Study 1 only). Escalation of commitment was measured by the investment of additional funds. To keep answers realistic, the investment was restricted to a range between 0% and 10% of revenues. To address the right-censored nature of the data, responses were categorized (Cat 1: 0-2.5% / Cat 2: >2.5%-5% / Cat 3: >5%-7.5% / Cat 4: >7.5%).

Likelihood of Founding a New Firm (Study 2 only). The likelihood of establishing a new firm after failure was measured via a 7-point Likert-type question ("very unlikely" (1) to "very likely" (7)).

4.4.2 Independent variables

Socioemotional wealth. SEW was measured using the 17-item SEW scale by Gerken et al. (2022), which was derived based on a validation of the "FIBER" scale. As opposed to Berrone, Cruz, and Gomez-Mejia's (2012) 5-factor structure, the scale suggests a 4-factor structure. All items were answered on 5-point Likert-scale questions ("strongly disagree" (1) to "strongly agree" (5)).

4.4.3 Moderating variables

Internal attribution. Attribution was manipulated in the vignettes.

Fear of failure (Study 1 only). Fear of failure was measured using the short version of the Performance Failure Appraisal Inventory (PFAI) by Conroy, Willow, and Metzler (2002). The construct comprises five Likert-scale questions ("strongly disagree" (-2) to "strongly agree" (2)).

4.4.4 Control variables

To control for relevant firm-specific characteristics, the variables *firm size* (only in Study 1 – # full-time employees), *sector*, and *liability* (based on the firm's legal form) were assessed. Concerning owner-manager-specific factors, information on the owner-manager's *age* and *gender* was collected. Further, *prior firm failure experiences* of owner-managers were measured. Finally, participants were asked about *other income sources and financial assets* they could rely on if the firm would need to be shut down.

5. Results

Descriptive statistics are provided in Table 1. The mean of 2.14 for the degree of escalation of commitment suggests that owner-managers decided to invest between 2.5-5% of sales despite negative feedback. This finding points to a significant overall tendency towards escalation of commitment among owner-managers, regardless of the prevalence of SEW. Concerning the likelihood of founding a new firm, the mean score of 2.70 indicates that owner-managers are "rather unlikely" to find a firm after failure. Finally, the mean SEW score of 61.39 reveals a notable level of SEW among owner-managers in the sample.

Table 1: Descriptive Statistics

n=314	Mean	Std. Dev.	(1)	(2)	(3)	(4)	(5)
(1) Escalation of Commitment	2.14	1.09	1.00				
(2) Likelih. of Founding New Firm	2.70	1.79	N/A	1.00			
(3) SEW	61.39	9.39	0.14**	0.12**	1.00		
(4) Fear of Failure	-0.50	0.90	-0.08	N/A	0.06	1.00	
(5) Internal Attribution (Study 1)	0.50	0.50	-0.04	N/A	0.02	0.06	1.00
(6) Internal Attribution (Study 2)	0.48	0.50	N/A	-0.10*	0.08	N/A	N/A
(7) Firm Size	10.29	15.46	0.02	N/A	0.11**	0.09*	-0.03
(8) Finishing Trades	0.33	0.47	0.02	0.06	0.10*	-0.04	0.03
(9) Core Construction	0.34	0.47	-0.06	0.02	-0.00	0.01	0.00
(10) Trades for Private Demand	0.13	0.34	-0.06	-0.05	-0.12**	-0.00	0.01
(11) Trades for Comm. Demand	0.07	0.26	0.14**	-0.08	0.04	0.04	0.01
(12) Health Sector Trades	0.04	0.18	-0.01	0.04	-0.15***	-0.02	-0.02
(13) Motor Trades	0.05	0.21	0.07	0.03	0.01	0.01	-0.13**
(14) Food-Related Trades	0.05	0.22	-0.06	-0.07	0.03	0.03	0.06
(15) Age	52.56	10.68	0.02	-0.09*	0.05	0.02	-0.02
(16) Gender (Female)	0.15	0.35	-0.06	-0.08	-0.04	-0.05	0.00
(17) Legal Liability	0.60	0.49	-0.08	-0.06	-0.06	-0.15***	0.11*
(18) Prior Failure Experience	0.06	0.21	0.11*	0.13**	-0.06	-0.04	-0.02
(19) Income Sources & Fin. Assets	2.49	0.92	0.17***	0.15***	0.02	-0.24***	-0.07

n=314	Mean	Std. Dev.	(1)	(2)	(3)	(4)	(5)
	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(6) Internal Attribution (Study 2)	1.00						
(7) Firm Size	N/A	1.00					
(8) Finishing Trades	0.05	-0.05	1.00				
(9) Core Construction	-0.06	0.04	-0.50***	1.00			
(10) Trades for Private Demand	0.00	-0.13**	-0.27***	-0.28***	1.00		
(11) Trades for Comm. Demand	-0.00	-0.04	-0.20***	-0.20***	-0.11*	1.00	
(12) Health Sector Trades	0.06	-0.07	-0.13**	-0.14**	-0.07	-0.05	1.00
(13) Motor Trades	-0.07	-0.01	-0.16***	-0.16***	-0.09	-0.06	-0.04
(14) Food-Related Trades	0.04	0.33***	-0.16***	-0.17***	-0.09	-0.07	-0.04
(15) Age	0.11*	0.09	-0.05	-0.01	-0.03	0.13**	0.01
(16) Gender (Female)	-0.04	-0.09*	-0.11**	-0.18***	0.45***	-0.08	0.02
(17) Legal Liability	0.06	-0.31***	0.05	-0.26***	0.26***	-0.07	0.09
(18) Prior Failure Experience	-0.01	-0.07	0.00	-0.07	0.05	-0.01	0.04
(19) Income Sources & Fin. Assets	0.04	0.09	-0.03	0.01	-0.04	0.06	0.03
	(13)	(14)	(15)	(16)	(17)	(18)	(19)
(13) Motor Trades	1.00						
(14) Food-Related Trades	-0.05	1.00					
(15) Age	-0.01	0.02	1.00				
(16) Gender (Female)	-0.09*	0.11*	-0.09	1.00			
(17) Legal Liability	-0.03	0.10*	-0.02	0.20***	1.00		
(18) Prior Failure Experience	0.09	-0.05	-0.01	-0.05	0.06	1.00	
(19) Income Sources & Fin. Assets	-0.04	0.05	0.05	-0.01	-0.14**	-0.04	1.00

N/A = Not applicable as variables were not used in the same model / study
***** p<0.01, ** p<0.05, * p<0.1**

5.1 Results – Study 1

An ordered logistic regression analysis was performed to examine the underlying hypotheses on escalation of commitment (Table 2). Model 2 provides evidence that higher SEW increases the odds of commitment escalation, hence confirming H1. As hypothesized, a stronger identification and intertwining of the business with the owner-manager's identity seems to have a significant influence on endowment and identity protection via escalation of commitment. Further, while the moderation effect of attribution (H2) is not supported, the moderation effect of fear of failure is significant. However, the relationship between SEW and escalation of commitment is weakened by higher fear of failure, which contradicts H3.

Table 2: Ordered Logistic Regression Results

Escalation of Commitment	Model 1	Model 2	Model 3
	Odds Ratio	Odds Ratio	Odds Ratio
Control Variables			
Firm Size	1.002	1.001	1.003
Core Construction	0.749	0.784	0.784
Trades for Private Demand	0.838	0.958	1.029
Trades for Commercial Demand	2.227	2.226	2.383
Health Sector Trades	0.814	1.118	1.166

Escalation of Commitment	Model 1	Model 2	Model 3
	Odds Ratio	Odds Ratio	Odds Ratio
Motor Trades	1.495	1.475	1.447
Food-Related Trades	0.662	0.699	0.617
Age	0.999	0.997	0.998
Gender (Female)	0.867	0.869	0.825
Legal Liability	0.797	0.776	0.788
Prior Failure Experience	2.399**	2.458**	2.596**
Income Sources and Financial Assets	1.394**	1.373**	1.368**
Independent Variables			
SEW		1.033**	1.005
Fear of Failure		0.907	4.098*
Internal Attribution		0.885	0.223
Interactions			
SEW x Fear of Failure			0.976*
SEW x Internal Attribution			1.022
Prob > Chi-Squared	0.023	0.015	0.007
Pseudo R-Squared	0.028	0.038	0.042
Observations	314	314	314
*** p<0.01, ** p<0.05, * p<0.1			

5.2 Results – Study 2

Similar to Study 1, an ordered logistic regression analysis was performed to examine the hypotheses related to the likelihood of reentering entrepreneurship after failure (Table 3). Model 2 reveals significantly higher odds of reentering entrepreneurship when SEW is higher, hence confirming H4. Contrary to expectations, model 3 does not support the hypothesized moderation effect of internal attribution on the relationship between SEW and the likelihood of reentering entrepreneurship after failure. Rather, model 2 reveals that the manipulation of internal vs. external attribution has a significant main effect on the likelihood to find a new firm after failure. However, given that the odds ratio is below 1, the results suggest lower odds of reentering entrepreneurship if the causes for the firm's failure are attributed internally. This finding contradicts the positive effect one could expect from a need for identity restoration after failure.

Table 3: Ordered Logistic Regression Results

Likelihood of Founding a New Firm	Model 1	Model 2	Model 3
	Odds Ratio	Odds Ratio	Odds Ratio
Control Variables			
Core Construction	0.814	0.822	0.827
Trades for Private Demand	0.731	0.797	0.799
Trades for Commercial Demand	0.472*	0.463*	0.474*
Health Sector Trades	1.124	1.481	1.442
Motor Trades	0.852	0.824	0.832
Food-Related Trades	0.563	0.562	0.561
Age	0.982*	0.983*	0.983*
Gender (Female)	0.593	0.573	0.571
Legal Liability	0.898	0.910	0.913

Likelihood of Founding a New Firm	Model 1	Model 2	Model 3
	Odds Ratio	Odds Ratio	Odds Ratio
Prior Failure Experience	2.685*	2.715**	2.719**
Income Sources and Financial Assets	1.444***	1.467***	1.464***
Independent Variables			
SEW		1.030**	1.035**
Internal Attribution		0.691*	1.320
Interactions			
SEW x Internal Attribution			0.990
Prob > Chi-Squared	0.014	0.002	0.003
Pseudo R-Squared	0.024	0.032	0.033
Observations	314	314	314
*** p<0.01, ** p<0.05, * p<0.1			

6. Discussion

The findings of this paper provide evidence for a positive impact of SEW on the degree of escalation of commitment to a failing family firm, suggesting that SEW drives owner-managers to invest more resources in situations of failure, seemingly motivated by a desire to protect their firm, SEW, and identity. SEW might thus prove disadvantageous in situations of failure, as it can distort rational decision-making. Moreover, fear of failure was found to exert a significant negative moderation effect. Three lines of argumentation might explain these results. First, owner-managers might be more likely to "freeze" in such situations, which prevents them from "fighting" the failure. Accordingly, given the high stakes involved in the described escalation scenarios, owner-managers might be more hesitant in their investment choice or tend to abstain from additional investments. A second explanation might be that owner-managers with a higher fear of failure are more reluctant to conduct additional investments as they seek to avoid another failure ("flight" approach). Finally, a third explanation might be that owner-managers with a higher fear of failure subliminally expect or already accepted the failure. Regardless of the cause, fear of failure might therefore benefit owner-managers in situations of failure. Consequently, they might be less inclined to escalate commitment and rather seek clarity on the outcome. Concerning entrepreneurial intentions after failure, the findings yield evidence for a positive impact of SEW on the likelihood to start a new firm after failure, thus confirming the hypothesized desire among owner-managers to restore their SEW endowments, identity, and self-concept. Furthermore, the significant negative main effect of internal attribution suggests that owner-managers, who attribute the causes for the firm's failure internally, might not be blindly driven by their desire for identity and endowment restoration. Rather, they might recognize the need to work on their internal capabilities before founding another firm or fully abstain from it altogether.

6.1 Theoretical Contributions

This paper provides several novel contributions to prior literature. Firstly, it extends family firm literature by providing evidence that SEW fuels escalation of commitment to a failing family firm and the likelihood to find a new firm after failure. Therefore, this research enriches findings on the "dark side" of SEW and underlines its relevance post-exit (Kellermanns, Eddleston, and Zellweger, 2012). Secondly, the results provide further clarity on antecedents of escalation of commitment in organizations. In this regard, the study introduces new quantitative insights to support propositions brought forward by prior research on escalation of commitment in the family firm context (e.g., Chirico et al., 2018; Symeonidou, DeTienne, and Chirico, 2022). Thirdly, this research provides contributions to grief literature by investigating the foundation of a new firm as a coping mechanism (Shepherd, 2003). Finally, this paper answers prior research calling for both an investigation of the role of fear of failure in escalation of commitment and further research on the role attribution in predicting future entrepreneurial engagement after failure (Cacciotti and Hayton, 2015; Costa, Ferreira, and Torres de Oliveira, 2023).

6.2 Practical Implications

Concerning practical implications, the analysis informs owner-managers with affective ties to their firms about its adverse influences, helping them to initiate countermeasures to avoid non-economic and impulsive decisions.

Moreover, this research holds informative value for governmental bodies. Given that owner-managers with high SEW share a tendency to accept non-economic decisions and escalate commitment to failing firms, a significant share of firms might survive solely due to their owner-managers' desire for endowment and identity preservation. The survival of failing businesses, however, can impose costs on the economy and society, for instance by slowing growth or blocking resources (Ucbasaran et al., 2013).

6.3 Limitations and Future Research

This research faces several limitations. Firstly, the findings rely on hypothetical scenarios rather than real-life business situations. However, this approach allowed to isolate behavior related to commitment escalation and career choices in controlled settings, which would be nearly impossible to assess in real life (Richards, Kammerlander, and Zellweger, 2019). Additional limitations arise from the focus of the sample on the German craft business sector and an overrepresentation of firms in the core construction segment. Future research should thus replicate the study to confirm its representativeness. Finally, limitations arise in the measurement of fear of failure, as researchers have criticized the PFAI's interpretation of fear of failure as a stable construct (Cacciotti et al., 2020). Hence, future research might use alternative measurements to validate the described findings on fear of failure. Further, future research could investigate whether SEW also drives the likelihood of reentering entrepreneurship if the firm is exited despite strong financial performance (e.g., firm sales).

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Perceived Success and Entrepreneurial Identity in West Africa

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Abstract: This research aims to understand the Fake It Until You Make It (FIUYMI) culture and its impact on entrepreneurial identity in the West African startup ecosystem. Self-presentation is important for entrepreneurs and often they tend to exaggerate their success. In West Africa, this is usually the case for entrepreneurs that want to gain social acceptance among their peers and to secure funding. It is represented by a desire of belonging and is amplified with digital social platforms and peer pressure. This study aims to evaluate the impact of perceived success using mixed methods research with both qualitative and quantitative data. The qualitative phase consists of semi-structured interviews with 20 startup founders from West Africa. The initial objective is to understand the motivations behind employing FIUYMI behaviour and its effect on the entrepreneurial identity and sense of success. A structured survey is then conveyed to 50 startup founders across the same region. The second objective is to quantitatively assess the prevalence of this behaviour and its impact on self-perception, and psychological well-being. Results suggest that FIUYMI is at first a good strategy for entrepreneurs to enhance perceived credibility and attract support and can be a positive tool for entrepreneurs to some extent as it boosts their confidence and network. It may later lead to psychological stress and has a perverse effect on entrepreneurs of not belonging to their community: Even when they achieve their desired outcome, they may consider their achievements to be fraudulent which is linked to a sense of imposter phenomenon. The research goal is to understand the complexities of perceived success and the 'Fake it Until You Make it' attitude in the West African context informing effective interventions in entrepreneurial behaviour. By showing its negative impact on an entrepreneur's journey, the research also aims to enhance accurate self-presentation and contribute to a more trustworthy entrepreneurial ecosystem in West Africa for entrepreneurs and investors.

Keywords: Entrepreneurial Identity, Perceived Success, Entrepreneurial Behaviour, West Africa

1. Introduction

Entrepreneurship constitutes a pillar of Africa's growth; In 2023, African tech startups attracted a record-breaking $1.4 billion in venture capital funding (Disrupt Africa, 2023). Entrepreneurship in Africa quickly became front and center of global news. As the market is in the spotlight with many opportunities for entrepreneurs, it is essential for entrepreneurs to project an image of success to attract support and secure funding (Davila, Foster, and Gupta, 2003). According to the African Development Bank Group (2024), West Africa, growth is projected to rise from an estimated 3.2% in 2023 to 4% in 2024 and 4.4% in 2025. In West Africa, it is relevant to make a good impression as social capital is as valuable as financial capital; social acceptance is a key pillar of entrepreneurial success (Light and Dana, 2013). Self-presentation is crucial for entrepreneurs. It has been explored by Goffman (1959) that defined it as the way individuals present themselves and their success to the world.

For entrepreneurs, self-presentation influences the perception of others and facilitates resource acquisition and social validation. Digital platforms like LinkedIn play an important role in this social validation process as they provide new means to reach wider audiences (Henderson and Bowley, 2010). Social platforms come also with their challenge as they intensify peer pressure and the necessity to conform to success norms while managing public image carefully (Afolayan and Folorunso, 2015).

In this dynamic ecosystem, it is easy for entrepreneurs to exaggerate their success and fall into the practice of acting as if they have already attained their objectives (Chen et al, 2009). Guided by a competitive, resource-constrained environment, and the pressure to always maintain a positive image, they tend to falsify the reality of their success to enhance their credibility (Pollack, Barr, and Hanson 2012). This has complex implications for entrepreneurial identity as the pressure to maintain this inflated image of success may impact mental health and authenticity (Parkman, 2016). This also affects building trust within the ecosystem. This research consists of understanding the motives behind this "Fake It Until You Make It" (FIUYMI) culture and measuring its impact on entrepreneurial identity in West Africa. The objective is to inform effective interventions in entrepreneurial behaviour in West Africa and to leverage the insights gained to enhance entrepreneurial practices across the continent.

2. Literature Review

Entrepreneurs' identity is defined by how entrepreneurs perceive themselves and how others see them within the entrepreneurial ecosystem (Jones et al., 2012). Entrepreneurial identity is dynamic and is constantly

challenged by social interactions and entrepreneur's experience (Navis & Glynn, 2011). In Africa, entrepreneurial identity is related to cultural and social beliefs that are specific to the region (Murugesan and Jayavelu, 2017). Social norms and community support are pillars of business success and shape how entrepreneurs present themselves and their startup (Kamoche et al., 2015). In Africa, social status and family ties are central and can either support or hinder entrepreneurial success (Ondiba and Matsui, 2019). Literature shows that family involvement is crucial, and entrepreneurs rely on their network for advice and financial support (Ondiba and Matsui, 2019). Entrepreneurial identity is made in these daily interactions and through peer influence as entrepreneurs look up to each other for validation and support (Sriram and Mersha, 2010).

These Entrepreneurs' behaviours impact their perceived success and constitute a central aspect in entrepreneurs' journey in evaluating their achievements. Perceived success is defined by both tangible results like financial gains and intangible concepts like social recognition (Fisher, Martin, and Lobo, 2016). For these reasons, the way entrepreneurs view their achievements is a critical aspect that affects their motivation and overall well-being (Obeng and Blunder, 2015).

Entrepreneurial identity and perceived success have a mutually reinforcing relationship. A confident entrepreneurial identity can enhance perceived success, entrepreneurs are likely to behave in a way that results in positive outcomes (Cardon et al, 2009). Conversely, perceived success can boost confidence of entrepreneurs in the way they perceive their work (Hoang and Gimeno, 2010).

Societal expectations in West Africa as in the continent, place a high value on visible signs of success and on entrepreneurs' validation by influential community members (George et al., 2016). Attaining entrepreneurs' business objectives is as important as showing one's success (George et al., 2016). Digital platforms like LinkedIn amplifies this need of positive self-presentation (Iwu and Allen-Ile, 2015). Speaking out loud about their achievement helps entrepreneurs gain social acceptance and more importantly, attract potential clients and investors (Shneor and Jenssen, 2014). This digital stage makes entrepreneurs project an image that often inflates their work as they want to appear more successful than they are (Murugesan and Jayavelu, 2017). This attitude is often the one of entrepreneurs who face challenges in attracting resources. It is the case for most entrepreneurs operating in the tech industry (Pollack et al, 2012).

Entrepreneurs who bluff their way to success may experience at first a boost in confidence and credibility (Maxwell, Jeffrey, and Lévasque, 2011). However, in the long run, this can lead to a misalignment between their self-perception and people's opinion which result in a sense of impostor phenomenon (Clance and Imes, 1978). In addition to that, it can cause anxiety for entrepreneurs and psychological stress because of the pressure to conform to their projected vision of success (Murugesan and Jayavelu, 2017). This fear of being unmasked can even cover their genuine achievements, creating a perpetual cycle of self-doubt and stress (Pollack et al, 2012).

For instance, research by Al Halbusi (2024) demonstrates how fear of failure and peer pressure can lead to anxiety among entrepreneurs in emerging countries and in Africa. Additional studies specific to the Nigerian market have shown how this pressure in portraying success creates a challenging environment for durable entrepreneurial growth in the region (George et al, 2016). A recent study by the World Economic Forum (2023), highlighted the importance of having the right growth mindset and how this significantly influences entrepreneurs' success. This requires fostering a culture of transparency and authenticity where entrepreneurs present their real work and achievements without fearing judgment and rejection (Pollack et al, 2012).

Understanding the dynamics between perceived success and entrepreneurial identity is essential to contribute to the broader discourse on entrepreneurship by providing context-specific insights and implications for theory and practice. Ultimately, the objective of this research is to enhance a more accurate self-presentation for entrepreneurs and encourage sustainable business practice to build a trustworthy entrepreneurial culture in Africa.

3. Methodology

The research conducted is non-experimental and consists of a data population of 20 West African Startup founders selected through purposive sampling for qualitative analysis and involves 50 founders selected through stratified random sampling for quantitative analysis. Data were gathered through semi-structured interviews for the qualitative scientific procedures and explained with thematic analysis. For the quantitative study, data were collected through a survey covering demographics, self-perception and psychological well-being. The last analysis used descriptive and inferential statistics in order to test and validate the research hypothesis. By combining qualitative and quantitative scientific procedures, the objective of this study is to offer a nuanced understanding of the complex dynamics at play in the FIUYMI culture among West African entrepreneurs.

For the qualitative phase, semi-structured interviews allowed to gather data from 20 startup founders. A diverse representation across various industries, ages, genders and business stages was possible thanks to purposive sampling and allowed for a rich exploration of participants motivation and experience with FIUYMI behaviour. The data population consists of tech startups from West Africa, representing startups at different stages of maturity and countries. The purpose of this first study is to get insight from West African entrepreneurs to better understand the perception they have about their entrepreneurial identity and their practices (if any) of amplifying their success. Participants anonymity is assured, encouraging them to share honestly about their journey. The interviews are guided by a structural framework based on existing literature and theoretical models related to entrepreneurial behaviour and psychological well-being (Kvale, 1996; Smith et al.,2010; Jones, 2015). Each interview lasts about an hour and is conducted either in person or virtually. Thematic analysis is then employed to identify patterns within the data to gather common entrepreneur's behaviour.

For the quantitative study, a structured survey was administered to 50 startup founders, selected using stratified random sampling. For this phase of the study, the objective was to ensure that the sample accurately reflects the broader population of West African startup founders to get relevant insights about entrepreneur's journey. The data population as for the interviewees, are assured of their anonymity and are tech startup founders from West Africa representing various industries and stages of business. The survey included measures on self-perception using the Rosenberg Self-Esteem Scale (Rosenberg, 1965) and on psychological well-being with the GAD-7 scale (Spitzer et al, 2006) and the Perceived Stress Scale (Cohen et al, 1983). The digital format allows for direct integration with statistical software. Descriptive statistics was used to provide an overview of the data, while inferential statistics allowed to test the study hypothesis and explore the relations between the variables.

4. Research Objectives

The objective of this research is to understand entrepreneur's behaviour when it comes to amplifying their success. The objective is also to measure the impact of exaggerating achievement on an entrepreneur's self-perception and well-being. Fake It Until You Make It (FIUYMI) behaviour will be discussed as FIUYMI throughout the study. They are defined and are not limited to exaggerating achievement, past experiences, enhancing qualification or overstating stage of development/partnerships.

To evaluate their impact, three hypotheses were formulated and allowed to guide the research:

H1: There is a negative relationship between frequent FIUYMI behaviour and entrepreneur's self-esteem.

H2: There is a positive relationship between frequent FIUYMI behaviour and entrepreneur's anxiety levels.

H3: There is a positive relationship between frequent FIUYMI behaviour and entrepreneur's stress levels.

5. Findings

5.1 Qualitative Study

The qualitative study is preliminary research that aims to understand the reasoning of entrepreneurs and why they may amplify their success. It is an essential step before measuring the prevalence and impact of this behaviour. Findings from the qualitative analysis provided in-depth insights into the experiences of entrepreneurs with FIUYMI behaviours and the motivation behind their actions.

The interviews revealed that entrepreneurs frequently exaggerate their success to navigate the competitive and resource-constrained environment they are part of. A significant theme that emerged in this regard was the role of social pressure and expectations, which pushed entrepreneurs to project an image of success. For many, amplifying their success was a necessity to be part of the ecosystem, gain social acceptance and attract first clients and investors. Regarding their behaviour, participants indicated for the most part that these practices initially boost their confidence and credibility and were indeed facilitating resource acquisition and peer validation. They also can't help but feel a sense of imposter syndrome that leads to stress and anxiety to maintain that always positive image of success. This behaviour was particularly evident among early-stage founders. The following table provides insights using original statements by the interviewees.

Table 1: Key findings from the qualitative study

Theme	Sub-Themes	Key Findings
Understanding what FIUYMI Behaviour are	Perceptions and Perceived Success	Some entrepreneurs exaggerate achievements, past experiences, number of clients, stages of development and or partnerships and collaboration.
Motivations Behind FIUYMI Behaviour	Social Pressure and Expectations, Resource Acquisition and Investment Attraction	Entrepreneurs feel compelled to exaggerate their success due to societal expectations and the need to secure funding.
Influence of Digital Platforms	Amplification of Success, Peer Pressure and Competition	Digital platforms like LinkedIn amplify the need for positive self-presentation which increases peer pressure and competition among entrepreneurs. Constant visibility intensifies the pressure to maintain an image of success.
Impact on Self-Perception	Short-Term Confidence Boost, Long-Term Psychological Strain	It initially enhances self-esteem but often leads to long-term psychological stress and anxiety. Entrepreneurs experience a conflict between their projected image and their genuine self-perception, contributing to imposter syndrome.
Cultural and Social Factors	Community Support and Validation, Family Involvement and Expectations	Cultural norms and family expectations significantly influence entrepreneurs' behaviour. Entrepreneurs rely heavily on their social network for support and validation.
Long-Term Effects	Sustainability of Success, Authenticity and Trust Building	Over time, maintaining an exaggerated image of success becomes unsustainable. The disconnect between perceived and actual success impacts trust in the ecosystem.

5.2 Quantitative Study

The quantitative study allowed us first to get insight on the frequency of FIUYMI behaviour and classify them based on their frequency and business stage.

The study showed that these behaviours are highly prevalent among West African startup founders. From our 50-population data, 44 entrepreneurs reported engaging in amplifying their work and exaggerating their success. This high prevalence underscores the significant role of perceived success and social acceptance in the entrepreneur's journey. Every industry is concerned, with a clear focus on tech industries which probably reflects a common response to competitive and resource-constrained environments. The highest percentage of respondents, 40%, occasionally engage in these practices. In that case, occasional use can be considered as a strategic tool rather than a habitual practice. The most concerning is the frequent and very frequent category that concerns about half of the population data. Very frequent engagement might correlate with higher levels of psychological stress and imposter syndrome, as maintaining such a facade can be mentally challenging.

Table 2: Frequency of FIUYMI behaviour

Frequency of FIUYMI behaviour	Percentage
Never	12 %
Occasionally (Every month)	40 %
Frequently (Every week)	26 %
Very frequently (Many times a week)	22 %

Looking at the data distribution by business stages showed that early and growth startups are the most concerned with frequent and very frequent FIUYMI behaviour. The high percentage for early stages can be attributed to the intense pressure on new businesses to validate their business concepts and to attract initial funding. Founders in the growth stage still rely on projecting an enhanced image of success but there is a slight decrease in frequent and very frequent engagement compared to the early stage. As businesses mature, the reliance on FIUYMI behaviours diminishes with 30% entrepreneurs that don't feel the necessity to project an

inflated image. These practices remain quite common occasionally even for mature businesses suggesting that even if the business has established its reputation and stability, there remains a need to occasionally project a slightly enhanced image to maintain their market position and appeal to potential investors or partners. It can also be linked to specific events that are part of the startup life like new product launches and funding rounds. This shows the necessity at every stage to address these dynamics fostering a culture of authenticity to contribute to a healthier and more sustainable entrepreneurial ecosystem.

Table 3: Prevalence of FIUYMI Behaviour according to the business stage

Business Stage	Never	Occasionally	Frequently	Very Frequently
Early Stage	8%	36%	32%	24%
Growth Stage	7%	39%	27%	27%
Maturity Stage	30%	50%	10%	10%

To better test the hypotheses, the second part of the quantitative analysis was about measuring the impact of these behaviours on self-perception and well-being among West African startup founders. The Rosenberg Self-Esteem Scale was then used to measure Self-Perception for entrepreneurs, it consists of 10 items rated on a 4-point Likert scale ranging from "Strongly Agree" to "Strongly Disagree." According to that scale, higher scores indicate higher self-esteem (Rosenberg 1965). For the surveyed entrepreneurs that never or occasionally used these practices, the mean self-esteem is 21 indicating a moderate level of self-esteem. Entrepreneurs who frequently and very frequently engaged in FIUYMI behaviour had lower self-esteem scores, with a mean score of 17. Data shows This can suggest that for entrepreneurs who tend to exaggerate their success, self-perception tends to decrease.

To measure psychological well-being the GAD-7 scale was used, it measured anxiety with 7 items rated on a 4-point scale ranging from "Not at all" to "Nearly every day" (Spitzer et al. 2006). Stress was also measured using the Perceived Stress Scale (PSS), that evaluates perceived stress with 10 items rated on a 5-point scale from "Never" to "Very often" (Cohen et al. 1983)

For both scales, higher scores were significantly correlated with frequent FIUYMI behaviour. The mean GAD-7 scores among participants who never or occasionally use this practice was 7 while it was 9 for the frequent and very frequent population. The pressure to maintain a facade of success can contribute to increased anxiety among entrepreneurs.

Regarding the PSS scale, the average PSS score for participants who never overstate their work was 15. It was 21,2 for the participants that frequently and very frequently amplify their achievements. Participants who engaged more frequently in FIUYMI behaviours reported higher stress levels.

The findings highlight the potential negative psychological impacts of such practices, reinforcing the need for interventions that promote authentic self-presentation and mental well-being within the entrepreneurial ecosystem.

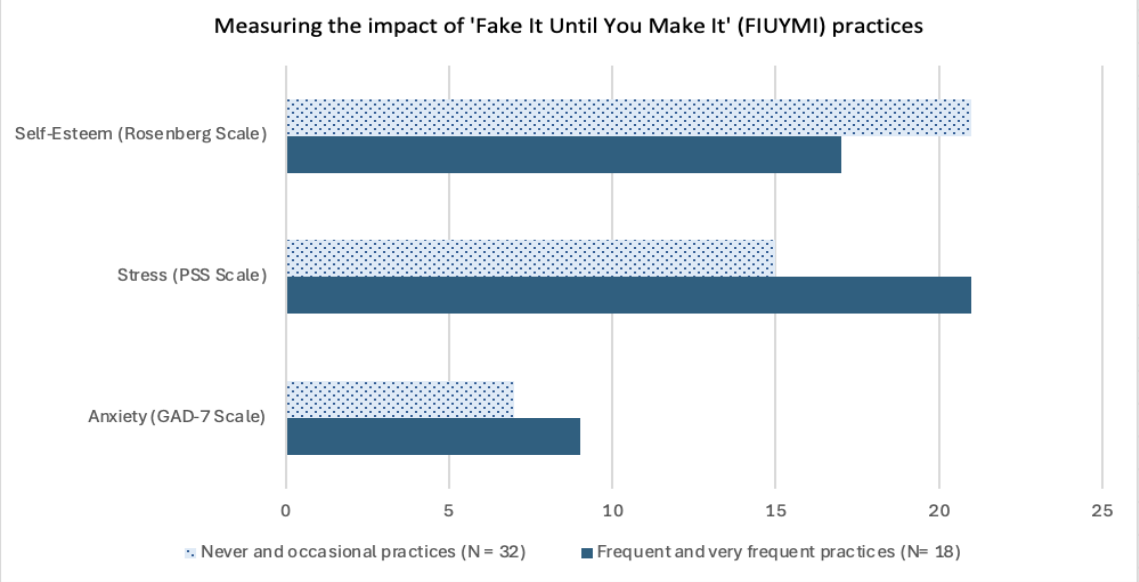


Figure 1: Measuring the impact of FIUYMI practices.

Pearson correlation coefficients were calculated for each of the three measures to further validate the impact of these behaviours on the self-perception and psychological well-being of the data population. The analysis focused on participants engaging frequently and very frequently in FIUYMI behaviours. By performing a correlation analysis, we can properly identify the strength and direction of these relationships. Measuring correlation clearly indicates that the hypotheses are validated, and entrepreneur's practices affect entrepreneur's identity.

Table 4: Measuring the correlation of FIUYMI behaviour against entrepreneur's well-being.

Measure	Correlation coefficient (r)
Self-Esteem (Rosenberg Scale)	-0,7
Stress (PSS Scale)	+0,6
Anxiety (GAD-7 Scale)	+0,65

6. Discussion and Conclusion

Table 5: Hypothesis validation from the study results

Hypothesis	Results
H1: There is a negative relationship between frequent FIUYMI behaviour and self-esteem among entrepreneurs.	Supported
H2: There is a positive relationship between frequent FIUYMI behaviour and anxiety levels among entrepreneurs.	Supported
H3: There is a positive relationship between frequent FIUYMI behaviour and stress levels among entrepreneurs.	Supported

These findings convey the need for practical interventions on both individuals and ecosystem level. For the individuals, it is about providing entrepreneurs with access to a support system and the right mental health resources. The objective is to mitigate the negative psychological impact of the FIUYMI culture. For the ecosystem, investors, incubators and accelerators should always prioritize transparency and authenticity as core values to promote open communication about the challenges of entrepreneurship. It is also about showing that failure is a possible option and should not be stigmatized. This study has shown that authenticity is essential to

foster an environment where entrepreneurs feel comfortable sharing their genuine progress and setbacks (Cohen, 1983). It is also important to address these issues as this can significantly reduce anxiety and stress among entrepreneurs (Spitzer, 2006).

This study also highlights the specific cultural and contextual factors influencing West African entrepreneurs and contributes to the broader literature on entrepreneurial identity and self-presentation. It provided qualitative and quantitative data to show a nuanced understanding of entrepreneurial behaviour and identity. The need for social validation often drives entrepreneurs to engage in FIUMI practices. Future research can build on these highlights by exploring how interventions aimed at promoting authenticity and mental health can be evaluated and implemented across different entrepreneurial ecosystems.

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From Farm to Fork: Addressing Food Waste in Households

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Abstract: With the rising environmental awareness, the issue of food waste is drawing considerable attention from civil society, scholars, industry practitioners and policymakers alike. Addressing food waste is crucial, as it incurs a variety of social, health, economic and environmental costs, including greenhouse gas emissions, soil degradation and the depletion of natural resources. The objective of this study is to analyze processes in food waste management to gain insight into factors influencing consumer behaviour, attitudes, and practices regarding consumption and food waste and loss prevention in the supply chain. This requires the analysis of decision making methods and waste reduction strategies and approaches, particularly for households. The goal is to emphasize the importance of raising consumer awareness and sense of individual responsibility, especially given the recent surge in collective community intentions to live more sustainably. However, translating these intentions into tangible actions is uncertain and filled with socio-economic complexities. Reports indicate that, households are responsible for approximately half of all food waste generated. Therefore, it's important to review the literature on barriers and triggers related to behaviour patterns and variations in food related lifestyle dimensions, to determine the factors that might influence food handling and food waste knowledge. Targeting households presents a promising starting point for future interventions, highlighting actions that may influence the current food consumption model to reduce the amount of food wasted. The methodological approach was structured into three steps. First, a literature review was conducted to gather insights and identify factors and interconnections between consumer behaviour and food waste. Second, related drivers and triggers were analysed. Lastly, the findings were summarized to highlight gaps and opportunities for improving attitudes towards food waste prevention.

Keywords: Consumer behaviour, Food waste, Sustainable consumption, EU Green Deal, Farm to Fork

1. Introduction

Integrating sustainable food management practices, including minimizing food waste requires a multidisciplinary and collaborative approach (Kim et al., 2019; Schanes et al., 2018; Simões et al., 2022). Targeted policies across the agri-food sector and adequate governance are essential to address the systemic nature of food waste and loss related challenges (EU, 2020). Complementary to policy initiatives, enforcing existing legislation and regulation tools, as those prescribed by the EU Green Deal of Innovation and the Farm to Fork. These policies are designed to manage human and animal welfare, and protect the planet while promoting the adoptionof green innovation strategies in support of sustainable long-term growth (Adamowicz, 2022). According to Siedschlag et al. (2022) targeted policy measures work to incentivize small and medium sized enterprises (SMEs) and, ultimately benefits end-users.

The EU recognizes that a transition to a more sustainable food system reshapes the economic landscape, thus the interaction patterns between food producers and consumers are underpinned by the Commission's regulatory system (EU, 2020). That is due to food production, processing, distribution and disposal being large contributors to greenhouse gas emissions, overexploitation of environmental resources (Canali et al., 2017; Cheng et al., 2023); ecosystem degradation (Birner, 2018; Štreimikienė et al., 2022) and biodiversity loss(EU, 2019). In response, the EU provides technical and financial assistance through existing instruments such as the European Agricultural Fund for Rural Development (EAFRT), EIT Food and European Interreg Projects among others, offering funding programs with national and regional reach.

As outlined in the Green Deal strategy, the EU's commitment to innovation is closely intertwined with its ambition to achieve climate neutrality by 2050 (EU, 2021; Kowalska et al., 2022). They drive change and mitigate risks while actively engaging citizens in fostering social innovation (Kowalska et al., 2022); and promote economic modernization guided by the SDGs framework (Birner, 2018). To support these transitions and transformations, the EU's strategy incorporates regular impact assessments. These assessments, informed by public consultations and the evaluation of environmental, social and economic impacts, analyze the effects on innovation and ensure that policy decisions are in alignment with the EU's goals (EU, 2020). This framework promotes policy coherence, embedding circular economy principles and outlining sustainable responsibilities and action across all food-related policies, to ensure resilience in the food supply chain (Chiaraluce et al., 2023; EU, 2020). It aims to establish sustainable standards the norm for food products in the EU market, benefiting both operators and consumers alike. For instance, this framework supports the integration of sustainable practices in the food industry through certifications and labelling(EU, 2020). These mechanisms aim to ensure vertical and horizontal policy integration in a "multilevel reinforcement" (Kreienkamp et al., 2022, p. 734) of best practices and coordination between industry

actors – consumers, producers, processors and policymakers (Sgroi & Marino, 2022), while creating feedback mechanisms within an interdisciplinary governance system (Conti et al., 2021; Oliver et al., 2018)

Active participation and collaboration among all stakeholders in the food supply chain is highly desirable (Fami et al., 2019) for promoting food waste reduction behaviours and consumption of environmentally-friendly food products (Secondi et al., 2015). It requires engaging with a broad range of partners, including farmers, food manufacturers, retailers, local authorities, community groups, and individuals (Secondi et al., 2015). Developing information sharing networks and creating partnerships are key to promoting behaviours to reduce food waste and facilitate the adoption of best practices at the individual and contextual levels (Secondi et al., 2015). Additionally, increasing consumer awareness of sustainable food consumption is vital (Canto et al., 2021).

2. Theoretical Insights into Food Waste and Consumer Behaviour

This section explores the characteristics of consumer behaviour and attitudes related to food waste, consumption decisions, and their role in accelerating the transition towards a sustainable food systems (Bedeau et al., 2021).

2.1 Food Waste

With the global population expected to grow from 8 billion to 9.7 billion by 2050, and 10.4 billion in 2100 (UN, 2022), policymakers worldwide are developing strategies in anticipation of predictable challenges, to ensure the integrity of social sustainable development (Bartelings & Philippidis, 2024). The United Nations's Sustainable Development Goals (SDGs) for 2030 provides a roadmap for sustainable progress, with the food system playing a key role (WHO, 2024). The UN is faced with a dual challenge, of feeding half a billion undernourished people while improving the diets of 2.8 billion overweight and obese adult individuals, as well as, millions of children and adolescents (WHO, 2024). Malnutrition in various forms, and diet related diseases remain a global cause of mortality, consequently, maintaining a sustainable food system is vital in this transformation from a human health perspective (Bartelings & Philippidis, 2024; Lindgren et al., 2018). Yet, access to nutritious food must not be at the expense of environmental, economic and social issues (Lindgren et al., 2018)

Meanwhile, the food system is responsible for approximately 30% of greenhouse gas emissions driving biodiversity losses (EC, 2021). It is estimated that as much as 40% of food produced is wasted or lost along the supply chain (WWF, 2021). Based on this evidence, the UN Sustainable Development Goal 12.3 targets a 50% reduction in per capita global food waste at the retail and consumer levels, along with minimizing food losses through production and supply chains caused by inefficiencies by 2030. According to Gustavsson et al. (2011, p. 1) and Thompson et al. (2020) "one third of all food produced globally is lost or wasted" amounting to 1.3 billion tons of food wasted annually. Yet, the FAO et al. (2023) estimate that approximately 8,9% (783 million) of the world's population suffered from hunger, while 2.4 billion people faced moderate or severe food insecurity in 2022, with 2.4 billion lacking regular access to sufficient and nutritious food (SDG indicator 2.1.2). On average, European consumers discard 123 kgs of food annually (Barone et al., 2019; Kunszabó et al., 2022) estimated at 88 million tonnes per year (EU, 2018). These percentages underscore the magnitude of this problem and its implications for resource utilization and environmental sustainability (Barone et al., 2019).

Thus EU policy roadmap for a more sustainable food system (EU, 2020), aims to achieve several goals including, "medium-term behavioural adjustments in consumption patterns" leading to social and economic impact (Bartelings & Philippidis, 2024, p. 568). It anticipates that household savings resulting from reductions in food waste can be spent elsewhere, either by purchasing the same food products (direct effect) or on other goods and services (indirect effect) (Bartelings & Philippidis, 2024). This phenomenon, known as the "rebound effect" (Albizzati et al., 2022; Bartelings & Philippidis, 2024), influences circular efforts, especially in terms of waste collection, resulting in financial benefits for businesses and consumers while having a positive impact on the environment (Aktas et al., 2018). Based on these insights, the importance of the bioeconomy cannot be underestimated (EU, 2012).

To achieve it's targets, the EU has implemented legislation mandating member states adopt methodologies for measuring food waste, as well as, introduce food waste prevention programs, in order to monitor and report food waste levels (EU, 2018). As stakeholders in the agri-food sector search for new product solutions and applications, the integration of well designed food policy interventions and recommendations for sustainable food consumption becomes fundamental (Falasconi et al., 2019; Mokrane et al., 2023). They underscore the importance of sustainable food management practices from the farm to the table, food waste reduction initiatives, and underscore the need for the implementation of preventative measures, thereby strengthening networks in food waste management (Mokrane et al., 2023). The food system affects the pillars of the sustainable development environment, economic and social goals (Aktas et al., 2018; Aureli et al., 2021; Fiore et al., 2017). In wealthier countries such as EU member states, households are a target group, partly because, according to Gustavsson et al. (2011) households generate

the largest volume of food waste compared to other actors in the food supply chain (Beretta et al., 2017; FAO et al., 2023).

2.2 Consumer Behaviour

From the Theory of Planned Behaviour (TPB) perspective, household food waste is examined alongside behavioural patterns in the context of social and psychological determinants over time (Ajzen, 2015; Thompson et al., 2020). This theoretical lens offers useful insights by exploring how perceived behavioural control (PBC), attitude, and social norms influence waste generation (Thompson et al., 2020). The TPB by (Ajzen, 2015) proposes that the decision process is the result of an intentional action to perform a specific behaviour. It is shaped by attitudes, norms and beliefs relevant to that behaviour (Ajzen, 2015). While, Quested et al. (2013) and Block et al. (2016) argue that food waste arises as the result of multiple interconnected behaviour variables. Other studies have empirically examined socio-demographic behaviour drivers and values, which include concern for the environment (Diaz-Ruiz et al., 2018; Setti et al., 2016); and concluded that consumers often face conflicting motivations that impact their efforts to reduce household food waste (Setti et al., 2016). To this effect, Setti et al. (2016, p. 694) state that food choices are rooted in "judgements, such as emotions, habits, and values, thus raising the cognitive dissonance between motivation and behaviour (intention-behaviour gap)" .

From an economic perspective, Pocol et al. (2023) identified five consumer groups based on waste behaviour, namely conservative, self-indulgent, indifferent, consumerist, and eco-responsible; while Di Talia et al. (2019) examined household income levels to categorize consumer types, classifying them into three groups: unaware, unaware but not wasteful and aware. Within socio-demographic and economic aspects, other factors to be taken into consideration are geographical aspects, food prices, typical purchasing habits and cultural influences (Aureli et al., 2021). Understanding and addressing food waste at the household level, involves recognizing its association with diverse behavioural aspects, such as, with social, norms, culture, demographics, family structure, among many other factors, that influence and drive change in consumer habits. Thus, identifying and comprehending these behavours is essential for effective strategies aimed at preventing food waste generation (Abeliotis et al., 2016). It is specially critical to encourage shifts in consumer behaviour for preventing food waste and loss across various stages of the supply chain.

To reduce the impact of their effect, the literature suggests that specific behaviours contribute to consumer food waste including buying or preparing too much food, incorrect storage methods, confusion over "best before" and "use by date" dates, lack of planning, impulse buying and lifestyle (Muresan, Harun, Andreica, et al., 2022). Marketing strategies, in combination with a lack of education and information about products, can inadvertently encourage food waste, even when items are still suitable for consumption (Muriana, 2017). This is often cause by labels like "use by date" or "sell by date" (Muriana, 2017) or the appearance of food (Chinie et al., 2021). Addressing these issues by improving consumer awareness and reducing biases related to food aesthetics or expiry dates could better align consumer choices with their intentions (de Visser-Amundson et al., 2023). This approach can significantly impact food waste management, as products often deemed waste due to visible imperfections or near expiry dates may still have inherent value (de Visser-Amundson et al., 2023). The complexity of food choices is further influenced by factors such as health concerns, taste preferences, budget, household structure, and cultural atittudes (Muresan, Harun, Brata, et al., 2022).

3. Methodology

This qualitative research study synthetizes existing literature to explore how consumer behaviour, attitudes and practices influence food waste and loss prevention at the household level. The analysis involved a thematic data extracted from scholarly articles, reports and other relevant sources. The key objective included identifying effective behaviour related and causes of food waste, food management strategies, and barriers and triggers to their implementation. The study aims to highlight insights that can inform policies and interventions to promote sustainable practices in food consumption and waste reduction.

To explore the interconnection between consumer behaviour and food waste, VOSviewer (van Eck & Waltman, 2014) was applied to perform a bibliometric analysis to examine the literature. SCOPUS and Web of Science (WoS) databases were used to select the articles following a search criteria that included the following keyword combination: "food waste" AND "consumer behaviour" OR "consumer behavior" AND "soci*" (for societal factors) (Figure 2). Limitations were set to peer reviewed journal articles; language: english; country: European countries; and discipline. Subsequently, Nvivo was used to code the articles in order to identify, and categorize interconnecting themes. VOSviewer identified distinct topics and perspectives on the subject by keyword search. The keyword examination revealed three clusters (figure 1 – green, red, blue). Words such as food waste, consumer behaviour,

consumer attitude, are some of the words that stand out to characterise this topic. The result indicates connections between the term “food waste” to “consumer behaviour” while at the same time illustrates the relationship between key subtopics.

The methodology was designed to address the following key question and subquestions (Bedeau et al., 2021):

- Q: 1. How do consumer behaviour, attitudes and practices impact food waste and loss prevention, particularly at the household level? 1.a) What methods and societal practices in food management for reducing waste exist? What are the triggers and barriers? 1.b) How can communication strategies be optimized into tangible actions to raise consumer awareness? Can policy measures and community engagement alone help?

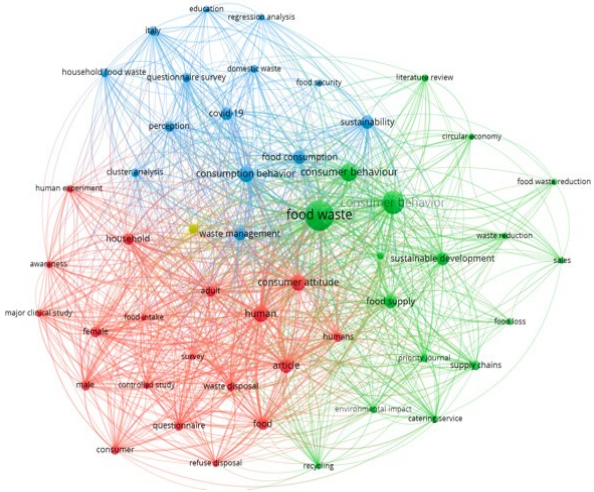


Figure 1: Keyword examination

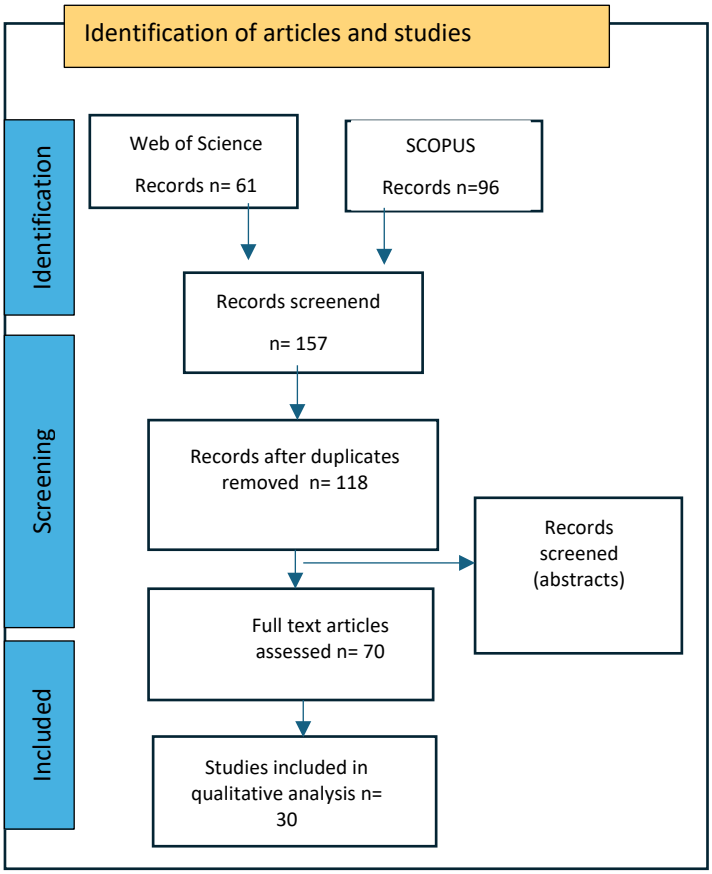


Figure 2: Identification of articles and studies

4. Findings and Discussion

This study highlights the need to primarily synthesize existing literature in order to design consumer behaviour strategies that are tailored to households. The goal was to gain a deeper understanding in the interplay between consumer behaviour, attitudes, and practices; and emphasize the role of mechanisms, refered to as “enablers” (Bedeau et al., 2021) in facilitating effective solutions. Where sustainable food consumpion is concerned, attitudes towards how food is handled vary depending on the unique characteristics and contexts between countries and communities. Thus, to effectively tap into their transformative potential, it is important to take local knowledge and practices in to account, and how these relate to food consumption, food waste potential (Bedeau et al., 2021) and preventative solutions.

The literature clearly shows a direct connection between food waste and socio-psychological factors , and it identifies the drivers and barriers that influence sustainable consumption (Özkaya et al., 2021) such as financial capacity, planning habits, attitudes, motivation, and family structure (Aktas et al., 2018). Motivation factors include “nutrition, health, consciousness, social identity, concern for farmers, ethical concerns, food security, perceived availability, store reputation, and animal welfare concerns among the factors that influence” (Özkaya et al., 2021, p. 5). Recently, a key motivator has become the preference for purchasing and consuming sustainable produce ie organic. Consumer food waste levels are also impacted by lifestyle factors including cooking practices, meal planning habits, price sentisitivity, social aspects of meals, and concerns about food safety (Aschemann-Witzel et al., 2018). Conversely, barriers to reducing food waste include “high prices, time limit, access, lack of information, trust in labelling, limited marketing communication and unawareness of environmental impact” (Özkaya et al., 2021, p. 5).

To address these challenges, Aschemann-Witzel et al. (2018) advocate targeted marketing strategies and policies designed aimed at specific consumer groups to reduce reduce food waste effectively. Their analysis reveals the role and importance of communication in shaping consumer perceptions of upcycled foods, raising consumer awareness, and encouraging sustainable consumption habits. Key interventions to boost awareness include product labelling, social media, educational programs, community campaigns and all types of print (Morone & Imbert, 2020).

Additionally, research by Amicarelli et al. (2022), Ankiel and Samotyja (2020), Aschemann-Witzel et al. (2020) and Falasconi et al. (2019) indicate that consumers often have low perception and lack awareness about the extent of food waste and its impact, a major barrier in sustainability efforts.

As the urgency to shift towards a circular economy and the demand for sustainable food systems intensifies, scholars illustrate the potential for converting food resources that would go to waste into products with value that can drive consumer demand (de Visser-Amundson et al., 2023). They further suggest that a higher degree of product transformation can attract consumers, with product design shaping consumer preferences. Achieving this requires innovation across the production value chain (BMZ, 2021; de Visser-Amundson et al., 2023; EU, 2018). To that effect, the EU promotes initiatives such as food donations, alternative uses in animal feed and applications in fashion, construction and energy. It is also funding projects like the Interreg CEFoodCycle Project (EU, 2022) to cut food waste and CO2 emissions. Overall, valuable insights are presented into how individual characteristics impact consumption behaviour (Cela et al., 2024).

5. Conclusion

Addressing food waste and behaviours associated with efforts towards prevention habits is a priority topic on the agenda of policymakers and society in general. Implementing practices to reduce food waste and loss holds potential to reshape the food system from the farm to the table (Castillo-Díaz et al., 2023; EU, 2012). Consequently, a thorough understanding of consumer behaviour, in particular household typology, is essential in order to develop measures that can bring about lasting improvement (Abeliotis et al., 2016). Despite the potential benefits, the uptake of waste prevention practices continues to be a challenge due to consumer perception.

Food waste management is increasingly prioritized in waste management strategies (Abeliotis et al., 2016), thus, understanding the characteristic of food waste behaviours, aids with prevention campaigns, identifying target groups, determining appropriate engagement channels, and the design of communications materials (Abeliotis et al., 2016). This approach requires a systemic and transdisciplinary collaborative approach, along with increased consumer awareness, skills and competencies to drive the transformation process (Canto et al., 2021; Stirnimann & Zizka, 2022). To effectively implement these strategies, the role of the university, as a key ecosystem player, becomes pivotal in bridging the gap between awareness, responsibility and action. This research explores how universities can fulfill this role by developing tailored educational programs and community campaigns that impart

critical knowledge about food waste, and empowers individuals with the skills and competencies necessary to engage in sustainable practices.

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Innovative Frontiers: Exploring Factors Influencing Travel Podcast Consumption in the Web 4.0 Era

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Abstract: With the advent of Web 4.0, society is evolving online in every aspect. The online media platform and user-generated content have given a new face to people's interactions and communication, with the evolution of new media platforms and the changing consumption patterns of user-generated content. They have also become a new way of earning a livelihood for many. Among the various media influencers and business entrepreneurs' podcasts as a platform have proliferated in recent years, with millions of people listening to travel podcasts. This study aims to explore the unresearched terrain of travel podcast listening via exploring the consumption factors of travel podcasts and provide valuable insights for the travel podcast creators and, and destination stakeholders. besides this paper is of the interest to the various researchers of the multiple domain like audio media, content, marketing, and tourism. The study involved a systematic literature review followed by a Delphi survey. A total of eleven factors are shortlisted via Delphi analysis as the prominent influencers of travel podcast listening. Authentic content and subjective norms are added as new factors to the existing list of literature, and a few factors are discarded based on the expert's viewpoints, e.g., fashion. The study unfolded various practical, conceptual, and managerial implications for tourist destination marketing managers, DMOs, and various stakeholders (the government and host community) in the tourism industry.

Keywords: Travel innovation, Audio travel podcast, Listening motivations, Web 4.0, Delphi survey

1. Introduction

In the contemporary media landscape, Content marketing has undeniably carved a significant niche in modern marketing strategies, exemplified by successful campaigns like Volvo Penta's Adventurous Campaign (Kim Moutsos, 2023) and its subsequent brand success (Schivinski and Dabrowski, 2016). In the Web 4.0 and IoT era, content creation has become not only a viable source of income but also a full-time profession, with the global podcasting market reaching $23.56 billion in 2023 and projected to grow at a CAGR of 27.6% from 2023 to 2030 (Rohit Shewale, 2024), offering promising opportunities for aspiring entrepreneurs.

In industries like travel and leisure, content creation plays a pivotal role in attracting potential customers (Cunha Ferreira et al., 2023). As in travel, the importance of experiencing the product beforehand cannot be overstated in stimulating interest in destinations (Chen et al., 2014). Social media, blogs, YouTube vlogs, and emerging technologies like virtual reality and the metaverse are increasingly instrumental in drawing tourists, highlighting the integration of communication and marketing strategies (García-Haro et al., 2021).

Likewise, Podcasts have emerged as a powerful medium for content distribution in the travel industry, capturing the attention of a growing audience globally. Global podcast listeners reached 4,464.7 million in 2023, reflecting a significant annual increase (Daniel Ruby, 2023). Despite its popularity, the "Travel Podcast" genre remains relatively unexplored in the existing literature, prompting this study to delve into travel podcast consumption patterns and audience engagement. While podcast creation has become more accessible, captivating listeners remains challenging (Jesse Noyes, 2014). Thus, this study aims to identify the factors influencing travel podcast consumption and provide insights for creators to expand their audience and target specific markets, utilizing the Delphi survey methodology preceded via a systematic literature review.

2. Literature Review and Research Background

2.1 Podcasting, Social Media, and User-Generated Content Creation

"Podcasting," a portmanteau of "iPod" and "broadcast," represents a significant shift in online radio. Podcasts are It is defined as a form of digital media, usually audio like a radio program that can be downloaded and listened to on MP3 players, computers, or smartphones. podcasts are disseminated across streaming platforms like Spotify, Apple Podcasts, SoundCloud, and others on the internet. They typically follow a series format with episodes released periodically and cover a wide range of topics, from news and education to entertainment and storytelling.

While content creation predominantly occurs on social media (García-Haro et al., 2021): user-generated content, devoid of bias, has gained notable credibility. Social media marketing, mainly influencer marketing, is a potent tool for brand awareness and education (Lou and Yuan, 2019; Robert Rose, 2023).

In parallel, podcasting emerges as both an art and a lucrative business venture (Martin Spinelli and Lance Dann, 2019). With top podcasts like 'The Joe Rogan Experience' grossing $30 million in 2019 (Statista, 2021) and the US podcast revenue nearing $1 billion in 2020, podcasting is financially rewarding. This dynamic landscape attracts premier talent, fuelling economic growth and innovation (Giliberti, 2016).

Moreover, amid the COVID era, the significance of content marketing has evolved, as indicated by the Content Marketing Institute (CMI) report. While 45% of organizations' key audiences consume videos, there is a notable openness to alternative content formats (Robert Rose, 2023). Despite the demand for content marketing, organizations struggle to identify subject experts, highlighting the need for research and strategic insights.

In this context, exploring podcasts within the travel domain promises valuable insights into user-generated audio content and consumption patterns. This study aims to illuminate how organizations, entrepreneurs, and influencers can leverage podcasts to craft compelling content marketing strategies, addressing a crucial gap in contemporary marketing practices.

2.2 Travel Podcast

The past literature has identified different factors affecting the wish of the user to adopt the podcasts, such as usability, image, relative advantage, situational factors, lower levels of complexity, and functionality (Chang et al., 2012). They emphasized the importance of adopting podcasts in digital tourism.

Travel with Rick Steves, 'Musafir Stories', 'Indie Travel Pod', and 'Travel with RV Show' are popular travel podcasts already exploiting the podcast's capabilities. Referred to as 'audio travel podcasts' or 'travel podcasts' (Lee et al., 2017), these programs entail individuals (travellers, hosts, guests) sharing their travel narratives and original travel experiences and dispensing information through downloadable recordings on various platforms.

According to a study conducted in the United States, the primary motivations for engaging with podcasts were identified as entertainment, information, and the perceived superiority of audio platforms (Chan-Olmsted and Wang, 2020). The primary factors identified in the context of true crime podcast consumption were convenience, boredom, escape, voyeurism, and amusement (Boling and Hull, 2018). Previous studies have examined the underlying factors that drive individuals to engage in podcast consumption as a whole (Chan-Olmsted and Wang, 2020). However, there needs to be more literature regarding the motivations behind listening to travel-related podcasts despite research on other genres, such as true crime amusement (Boling and Hull, 2018), entertainment, and comedy. Notably, Xie and Lew (2008) stand out as an exception in exploring the realm of travel podcasts.

Apart from the listener's perceptions, the podcast has been explored during travel as a tour assistant for the on-side tours at national parks, museums, and historical and cultural sites. A few studies have already explored the effect of these narratives on innate intentions. However, there still needs to be a lag between the in-depth understanding of this emerging social media phenomenon among the study domains of travel, audio media and marketing. Despite its potential for influencing the audience through narratives and storytelling and its use in the advertising and branding world, podcasts have yet to be a focus of inquiry for many researchers. Considering its importance and dearth in the literature, it might be helpful for marketers to have insights into this emerging phenomenon. The present study will act as a founding study that provides insights into the podcasting world of travel and tourism and will explore this abundance of listeners and the constant increase in listenership.

Table 1: Motivations for Travel podcast listening

Motivations for Travel podcast listening		
S.N	**Motivations**	**References**
1	Arousal	Boling and Hull (2018); Chung and Kim (2015); Rubin (1977)
2	Entertainment	Chan and Wang (2020);

Motivations for Travel podcast listening		
S.N	**Motivations**	**References**
3	Companion/connection/ Social	Chou et al. (2022); Chung and Kim (2015);Chan-Olmsted and Wang (2020); Papacharissi and Mendelson (2007);
4	Convenience/Mobility/Multi-tasking/time-shifting/Customizable experience	Chung and Kim (2015); Papacharissi and Rubin (2000)
5	Educational	Chung and Kim (2015); Vitis and Ryan (2021)
6	Fashion	Chung and Kim (2015)
7	Hobby	Boling and Hull (2018)
8	Habit	Boling and Hull (2018); Chung and Kim (2015)
9	Curiosity- interest	Tobin and Guasagno (2022)
10	Escape/Relaxation	Boling and Hull (2018); Chung and Kim (2015)
11	Information	Khan (2016); Rubin (1983); Suyu Chou, et al. (2022)
12	Digital collection/ Library building *(Removed in second round)*	McClung and Jhonson (2010)
13	Story telling transportation /Participation/engagement	Chung and Kim 2015; Perks et al. (2019)
14	Personal Identification *(Removed in second round)*	Sylvia and Wang (2020)
15	Podcast perceived affinity	Chung and Kim 2015
16	Communal identification/belongingness	Sylvia and Wang (2020)
17	Podcast perceived realism	Chung and Kim (2015)
18	Perceived travel risk/ Travel anxiety	Vitis Ryan (2021); Expert
19	WOM *(Added in second round)*	Expert
20	Content *(Added in second round)*	Expert
21	Subjective norm *(Added in second round)*	Expert

3. Research Methodology

3.1 Delphi Survey in Tourism

The Delphi technique is one of the most widely accepted qualitative (Gupta and Clarke, 1996) and structured approaches for group studies (Rowe and Wright, 2001). Ng (1984) described it as an informed prediction using the expert's opinions once a consensus is reached among the panel of experts. Among the four forecasting techniques mentioned by (Lin and Song, 2015), the Delphi technique is found to be one of the most popular judgemental forecasting techniques used in tourism studies. Hence utilised for the present study.

The present study is conducted in two phases. The *first phase*, from prior literature, extracted many aspects of the reasons for various audio media listening (such as podcasts, radio, online music, etc.). In the *second phase*, these factors were refined and ranked using Lawshe's content validity ratio in two sequential rounds utilising the Delphi technique.

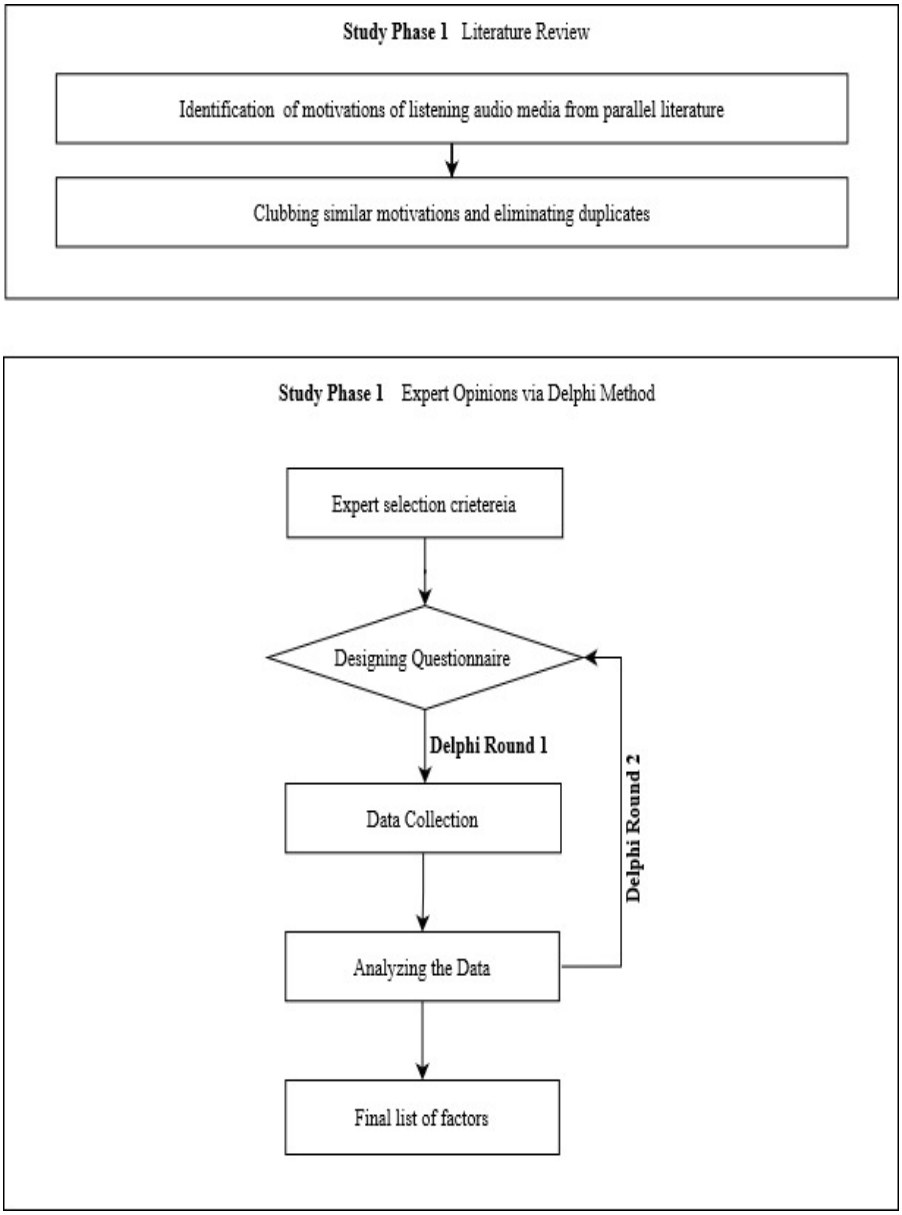


Figure 1: Design of research methodology

3.2 Study Phase 1

In the study's *first phase*, various factors that motivate listening to different audio media (like podcasts, radio, online music, etc.) are extracted from previous literature, and an exhaustive list of variables is created. Afterwards, this list is analysed carefully by the researcher, and a few variables that fit the study's objective are shortlisted in Table 1.

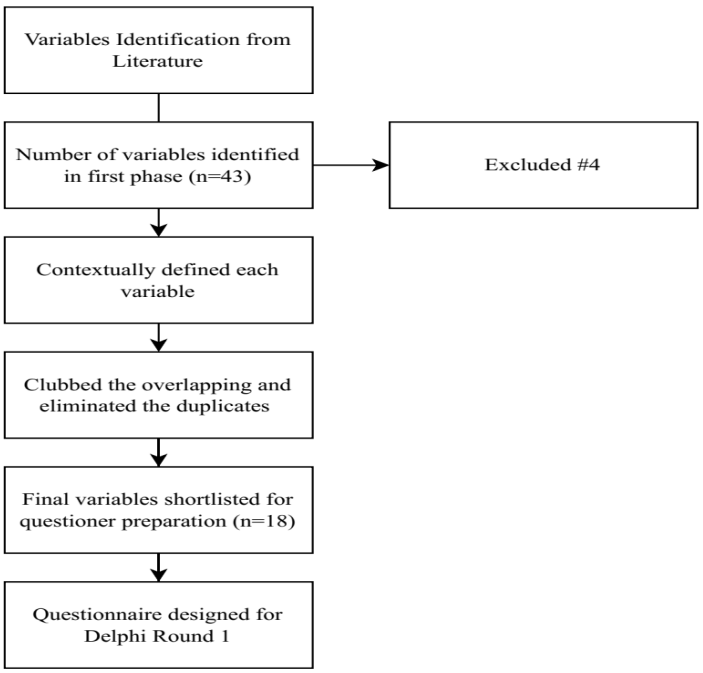


Figure 2: Study Phase 1, Literature review steps

3.3 Study Phase 2

The *study's second phase* is designed considering the limitations and advantages of the Delphi technique. The choice of criteria for this study is mentioned in Table 2. The experts have asked about their opinions on the relevance of these selected factors to the context of the present study in two sequential rounds. These factors are then rated based on their importance.

Table 2: Choice criteria for the study

Criteria Choice for Identifying the motivations and inhibitors of travel podcast listening study	
Purpose of the study	Exploring and shortlisting the factors of podcast listening
Number of rounds	Two
Experts	Heterogeneous group
Mode of operation	Remote
Anonymity of panel	Full
Communication media	Via e- mail and over call.
Concurrency of rounds	Sequential

Adapted from; Day and Bobeva (2005)

4. Data Collection and Analysis

4.1 The Expert Panel

The expert panel consisted of a perfect blend of academic marketing experts who worked in both tourism and non-tourism domains, with previous industry experience and avid podcast listeners. Using the Delphi method, the study utilised non-random sampling to select 15 experts as suggested for social studies (park, 2002). It includes purposive and snowball sampling to select panels.

Professors and associate professors with a keen interest in tourist behaviours, destination marketing, and branding from the top institutions of India spread over four corners, including Tourism Business Management schools and other management schools in general, were approached. To add a technological viewpoint, the academicians who had research interests in technological advancements in tourism were approached. In

addition, experts from a non-tourism background working in marketing and consumer behaviour were also included in the panel to have a perspective apart from tourism. A few avid podcast listeners are also part of the sample to make the survey more insightful from the listeners' perspective. In order to touch upon every aspect of the study, the researcher has included experts from all related domains to maintain the heterogeneity of the panel. For anonymity, all individuals were contacted through emails and phone; no experts knew each other. Among many contacted experts, a few showed interest in participating in the survey. Table 3 includes the final panel list and their respective designations.

Table 3: Expert panel composition

Academicians				**Total**
Domain and Designation	**Tourism Marketing and Management**		**Marketing and consumer behaviour**	
	Non-tech.	**Tech.**		
Professor	4	-	0	4
Associate professor	2	1	1	4
Assistant professor	1	2	1	4
Avid Listeners	-	-	-	3
Total experts				15

4.2 Delphi Round 1: Gathering and Analysing the Data

4.2.1 Delphi Round 1 Results

The objective of round one was a) to confirm whether the identified motivators from the literature appeared to be relevant or not and b) to get the new motivators and inhibitors of podcast listening that might be missing in the literature. Hence, in the first round of the Delphi survey, experts were presented with the questionnaire in Excel format, listing all the possible motivators of podcast listening along with their contextualised definitions. They were asked about the listed motivator and whether it should be included in the further course/phase of our study or not (for reference, the experts we provided with the travel podcast link in the description mail, which described the objective of our study and instructions to respond for questions). After analysing the frequency of disagreement, we found that digital collection and personal identification received the least, yes, i.e. 2 and 1, respectively. Hence, the author dropped these two variables in this phase.

To fulfil the second objective of this round, the subsequent section of the questionnaire was presented with open-ended questions to seek new possible motivators and inhibitors for travel podcast listening. The questions are as follows:

- What other possible motivators of travel podcast listening must be included in the study but are missing in these listed factors?
- What possible inhibitors of travel podcast listening must be included in the study?

Examples of travel podcast inhibitors also followed the second question to make it more transparent to the experts. No significant inhibitors of travel podcast listening were identified earlier in the literature; only some reports mentioned them in the form of paid subscriptions and advertisements (Spotify, 2022). Hence, we cited both examples and inquired about the travel podcast inhibitors except these.

To bring more confidence to the study and the suggestions from experts, not only were the experts asked about listing new factors, but they were also asked to give sufficient justification for considering their suggestions.

After collecting all the responses from experts, the analysis of the qualitative section of the questionnaire was conducted, and it was found that the answers to the questions were diverse; few of them were in the form of lists (only the new factor name), and few were in comments with elaborative descriptions. As the comments were comparatively few, the researcher analysed the comments and suggestions manually. To analyse these comments, the author followed a systematic thematic analysis approach as suggested by Braun and Clarke (2012). Thematic analysis followed due to its wide range of applications and its flexibility in a qualitative analytic approach. Thematic analysis applies to almost all types of qualitative research questions and designs

and, hence, to our study as well (Clarke and Braun, 2017). See Tables 4 and 5 for more detailed descriptions of the thematic analysis.

4.2.2 Delphi Round 1 Results

Based on the thematic analysis, we identified WOM (Word of Mouth) and subjective norm as new possible motivators for listening to travel podcasts. Traditionally, WOM is defined as face-to-face communication; however, nowadays, it has taken the new form of e-WoM (Electronic Word of Mouth). E-WOM is a consumer-to-consumer communication through blogs, vlogs, and websites where the consumers do not necessarily know each other. The present study considers both types of WOM, traditional as well as E- WOM.

Subjective norm appeared as a new motivator is defined as "a person's perception that most people who are important to him think he should or should not perform the behaviour in question" (Addison-Wesley, Reading, MA (1975).

From thematic analysis, other factors were identified as the inhibitors, like past performance and physical accessibility. Physical accessibility being a duplicate of convenience (previously on the list) and prior experience being less frequent did not emerge as a new theme. Further, the content of the travel podcast emerged as a possible inhibitor to listening. The content quality, its type, the authenticity of the information, diverse interests related to travel, podcast episodes in different languages, etc., reflected the possibility that a listener might not be interested in listening to travel podcasts due to these characteristics of podcast content, hence we consider it under an umbrella term 'content'. Other inhibitors like 'addiction' appeared, but due to less frequency of occurrence, those dropped.

Hence, three main themes emerged as the most talked about.

- WOM
- Subjective norm
- Content

Table 4: Coded comments illustration

Respondent	Comment	Comment coded as
R2: For the motivators	Suggestions to listen to a podcast by a close friend	WoM, Social Influence or Subjective Norms
R4: For the inhibitors	Besides a couple of inhibitors mentioned above, the major inhibitors are: the nature of information, authenticity of the facts and figures on a tourist's destination that are shared to tourists. Nature and typology of tourist interviewed; to know the experiences, what they had experienced during their sojourn to a specific tourist destination. What nature of coverage the podcast had made of the local community to know their customs and rituals and which were the tourist places where the operators of Podcast had made the coverage of tourist. Moreover, were the contents have been thoroughly vetted before getting them circulated. Further, what percent of content are understood by the foreign tourist and a tourist not know the language delivered through the podcast.	Nature of information, Authenticity of the facts and figures, Language barrier, Nature and typology of tourist's interviewed, Content quality
R7: For the inhibitors	Quality of content- drab and lack lustre, content not up to the mark may reduce listeners' interest and they skip episodes/sessions or negate channels all together.	Content Quality, Availability of better options.

Table 5: The frequency of occurring identified codes and their interlinkages; Changing Codes to themes

Respondent	The possible new motivator for podcast listening	Appearing Frequency	Final theme/ Construct
R2, R4	WoM, hearsay	2	WOM and Subjective norm
R3,R2	Social Influence	2	
R4,R7	Subjective norm	2	
R4	Physical Accessibility	1	
R4	Past experiences	1	

Respondent	Possible new inhibitors	Appearing Frequency	Final theme/ Construct
R1,R4	Unrelated content	2	Content
R3,R7	Unavailability of Content	2	
R3,R7	Quality of Content	2	
R4	Authenticity of the facts and figures	1	
R4	Language barrier	1	
R4	Nature and typology of tourist's interviewed	1	
R10	Addiction	1	
R3	Unpopularity		

4.3 Delphi Round 2: Gathering and Analysing the Data

In the second round of Delphi, we modified the questionnaire for Delphi round 1; we removed digital collection and personal identification, and new inhibitors were added. The modified questionnaire is then presented to the experts to rate the given factors based on their importance on a five-point rating scale, from least important to most important.

After collecting the data, the data was recorded against each factor of every respondent in Excel format. This round's data is analysed using Lawshe's Content validity Ratio (Lawshe, 1975).

The Critical value of 0.66 for Lawshe's CVR for accepting and rejecting the possible listening motivations obtained concerning the panellist's count (i.e. 15) for each factor. (Critical Values for Lawshe's Content Validity Ratio).

Calculating Content Validity Ratio (CVR):

Content Validity Ratio (CVR) = (ne- N/2) / N/2

ne= is the essential score

N= total number of experts

According to Lawshe, there are three types of values/scores in the rating scale. The top 2 values or parameters are essential, the middle is useful but not essential, and the last one is not necessary. In the context of our study, extremely important and very important are equivalent to essentials. Important was considered useful but not important, and somewhat important and least important were assumed as not necessary.

4.3.1 Delphi Round 2 results and discussion

The essential scores of each construct with CVR are presented in Table 6, along with the list of accepted and rejected. Out of 19 factors, eleven were selected through the second round.

Table 6: Essential scores of motivations with CVR and acceptance status

S. N	Podcast listening Motivation	Ne	CVR	Result
1	Curiosity of interest	15	1.00	Accept
2	Arousal	14	0.87	Accept
3	Educational	14	0.87	Accept
4	Subjective norm	14	0.87	Accept
5	WOM	14	0.87	Accept
6	Information	14	0.87	Accept
7	Story telling transportation /Participation/engagement	13	0.73	Accept
8	Content	13	0.73	Accept
9	Podcast perceived realism	13	0.73	Accept

S. N	Podcast listening Motivation	Ne	CVR	Result
10	Perceived travel risk/ Travel anxiety	13	0.73	Accept
11	Entertainment	12	0.60	Accept
12	Convenience /Multi-tasking	10	0.33	Reject
13	Escape/Relaxation	9	0.20	Reject
14	Communal identification/belongingness	9	0.20	Reject
15	Hobby	9	0.20	Reject
16	Podcast perceived affinity	8	0.07	Reject
17	Companion/connection/ Social	8	0.07	Reject
18	Fashion	6	-0.20	Reject
19	Habit	6	-0.20	Reject

5. Discussion

The study has uncovered insights into travel podcast consumption, revealing motivations and barriers perceived by experts and listeners.

The Delphi survey's first round identified WOM and subjective norms as motivators and content as new inhibitors. Subsequently, eleven factors were confirmed in the second round.

Among the identified motivations, factors such as curiosity, arousal, education, subjective norms, word of mouth, and information emerged as crucial drivers influencing travel podcast consumption. Previous research highlights the influential role of WOM and e-WOM in consumer behaviour, fostering credibility and adoption of new products/services. Similarly, subjective norms influence technology adoption and acceptance of innovation.

Conversely, inhibitors such as content quality, perceived risk, and podcast realism hinder listener engagement. Addressing these barriers is crucial for creators to broaden their audience appeal.

Strategies focusing on WOM and community promotion can enhance travel podcast accessibility and popularity. Additionally, prioritizing authentic, quality content tailored to traveller interests can bolster destination attractiveness via podcasts.

Given the convenience of audio media, promoting travel content through streaming platforms proves advantageous. Adapting to Gen Z preferences necessitates destination brands' presence across various media, including local language content, to boost domestic travel and local economies.

6. Research Implications

Theoretically, implications of this study go beyond the specific context and adds nuance to existing theories of consumer behaviour and media consumption by identifying the motivations and inhibitors influencing travel podcast listening.

Incorporating subjective norms and word of mouth into the analysis expands upon established frameworks, such as the Theory of Planned Behaviour and the Diffusion of Innovations theory, which emphasise social influences and interpersonal communication in shaping individual behaviours. Furthermore, recognising content quality and authenticity as critical determinants of listener engagement contributes to ongoing discussions surrounding media credibility and trustworthiness.

Practically, the results of this study demonstrate the potential for destination managers to utilise podcasting as a strategic tool for destination promotion.

The findings underscore the multifaceted nature of audience preferences, encompassing informational, social, and entertainment-driven motives. Authentic content and storytelling in engaging listeners, emphasizing the need for high-quality production and narrative delivery in travel podcasts. In the article 'Should your Company Start a Podcast' Jesse Noyes (2014) in Harvard Business Review noted how difficult it is to create and sustain a good podcast. Centralising the overall destination content through podcasts and other media channels will be

beneficial for the overall marketing and content strategy of the destination and its services. The utilisation of travel podcasts also has the potential to serve as a transformative mechanism for enhancing the image of destinations and promoting sustainability. We further suggest harnessing the potential and expertise of the podcasters by leveraging the exemplary collaboration efforts with them. The insights provided in the study will also hold significant value for anybody aiming to access the expanding market of travel content consumers, particularly Destination Marketing Organisations (DMOs Podcasts have the potential to be an effective tool for brand storytelling and consumer engagement if they are produced with the proper drive, support, and regularity (Jesse Noyes, 2014).

7. Conclusion, Limitations and Future Scope

This study has delved into the relatively uncharted territory of travel podcast consumption, identifying key factors influencing listener engagement and providing valuable insights for content creators and destination marketers. The findings from the Delphi survey highlighted eleven critical motivations for listening to travel podcasts, including curiosity, arousal, education, subjective norms, word of mouth, and information, while also recognizing content quality as a significant inhibitor.

The findings of this research provide important insight into what drives people to listen to travel podcasts, as well as the potential next steps for podcast producers, destination brands, and other stakeholders like destination brands. Integrating WOM and subjective norms into the analysis enriches existing consumer behaviour and media consumption theories, emphasizing the social influences and interpersonal communication in shaping podcast listening habits. These insights underscore the importance of authentic, high-quality content and engaging storytelling in attracting and retaining listeners.

The results underscore the strategic potential of travel podcasts in destination promotion. By leveraging the identified motivations and addressing the inhibitors, destination marketers can enhance the appeal and effectiveness of their podcast content. This study advocates for a comprehensive content strategy that integrates podcasts with other media channels, focusing on authentic narratives and quality production to engage audiences and promote destinations effectively.

While comprehensive, the study has a few limitations that should be acknowledged. The opinions expressed by the experts may not necessarily reflect the views of all podcast enthusiasts. The extension and generalization of this study to the general public should be approached with caution. However, it can be seen as a solid foundation for future research.

Furthermore, the factors considered in this study may only partially capture some of the various motivations behind consuming travel podcasts. For instance, the analysis did not include platform subscriptions and advertisements. Therefore, future research endeavours could explore the intricate psychological aspects associated with podcast consumption. Future research could also explore the intersectionality between travel podcast consumption and destination marketing strategies and employ different variables as predictors to enhance the precision of the findings. Additionally, it would be beneficial to validate the identified factors by conducting multiple measurements to ensure their reliability and consistency.

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Collective Action and Business Competitiveness

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Abstract: This study aims to comprehensively review the extant literature examining the intricate relationship between collective action (CA) strategies employed within industrial contexts and the consequent impact on organizational competitiveness. Utilizing a systematic literature review methodology, this study meticulously identifies and synthesizes the challenges and solutions associated with CA. Additionally, it delineates various factors that influence business competitiveness in relation to collective action strategies. The analysis culminates in the development of a conceptual model that elucidates the dynamic interplay between collective action problems and strategies, alongside key business competitiveness factors. Furthermore, the study highlights the moderating role that governance structures can exert on this relationship. This review stands out in the literature due to its unique focus on the intersection of collective action strategies and organizational competitiveness. It addresses a gap in existing research by providing a comprehensive synthesis of these variables within the context of business environments. The study underscores the imperative for a more profound theoretical exploration of business-related collective action. It suggests a critical examination of the role that existing business associations play in enhancing or impeding the competitiveness of firms. By doing so, it offers valuable insights for practitioners and policymakers aiming to leverage collective action for competitive advantage. The comprehensive analysis offered in this review provides a robust framework for understanding the factors that drive the effectiveness of collective action strategies and their implications for business competitiveness. By identifying the challenges and solutions associated with collective action, as well as the business competitiveness factors influenced by these strategies, this study contributes to a deeper understanding of the field. Additionally, the conceptual model proposed here highlights the crucial role of governance in moderating the relationship between collective action and competitiveness, offering a nuanced perspective that can inform both academic inquiry and practical implementation. Overall, this study provides a valuable foundation for future research and practice, emphasizing the importance of collective action in achieving and sustaining competitive advantage in the business world.

Keywords: Business competitiveness, Collective action, Governance, Innovation, Social capital, strategy

1. Introduction

The theme of CA, triggered by Olson (1965), has received the attention of several authors in different fields of knowledge. Similarly, business competitiveness has been approached from different perspectives, supported by different theoretical approaches, such as industrial economics (Porter, 1980) or resource-based view, RBV (Barney, 1991). However, the relationship between these two fields has yet to be the subject of attention by researchers. In this context, it is relevant to have a deeper understanding of the impact of CA strategies on business competitiveness.

With his seminal work *The Logic of Collective Action*, Olson (1965) established the conceptual foundations for research in the field of problems that emerge from the conflict between individual and collective rationality, seeking to define a general theory that explains the factors that affect CA, focusing on the study of organizations that provide collective goods. A collective good is the result of the action of a group focused on a common objective, for example, ensuring food security. Public goods are all those that observe the characteristics of non-exclusion and non-rivalry, as in the case of defining public policies (Olson, 1965) or the characteristics of an industry that have non-rival application to all companies in a sector (Barnett, 2006). Common-pool resources are characterized by their joint use by a particular group, whose exclusion from their use is problematic, (Ostrom, 1990). This subtraction distinguishes public goods problems from common-pool resources problems.

Organizations that provide collective goods can take on a diverse nature, such as unions, pressure groups, professional orders, various business associations, consortiums, or clubs, and can take on a formal or informal nature (Brito, 2001). To generate collective benefits, organizations generally rely on resources from their members or funds made available by government entities. Problems of CA in these organizations can arise when their members have the option of contributing or not to the generation of collective benefits.

The study of competitiveness has generally been approached at the macro level, which encompasses national, regional, or industry-wide issues (Porter, 1980), and addresses the company's competitiveness from the perspective of the competitive advantages that it can obtain from industry factors in which it operates and, therefore, are external to it; and the micro level perspective that bases the company's competitiveness with a focus on its internal resources, tangible and intangible, the resource-based view (RBV) built from Barney (1991).

2. Methods

A Systematic Literature Review (SLR) is a powerful tool for scientific research (Xiao and Watson, 2019). The literature review protocol guarantees a rigorous, transparent, and repeatable process (Okoli and Sharaban, 2012, Tranfield *et al*., 2003,) and ensures that the advancement of scientific knowledge is adequately supported by existing knowledge. Data analysis combines a bibliometric and a thematic approach (Bahoo *et al*., 2020). Bibliometric analysis is a suitable tool for identifying the most relevant works (Zupic and Cater, 2015) and is vital for analysing relationships and gathering topics from academic articles (Liu, 2017). For bibliometric analysis, one used the VOSViewer v1.6.18 software.

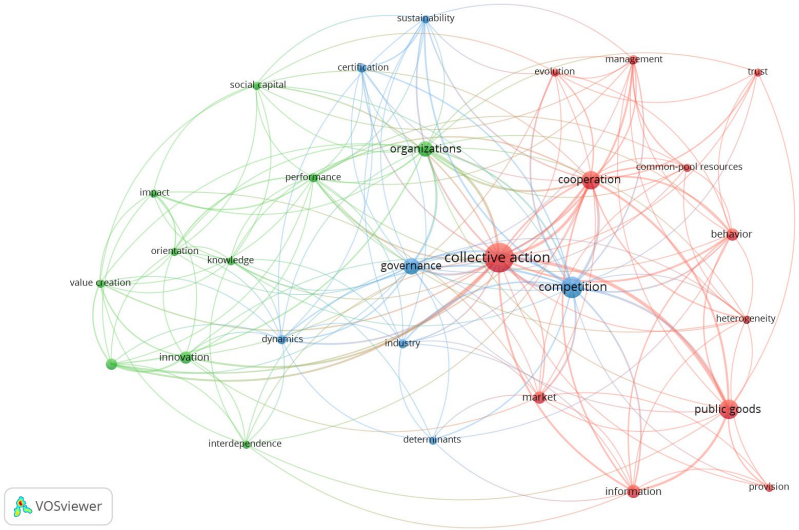
In January 2023, a bibliographical search was carried out in the Web of Science (WoS), a database recommended for systematic literature reviews (Bengtsson and Raza-Ullah, 2016), as the journals included in this database are carefully and rigorously evaluated, which give them adequate scientific validity (Ankrah and Al-Tabbaa, 2015). The following search terms were used: WoS - All fields: "collective action" and competit*. One obtained 832 documents, which were refined by combining ten keywords from each of the two domains, CA and competitiveness (Zuñiga-Collazos *et al*., 2019). This refinement resulted in 199 articles, which were submitted to inclusion and exclusion criteria. We use several WoS filters as inclusion criteria and we exclude articles unrelated to collective action and competitiveness in a business environment, which resulted in a final sample of 67 articles.

3. Findings and Discussion

3.1 Thematic Relations

To understand the structure of a network of relationships between themes that represent a construct of a given area of research, we can use a bibliometric method (Zupic and Cater, 2015), which is vital to analyse relationships and gather topics from academic articles (Liu, 2017). A co-keyword occurrence analysis was used to construct a conceptual structure of the research domain (Callon *et al*., 1983). In the set of 67 articles, 550 co-keywords were found. Considering the minimum occurrence of 3 times per keyword, it resulted in 29 co-keywords (Figure 1). These three clusters show a network of thematic relationships.

The first (red cluster) encompasses 12 items and has CA as its central theme, highlighting public goods and cooperation issues. Business competitiveness factors constitute the central body of the second cluster (green), encompassing 10 items, with innovation, knowledge, and performance being the most relevant. The themes of governance and competition stand out in the third group, with seven items (blue cluster). The position of this cluster in the network points to the interconnection that governance can establish between CA and business competitiveness.



Source: Own elaboration using the VOSViewer v1.6.18 software

Figure 1: Co-keyword occurrence analysis

According to Zupic and Cater (2015), bibliometric analysis is not a substitute for traditional analyses, so a thematic analysis was also used for all articles under study.

3.2 Thematic Analysis

The thematic analysis of the 67 articles led us to define thematic areas and respective categories and subcategories as illustrated in Table 1.

Table 1: Categories and subcategories by thematic areas

Thematic Areas	**Categories**	**Subcategories**
Collective Action	CA Problems	Barriers Adherence Participation
	CA Strategies	Corporate Political Activity Consortia and Alliances Cooperation
Business Competitiveness	Resources	Social Capital
	Innovation	Quality Differentiation
	Markets	Access Certification
	Performance	Productivity Decision Making
Governance	Coordination	Competition Collaboration
	Regulation	Monitoring Lobbying Self-Regulation

Source: Own elaboration

3.2.1 Collective action

CA problems

The successful management of common-pool resources is one of the most challenging and pressing problems facing natural resource management and environmental economics (Ostrom, 2010). Many obstacles to CA are related to the inadequate use of existing regulations, such as the institutional configuration of the tax regime (Rixen, 2011; Skurray, 2015).

A lack of social capital reduces the ability to act (Kokthi et al., 2021), and a lack of motivation to change a current situation can also result in a CA problem (Monios and Lambert, 2013). The degree of commitment and consequent contribution to common objectives depends on the partners' perceptions regarding the behavior of others (Fonti et al., 2017). Low participation in collective activities can reduce the ability of groups to provide valuable services to their members (de Reuver et al., 2016). However, to ensure long-term success more is needed to rely solely on pre-existing levels of trust and reciprocity between those involved in CA (Ostrom, 2010). Active participation in supply chain management can be achieved by developing organizations capable of managing supply in volume and quality (Dervillé and Allaire, 2014). Formalization sets forth regulations, procedures, and standards within an inter-organizational setting, fostering stability, while also binding both parties to the relationship. Interaction, on the other hand, promotes the exchange of information, coordination, cooperation, and deeper engagement among participants, restricting opportunism.

Opportunism is one of the main problems that emerge in collective actions, as in the case of strategic alliances with partners of different natures and other inter-organizational networks and is decisive in the effectiveness of CA (Fonti et al., 2017). Despite the action problem within them, alliances are often attractive (Konrad, 2018). A collective problem of opportunism is the inability to internalize a positive externality (Cheikbossian, 2021). Opportunism acts as a hindrance, undermining CA in two distinct ways: individuals may either be swayed to act selfishly and opportunistically, or they may become hesitant to cooperate due to the apprehension of others' opportunistic behaviour which leads to the dilemma of initiating CA (de Reuver et al., 2016). Opportunism has also harmful effects on the performance of franchisees in a franchise network, that may be limited by establishing appropriate normative expectations and cultivating strong ties between parties (Kidwell et al., 2007). In advocacy groups, some activists may decide to take the lead, which introduces a CA problem (Reuben et al., 2015).

The tension between the collective interests of the group and the individual interest of each member impacts the dynamics of intergroup cooperation and competition (Coen, 2013). Analysis of the interactions between intra-group CA problems and inter-group conflict shows that inter-group competition promotes intra-group cooperation and that larger groups are more effective in overcoming their CA problems (Cheikbossian, 2012). When forming alliances and faced with a conflict in a framework with incomplete information about the relative strength of the potential ally, participants anticipate the selection of other players and the informative value of their own and others' choices (Konrad and Morath, 2018). In the case of consortium formation, conflict management and strong protection of the competitive advantages of associated companies are also crucial to motivating participants' contributions (Xia et al., 2012). In multifaceted digital platforms characterized by rapid growth, distributed innovation, and role flexibility operating in different geographic locations, it is recommended that business models are designed in a way that allows the creation of joint value from the beginning and avoids the emergence and escalation of conflicts (Ricart et al., 2020). From the above findings, we can derive the first proposition:

(P1): CA problems may lead to less business competitiveness.

CA strategies

Members of interest groups appear to value both the private goods they receive in the form of selective incentives and the lobbying services purchased with their members' money (Pecorino, 2001). The incentives for CA to influence policy are high since the potential benefits are significant and concentrated (Chase, 2004). The multifaceted relationships between collusion, lobbying and group formation, and environmental policy highlight the role of trade liberalization in product market competition and its consequent impact on the incentive to lobby for less stringent environmental policies (Damania and Fredriksson, 2003). An ownership community that embodies consent, jurisdictional competition, and residual claim (incentive alignment) mitigates CA problems (Makovi, 2019).

Cooperation mechanisms established by social capital play a positive role in creating trust in a group of people, which reduces opportunistic behaviour and facilitates the development of collective activities in the form of security mechanisms (Kokthi *et al*., 2021), such as security food, a collective good assumed to be desirable for this entire industry (Pouliot and Sumner, 2013). Solidarity and reciprocity are essential ingredients of social capital and influence the degree of cooperation between local stakeholders, which are necessary preconditions for successful collective actions (Kokthi *et al*., 2021). Reciprocity can also be facilitated if the cooperative intentions of others can be assessed with information gathered through communication and face-to-face interaction (Price, 2006). The level of reciprocal cooperation is a critical element of community resource management, which helps resource users to collaborate (Tembata and Takeuchi, 2018). It is suitable to design relationships that help establish appropriate normative expectations and cultivate strong ties between parties (Kidwell *et al*., 2007).

Participation in consortia benefits companies in two ways: through the final products that companies develop together and through the cooperation process, which includes inter-organizational learning and the construction of social capital (Xia *et al*., 2012). Through networked CA activities, participants identify common interests, share market knowledge, and develop new business opportunities (Devaux *et al*., 2009), which leads to higher incomes for small agricultural producers (Kazangi *et al*., 2009), benefit from the technological, commercial and institutional innovations generated. Creating public-private consortia can be a way to develop new markets (Monios and Lambert, 2013) and participation in alliances improves the ability of partners to access and share some goods produced within alliances without restrictions (Monge *et al*., 1998). Based on the findings of these authors we can derive the second proposition - (P2): CA strategies contribute to solving CA problems.

3.2.2 Business competitiveness

Resources

Social capital is a collective resource and is crucial for those involved in CA to share resources with other members. Among the components of social capital are reciprocity, reputation, information, knowledge, and trust (Enriquez-Sanchez *et al*., 2017). Reciprocity suggests that people cooperate more when they perceive that others are cooperating and less when they perceive that others are opportunistic (Price, 2006) and collective effort is a public good for group members (Cheikbossian, 2021). Reciprocity motives are essential predictors of individual decisions in CA situations (Fisher and Qaim, 2014) and influence participation in collective activities. However, to ensure long-term success more is needed to rely solely on pre-existing levels of trust and reciprocity among those involved in CA (Ostrom, 2010). Reciprocal preferences in groups should provide the voluntary offer of public goods, the size of which is associated with greater levels of trust among group members (Guttman, 2013).

The reputation generated by the satisfaction of users of a technological platform is a collective good, which, when benefiting all participants, takes on the characteristics of a commonly produced good (Cennamo and Santaló, 2019). Traceability protects an industry's reputation from randomly occurring incidents, identifying and isolating the product that caused the problem, and limiting the size of recalls (Pouliot and Sumner, 2013). The information transmitted by the density of relationships provided by the existence of social capital allows for better decision-making and obtaining advantages for those who have access to them, as long as the information is accurate and reliable (Kokthi *et al*., 2021; Laussel *et al*., 2022).

Innovation

The quality and differentiation of food products are critical dimensions for success in modern food markets, and producer-controlled market organizations have the potential to significantly impact the sharing of fixed costs associated with innovation and certification thereby exerting influence over the quality of distributed products in the market and regulating supplies (Saitone and Sexton, 2010). In the complementary innovation process (Maciel and Fisher, 2018), companies exchange critical resources to promote peer entry, growth, and continuous product innovation. National innovation policies interact strategically to enable more effective business environments, fostering global entrepreneurship and innovation (Potts, 2016). However, some established sectors share common characteristics that resist change, particularly disruptive innovation, which impedes the launch of innovations or innovative practices in the market (Jaffee and Freeman, 2002; Weiss and Bonvillian, 2013). CA is essential for innovation in the agricultural and construction sectors and to encourage investment in innovative technologies in the energy sector. Complementary innovation is fostered by

heterogeneous companies belonging to ecosystems based on technological platforms, which promotes the creation of value (Cennamo and Santaló, 2019).

Markets

Conditions for market access are best achieved with the collective organization of producers, which increases levels of social capital to strengthen internal and external relationships (Lutz and Tadesse, 2017). Market infrastructure is fundamental for the CA of collective actors to extract value from their private capabilities, which is why it is crucial for successful market formation (Struben *et al*., 2020).

Performance

Productivity is positively related to engagement in the exchange of strategic information in both the short and long term (Barnes *et al*., 2017) and with improved coordination of inter-group competition (Cheikobossian, 2012). CA, solid leadership, and a focus on technical, organizational, financial, and marketing innovation are essential for improving performance in dynamic markets (Kazangi *et al*., 2009). Government regulation can reinforce corporate profitability by inducing CA to mitigate environmental risks (Pang, 2018) and promoting reforms that improve labour quality, social harmony, and economic security (Karsten, 1995), thus reinforcing productivity.

The context of decision-making is vital for structuring and developing CA through resource allocation and strategy performance (Pittz and Adler, 2016). Using common-pool resources is often a competitive activity and raises essential questions about the costs and benefits of engaging in cooperative behaviours and the socio-structural dynamics that form the basis of decision-making by stakeholders (Barnes *et al*., 2017). Now we can define two other propositions relating to CA strategies and business competitiveness:

(P3): CA strategies have an influence, positive or negative, on business competitiveness.

(P4): The pursuit of business competitiveness factors stimulates CA strategies.

3.2.3 Governance

Coordination

The need for a governance mechanism for CA in ecosystems (Cennamo and Santaló, 2019), and collective institutions are necessary to obtain orderly market behaviour (Harriss-White, 1995). The effectiveness of collaborative collective actions to manage common-pool resources depends on the scale of the issue being assessed (Bowen *et al*., 2018). Collective governance entails the implementation of institutional innovations and investments by resource users thereby aligning interests in resource exploitation with those focused on maintaining stock balance. Collective management or governance is an alternative to, or can complement, centralized and market-based management approaches for common-pool resources, whose sources of inefficiency can be reduced through coordinating efforts and defining rules of using (Costello and Deacon, 2017; Skurray, 2015). In the case of multi-sector partnerships involving several stakeholders, an open strategy governance platform is appropriate (Pittz and Adler, 2016).

To mobilize collective coordination capabilities to face global changes in different regional contexts, market agents need material and immaterial investments and the help of regional public actors to build new local collective capabilities (Dervillé and Allaire, 2014). To encourage CA by companies to reduce polluting emissions (Pang, 2018), it is required cooperation and coordinated CA for the use of resources and the imposition of joint restrictions (Tembata and Takeuchi, 2018). Market-based instruments (MBI) are generally used to promote competition, with individualized approaches to improving ecological values framed around the farm scale (Cooke and Moon, 2015). Initiatives depending on relational governance are inclined to foster collaboration to a greater extent. Non-financial incentives, such as reputational benefits and shared intellectual property rights, are more likely found in projects that rely on relational governance (de Reuver *et al*., 2016).

The coordination of collaborative conduct by business associations and consumer alliances plays a central role in the complementary innovation process, allows the development of a market and increased global competitiveness (Maciel and Fischer, 2018).

Regulation

Implementing and enforcing institutional rules are responsible for success, and comparing successes and failures can help understand what works and what does not to support CA (Buhren and Dannenberg, 2021).

Institutions affect social processes and the system's outcomes vary depending on the agency's reactions to output and voice (Shin, 2022). The polycentric approach (Ostrom, 2014), overseen by engaged local, regional, and national stakeholders, offers a significant advantage over a single governmental unit to solve global CA problems. Regulation based on market instruments can limit the incentive to share information about common-pool resources (Costello and Deacon, 2007), while at the same time, it can generate tension between the focus on property and political environmental management leading to insufficient conservation of public goods (Cooke and Moon, 2015). The quality of environmental public goods, such as air quality and drinking water, or quasi-public goods such as health care varies with the number of local governments and the relationships between different jurisdictions (Hatfield and Kosec, 2019, Karsten, 1995).

Monitoring is an essential factor in the success of CA by reducing opportunistic behaviours, which can also be achieved through government imposition of mandatory participation (Saitone and Sexton, 2010). Increased monitoring opportunities and a formal or informal penalty system may deter opportunism (Price, 2006). The imposition of food safety standards or a traceability system on the industry can be carried out through self-regulation or government regulation (Pouliot and Sumner, 2013), but the existence of a great number of voluntary standards organizations may constitute a problem (Reinecke *et al*., 2012).

Sectors characterized by a greater degree of competition and low concentration levels tend to exert pressure jointly, that is, through sectoral business associations. In contrast, individual lobbying predominates in sectors with greater concentration and more differentiated products (Bombardini and Trebbi, 2012). The process of competition and CA that leads to change reveals a complex picture that highlights the contradictory motives of organizational actors who fight for and against institutional change (Jaffee and Freeman, 2002). Competition can trigger the need for institutional change, but it can also prevent it from happening when the change threatens organizations' current distribution of resources. Pressure from political entities representing producing companies hindered by the constraints of national market sizes often leads to the emergence of protectionist measures and the formation of trading blocs.

Self-regulation may not prevent market manipulation, so the roles of law, regulation, and self-regulation in deterring manipulation depend on the costs and benefits of available alternatives (Pirrong, 1995). The industry's coordinated response to a CA problem, associated with the need for moderation in price increases, proves to be preferable to government intervention (Ellison and Wolfram, 2006). However, sometimes the intervention of state institutions is necessary to resolve common problems (Kokthi *et al.*, 2021).

The rules of the collective organization determine the type of relationship that is established between the members of a sector (Bowen *et al*., 2018) and the definition of norms and codes of conduct by the organizations coordinating CA constitutes a mechanism for managing the tensions and conflicts generated by the opportunistic behaviour of members (Maciel and Fischer, 2020). We can define two other propositions about the role of governance:

(P5): Governance mechanisms moderate the relationship between CA problems and business competitiveness.

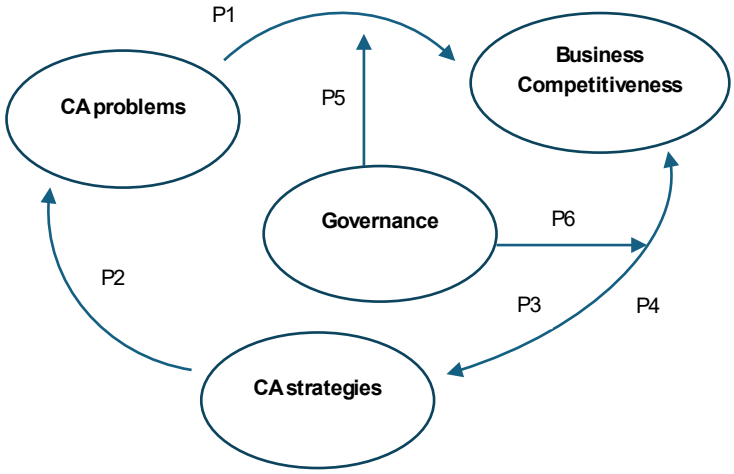
(P6): Governance mechanisms moderate the relationship between CA strategies and business competitiveness.

This thematic analysis and the propositions derived from it led us to propose a conceptual model that presents the relationships between the primary variables.

4. Conceptual Model

The existence and production of collective goods are essential conditions for the economic development of society. The very nature of these goods leads to companies needing to get involved in collective actions in which actors of other types also participate. CA produces a set of collective goods valuable for business competitiveness. However, it also gives rise to problems whose nature and resolution require developing CA strategies. The main problems of CA can occur at different stages: in formation, structuring, adherence and participation in collective actions; the dynamics and context in which CA unfolds, as well as the characteristics of markets, also influence CA problems. The number and size of participants in the CA are equally relevant to the outcome of that action. Opportunism, particularly in situations involving common-pool resources, is one of the main problems that emerge in collective action, generating tensions and conflicts between participants. There is a very close relationship between business competitiveness and CA strategies. Solving CA problems involves defining and implementing CA strategies.

Governance can play a relevant role in ensuring the success of collective actions in different areas of socioeconomic activity and is essential for strategies to have an impact. The social capital generated by governance is a fundamental antecedent for the dynamization and existence of CA and the production of collective goods. Regulation and self-regulation emerge as two relevant governance mechanisms to guarantee this success, which is also strongly linked to the type of coordination exercised. Governance mechanisms, therefore, contain CA strategies and must contribute to resolving CA problems and fostering business competitiveness.



Source: Own elaboration

Figure 2: Conceptual Model for Collective Action and Business Competitiveness

5. Conclusion

This paper examined the relationship between CA and business competitiveness based on a systematic literature review that combined bibliometric and thematic analysis, leading to the development of six propositions within a conceptual model. These propositions address both the endogenous and exogenous interaction between CA problems and strategies and business competitiveness. The paper also highlights the role that governance is likely to play in moderating these relationships, whether as a coordinating agent or as an actor in regulation and self-regulation.

This investigation has some limitations, related to the sole use of the WoS database to select articles for analysis within business, economics, and management. CA and its relationship with business competitiveness present a vast field for further investigation. It is possible to expand the study with contributions from other scientific fields, as could be the case with Sociology. More theorical and empirical studies carried out with business associations will be able to shed light on the governance of CA and its impact on business competitiveness. Defining a systemic model that relates CA to business competitiveness makes sense, considering antecedent, process, and consequent variables.

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The Power of Proximity: The Impact of Proximity Between Early-Stage Investors and Universities

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Abstract: Early-stage investors and universities are crucial stakeholders in entrepreneurial ecosystems, yet their combined impact remains underexplored. This paper examines how the proximity between early-stage investors and universities affects the founding rate and success of affiliated startups. The analysis utilizes data from the Crunchbase 500 list for Germany. Findings indicate a positive correlation between the proximity of early-stage investors and universities with higher success rates and founding rates of affiliated startups. However, the results show varying dynamics and partial statistical significance, suggesting different implications for small versus large universities. Should these tendencies be confirmed with a more extensive dataset, the findings could have practical implications for early-stage investors and universities, tailored to their size.

Keywords: Venture capital, Start-ups, Entrepreneurial ecosystem, Start-up founding rate, Start-up success rate, Investor start-up proximity

1. Introduction

Start-ups backed by venture capitalists (VCs) significantly contribute more to economic growth than those without VC support (Gompers et al. 2020; Samila & Sørensen 2011; Sørensen 2007). VCs invest in start-ups primarily due to high return expectations. Because start-ups typically exhibit asymmetric returns, VCs aim to identify outliers within their portfolios that can provide substantial returns (Cochrane 2005). Although VCs evaluate factors like team, product, market environment, and strategy, they often face significant information asymmetry compared to the founders (Gompers et al. 2020; Kaplan & Strömberg 2004). To mitigate this, VCs syndicate and exchange information within their networks (Alexy et al., 2012; Ljungqvist et al., 2005). Universities are crucial to the entrepreneurial ecosystem, providing research for new technologies and attracting and educating the human capital necessary for launching businesses (Padilla-Meléndez et al. 2021; Rodríguez-Gulías et al., 2016). However, there is a scarcity of studies examining the interrelation between universities and VCs. Existing literature, such as works by Atkinson, Croce et al., and Kremer et al. (1994; 2014; 2022), focus on university-affiliated or university-managed VC funds, while Cai et al. (2016) concentrate on VC-backed founders and executives from the US with MBAs from top-ranked business schools. There is a notable gap in the literature concerning the impact of proximity between universities and early-stage investors on start-up founding rates and success. This study aims to fill this gap by. The proposed hypotheses are:

> ***H1****: Investors that have closer relationships with universities are investing in more successful start-ups.*
>
> ***H2****: Universities with closer relationships with early-stage investors are associated with more successful start-ups founded by their former students.*
>
> ***H3****: Universities with closer relationships with early-stage investors have a relatively higher founding rate of start-ups among their former students.*

These hypotheses were chosen to explore the multi-dimensional impacts of proximity, including its role in facilitating knowledge transfer, fostering trust, and enhancing coordination between investors and academic institutions. By testing these hypotheses, we aim to provide insights into how localized interactions within entrepreneurial ecosystems can foster innovation and growth.

2. Background and Context

2.1 Impact of Early-Stage Investors

Funding is critical for start-up success (Cantamessa et al. 2018). Different types of investors, including family and friends (F&Fs), business angels, crowd investors, and VCs, contribute varied resources such as financial capital and social capital. F&Fs often provide initial seed funding and emotional support, which is crucial for nascent entrepreneurs (Berger et al. 2020). Their involvement can reduce the perceived risk of entrepreneurship and provide a safety net. However, their lack of experience in start-up investments can lead to complex ownership structures and administrative challenges (Bessière et al. 2020). Business angels offer both financial capital and

valuable networks, often investing locally and actively participating in the start-up's growth (Kelly 2007; Mason et al. 2016). They typically have entrepreneurial experience and provide mentorship, strategic advice, and access to their networks. Studies have shown mixed results on the impact of business angels, with some indicating significant positive effects on start-up success (Fili & Grünberg 2016; Kerr et al. 2014), while others find no substantial contribution (Cavallo et al. 2019). Crowd investments have gained importance, allowing start-ups to raise funds from a large number of small investors. This method is particularly effective for consumer products, as it combines capital raising with market validation and feedback (Brown et al. 2018). However, crowd-funded start-ups may struggle to attract traditional VC funding due to perceived lower quality and regulatory complexities (Mochkabadi & Volkmann 2020). Despite these challenges, crowd investors can provide a quick infusion of capital and initial customer engagement, critical for early-stage validation and growth (Mollick 2014). VCs are crucial in providing substantial financial resources and expertise. They perform rigorous due diligence and contribute to the start-up's strategic direction, leveraging extensive networks to facilitate growth (Gompers et al. 2020). VCs prioritize factors such as the founding team, business model, market potential, and product innovation when making investment decisions (Kaplan & Strömberg 2004). Their involvement often signals quality to other investors and stakeholders, thereby enhancing the start-up's credibility and access to additional resources (Barry et al. 1990).

2.2 Impact of Universities

Universities play a pivotal role in entrepreneurial ecosystems by generating knowledge, fostering innovation, and nurturing human capital (Audretsch 2014). The economic impact of universities has evolved from primarily political and social contributions to significant economic drivers, particularly through technology transfer and start-up support (Romer 1986). Universities contribute to start-up ecosystems by providing research, attracting and educating talent, and fostering an entrepreneurial mindset (Padilla-Meléndez et al. 2021). Knowledge spillovers from university research can lead to the development of new technologies and business models (Audretsch et al. 2012). This spillover effect is facilitated through collaborations, publications, and the mobility of skilled graduates who transfer knowledge to the industry (Acs et al. 2009). High-ranking universities with strong entrepreneurship programs tend to produce more successful founders (Cai et al. 2016). Entrepreneurship education provides students with the skills and knowledge needed to start and manage new ventures. These programs often include practical components such as business plan competitions, mentorship from experienced entrepreneurs, and access to incubation facilities (Franklin et al. 2001). Universities also facilitate start-up formation through technology transfer offices, incubators, and proof-of-concept centers, providing essential resources and support to nascent entrepreneurs (Audretsch 2014). These support structures help bridge the gap between academic research and commercial application, increasing the likelihood of successful start-up formation (Gaspar 2009). The concept of "entrepreneurial universities" highlights the shift towards a more proactive role in commercializing research and fostering start-up ecosystems (Harrison & Leitch 2010).

2.3 Proximity of Investors and Universites

The intersection of early-stage investors and universities is critical in the formation of university spin-offs. Existing literature evaluates the performance of university-led VCs (Atkinson, 1994; Croce et al., 2014; Kremer et al. 2022) and universities' roles in spin-offs (Alexy et al., 2012; Hayter, 2013; Lerner, 2004; Padilla-Meléndez et al. 2021; Wright et al., 2006). Additionally, factors such as coordination (Hayter, 2016b) and faculty entrepreneurial behavior (Hossinger et al., 2020) are significant, with venture capital being crucial to spin-off creation and success (Munari & Toschi 2011; Smith & Bagchi-Sen 2012). Notably, university-led VCs exhibit lower investment exit rates (Kremer et al., 2022). Knowledge spillover theory, where universities act as knowledge intermediaries and VCs as capital intermediaries, further elucidates the dynamics (Acs et al. 2013; Hayter 2016). For instance, VC-backed university spin-offs have a 20-26% higher commercialization rate (Hayter 2013), consistent with other studies (Harrison & Leitch 2010; Samila & Sørensen 2010). Universities can enhance start-up support through strict admission criteria and initiatives like incubator programs and pitch events, which positively signal to investors and improve founding rates (Berger et al. 2020; Cai et al. 2016). Early-stage investors provide not only financial but also social capital, vital for start-up success. However, university spin-offs often face an equity gap as traditional investor types like friends and family are less available (Widding et al. 2009). The benefits of investor proximity to universities are debated. Some studies show that specialized networks or extensive diverse networks enhance investment performance (Alexy et al. 2012; Ljungqvist et al. 2005), while a mix of these networks does not (Alexy et al. 2012). Gompers et al. (2009) find that specialization and experience, rather than extensive networks, improve VC performance. Furthermore, VC-backed start-ups where the founder and VC executive share a business school background tend to be more successful (Cai et al. 2016).

3. Data and Methodology

3.1 Data Collection

The underlying data for this study was sourced from Welpe et al. (2021), who enhanced the Crunchbase 500 (cb) list by adding German universities of the founders. The cb list from December 2020 ranks 500 German start-ups based on criteria like the number of connections a profile has, the level of community engagement, funding events, news articles and acquisitions. An entity's rank is fluid and subject to rise and fall over time. Time-sensitive events such as product launches, funding events, leadership changes and news affect a company's Crunchbase rank (Crunchbase 2021). The ranking position is assumed to correlate with start-up success. The given data set is not without its limitations. First, the data has a strong success bias since the data set only considers the best-ranked start-ups, according to Crunchbase. At the same time, the measurement of success is not 100% transparent since it is based on the intransparent Crunchbase algorithm. It cannot be guaranteed that Crunchbase's ranking does not consider the educational background or the list of investors for their ranking. Alternative success measurements like IPO rate or failure rate are not suitable for the given list of start-ups due to the young age and recency of the analyzed start-ups (Gompers et al., 2009) and creation of job opportunities due to the different business models of the compared start-ups. From this list, 426 start-ups were identified with at least one founder who graduated from a German university. If founders studied at different universities, all were considered. University size was measured by the number of enrolled students as collected by Welpe et al. (2021). Ownership data were analyzed using the Amadeus database. Of the 426 start-ups, early-stage investor data were available for 401 start-ups. Early-stage is defined as an average of three years, encompassing periods from incubation/pre-seed to seed phase and seed phase to series A, typically lasting 12 to 24 months each (Cavallo et al. 2019). Dates of incorporation were verified through various online sources, including Germany's commercial register. The investor list included all shareholders, including founders who invested in other start-ups. For instance, a founder from one of the 401 start-ups investing in another start-up counted as two start-up investments.

3.2 Data Analysis

This paper uses data from the Crunchbase 500 list for German start-ups from December 2020, supplemented by the educational background of founders and the respective start-ups' early investors. Two proprietary proximity scores were calculated to quantify the relationships between universities and investors.

The proximity score PS(*Investor*) for an investor to universities has been calculated according to the following formula:

$$PS(Investor) = 1 - \sum_i \frac{U(i)}{i\ U}$$

Here, i denotes the number of investments the investor has with one university. U(i) denotes the number of universities which are affiliated with the investor i times. The proximity score is high for investors who invested in start-ups affiliated with fewer universities, but more often with the same universities. A score of 0 would mean that all of the invested start-ups are associated with different universities. A score of 1 would mean that the investor invested in an infinite number of start-ups at the same university. In short, the PS(*Investor*) proximity score measures how concentrated an investor's investments are within a few universities

Accordingly, the proximity score PS(*University*) for a university to investors is defined as follows:

$$PS(University) = 1 - \sum_i \frac{I(i)}{i\ I}$$

Here, i denotes the number of investments at one university from the same investor. I(i) denotes the number of investors which are affiliated with the university i times. The proximity score is high for universities who received many start-up investment from a low number of investors. A score of 0 would mean that each start-up from the university was funded by different investors. A score of 1 would mean that an infinite number of start-ups at the university were funded by only one investor. The proximity score is higher for universities with fewer affiliated investors but more affiliated investors that invested in more start-ups from this university. The score ranges between zero – no investor invested in two or more start-ups from this university – and one – all investors invested in two or more start-ups from this university. In short, the PS(*University*) proximity score measures how concentrated a university's investments are from a few investors.

3.3 Descriptive Statistics – Investors

The investor list was manually consolidated to identify related entities and individuals. The dataset comprised two tables. The first identified 237 investors with at least three investments in the 401 start-ups within three years post-incorporation, with 16 investors making ten or more investments. The second table included 86 universities affiliated with at least three start-ups, with 26 universities affiliated with ten or more start-ups. The investors have been filtered for those with at least three investments in the given data set to have more reliable proximity scores that would be otherwise highly influenced by the small number of investments and, therefore, associated universities. The considered investors have between three and 37 different investments in the data set. The distribution of the number of investments can be seen in Table 1 and is highly concentrated at the lower end, with 44% of the investors with only three investments in the given data set and 19% with four investments. More than 93% have less than ten investments.

Table 1: Frequencies of Variables in the Data Set Regarding the Investors

	Mean	Percentile 25	Median	Percentile 75	Std. Deviation
Number of investments	5	3	4	6	4
Average cb rank of investments	213.72	156.14	204.33	263.67	77.76
Proximity of investors to universities	.19	.00	.17	.30	.17
Proximity of investors to universities without zero scores	.28	.17	.25	.35	.13
Number of universities associated with investments - counted once	10	6	9	12	7

The scores are not normally distributed, with a high number of zero scores (Figure 1 (c)). The distribution of proximity scores larger than zero is almost perfectly normal (Figure 1 (d)). However, the large number of 78 investors with a proximity score of zero results in an uneven distribution (Figure 1 (c)), which demands the use of non-parametric statistics for the analysis. The last relevant variable in this data set is the number of universities an investor is associated with. This variable is lognormal distributed, which is why all subsequent calculations use this variable's natural logarithm (ln).

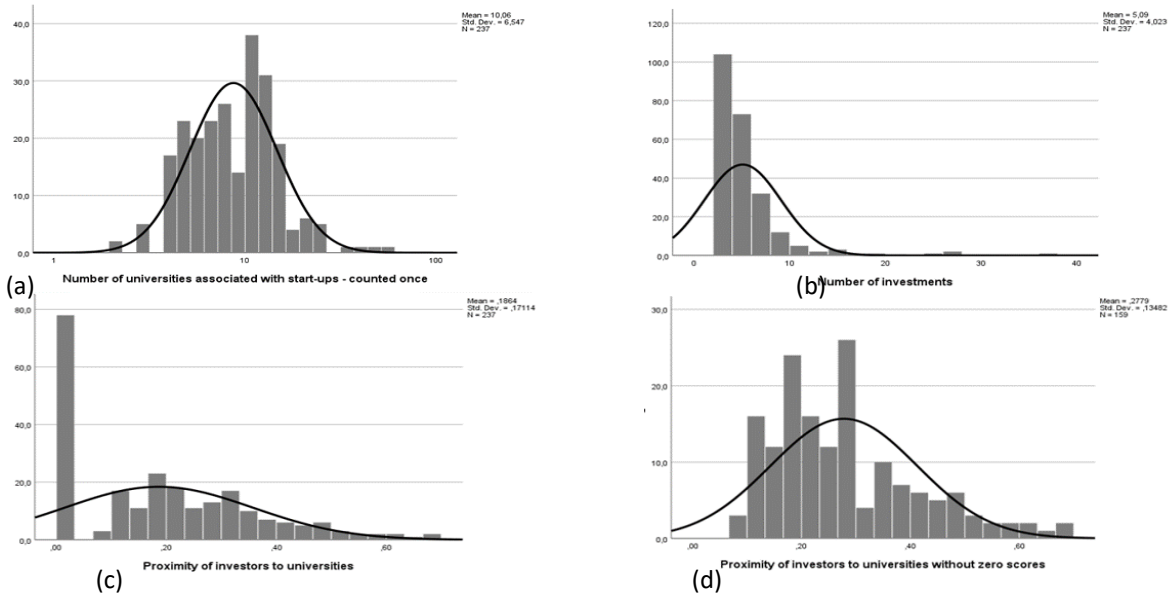


Figure 1: Histograms of Investor Related Variables

3.4 Descriptive Statistics – Universities

After filtering the data for universities with at least three start-ups in the data set, 86 universities are left to be analyzed. Those universities have a median of 17.952 students. The number of students is distributed close to a lognormal distribution; hence all subsequent calculations use the ln that shows a slight negative skew (see Figure 2 (a)). The same applies to the number of start-ups affiliated with a university. However, compared to the ln of

the number of students, the ln of the number of start-ups has a strong positive skew due to the high number of universities with three and four start-ups in the data set (see Figure 2 (b)).

Table 1: Frequencies of Variables in the Data Set Regarding the Universities

	Mean	Percentile 25	Median	Percentile 75	Std. Deviation
Number of students	20.662	8.350	17.952	30.153	15.110
ln of number of students	9.54	9.03	9.80	10.31	1.06
cb Startups per 100 students	.1685	.0231	.0390	.0694	.5267
ln of cb Start-ups per 100 students	1.58	.83	1.36	1.93	1.20
Number of startups	10	4	6	11	11
ln of number of startups	1.92	1.39	1.79	2.40	.78
Average cb rank of startups	266.14	225.23	267.28	303.53	58.73
Proximity to investors	.0309	.0000	.0000	.0410	.0552
Number of investors associated with this university	115	39	68	122	141

The number of students and the number of start-ups affiliated with a university in the given data set is deviating a lot which is why also the cb start-ups per 100 students deviate heavily across the universities. Again, the natural logarithm is used, which shows weak positive skew (see Figure 2 (c)).

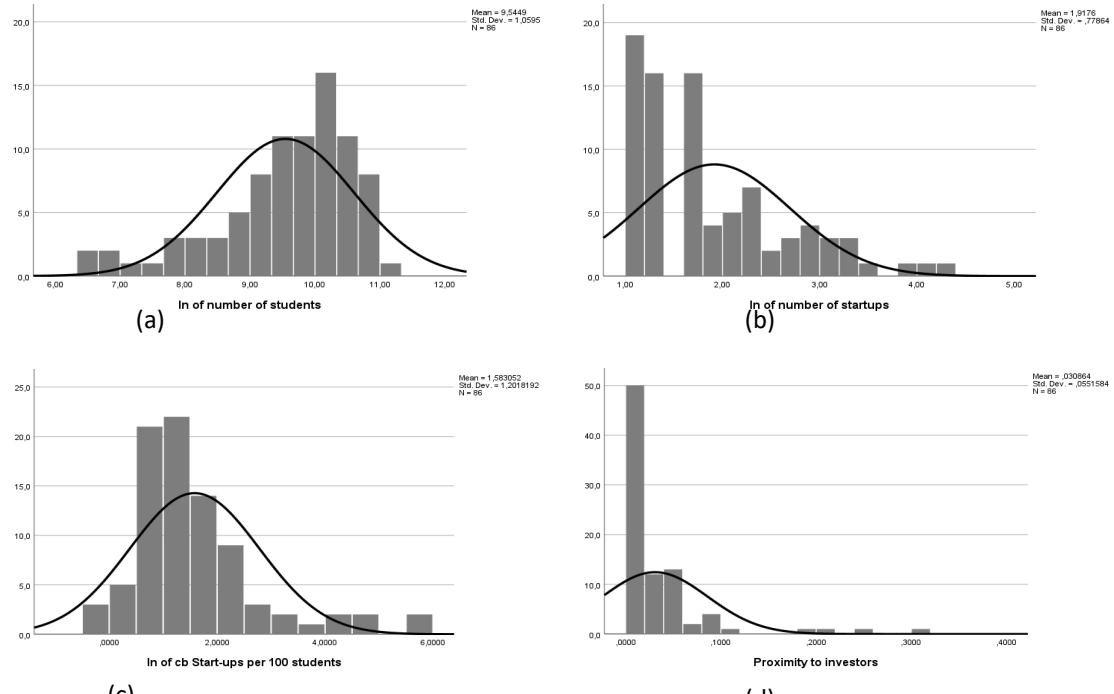


Figure 2: Histograms of University Related Variables

4. Results

The first hypothesis (H1) posits that investors with higher proximity scores are more likely to invest in successful start-ups. This analysis was conducted using the Kruskal-Wallis test, to account for the non-normal distribution of data. As Table 1 indicates most investors tend to invest in start-ups from a limited number of universities. This pattern suggests that certain investors may have a preference or specialization. In addition, Table 3 categorizes investors based on their proximity scores and the number of investments they have made. It can be deducted that investors with higher proximity scores frequently invest in start-ups from the same universities, suggesting a focused investment strategy.

Table 2: Distribution of Classed Investors According to their Proximity Scores

			Proximity of investors to universities				
			Count	Count (%)	Mean	Median	Std. Deviation
Proximity of investors to universities (classed)	No proximity		78	32.9%	.00	.00	.00
	Low proximity		19	8%	.11	.12	.02
	Medium proximity		45	19%	.18	.17	.03
	High proximity		47	19.8%	.27	.28	.03
	Very high proximity		48	20.3%	.45	.43	.10

However, the K-test results show that there is no statistically significant correlation between higher proximity scores and the success rates of start-ups (*p = 0.515*). While there is a non-significant tendency for investors with higher proximity scores to invest in more successful start-ups, the correlation is not strong enough to be statistically significant (Table 4). Even though the mean ranks have the right direction for the stated hypothesis, the null hypothesis must be retained due to the high scattering of the cb rank average. The findings suggest that proximity is one of many factors influencing start-up success, and further research is needed to explore additional variables that might play a more decisive role. The pairwise comparison of the proximity scores of successful and less successful start-ups additionally aids the tendency for higher proximity scores to be associated with more successful start-ups. However, the statistical analysis confirms that this tendency is not significant, reinforcing the conclusion that proximity alone is not a decisive factor in start-up success.

Table 3: K-test Results for H1

Ranks

	Proximity of investors to universities (classed)	N	Mean Rank
Average cb rank of investments	No proximity	78	128.07
	Low proximity	19	123.42
	Medium proximity	45	117.73
	High proximity	47	116.73
	Very high proximity	48	105.92
	Total	237	

Test Statistics[a,b,c]

	Average cb rank of investments
Kruskal-Wallis H	3.259
df	4
Asymp. Sig.	.515

a. Kruskal Wallis Test
b. Grouping Variable: Proximity of investors to universities (classed)
c. Some or all exact significances cannot be computed because there is insufficient memory.

The second hypothesis (H2) posits that universities with higher proximity scores are associated with more successful start-ups. Table 5 categorizes universities based on their proximity scores and the number of start-ups they have produced. Higher proximity scores indicate that universities frequently produce start-ups that receive investments from the same investors. The categorization helps in understanding the concentration and focus of start-up investments at different universities.

Table 4: Distribution of Classed Universities According to their Proximity Score

		Proximity to investors				
		Count	Count (%)	Mean	Median	Std. Deviation
Proximity to investors (classed)	No proximity	45	52.3%	.0000	.0000	.0000
	Low proximity	6	7.0%	.0163	.0163	.0045
	Medium proximity	18	20.9%	.0362	.0380	.0073
	High proximity	17	19.8%	.1120	.0931	.0794

The K-test results (see Table 6) show a statistically significant correlation between higher proximity scores and the success rates of start-ups (*p = 0.065*). This finding suggests that universities with higher proximity scores tend to produce more successful start-ups, indicating the importance of close relationships between universities and investors. The null hypothesis can be cautiously rejected. A subsequently conducted pairwise comparison between the different types of universities grouped by their degree of proximity (no proximity to high proximity) showed a significant difference between the groups with the highest proximity and the ones with no proximity

(see Figure 3), supporting the statement that universities with high proximity to investors are associated with more successful start-ups on average than universities with no proximity to investors.

Table 5: K-test Results for H2

Ranks

	Proximity to investors (classed)	N	Mean Rank
Average cb rank of startups	No proximity	45	48.02
	Low proximity	6	49.83
	Medium proximity	18	43.33
	High proximity	17	29.47
	Total	86	

Test Statistics[a,b,c]

	Average cb rank of startups
Kruskal-Wallis H	7.229
df	3
Asymp. Sig.	.065

a. Kruskal Wallis Test
b. Grouping Variable: Proximity to investors (classed)
c. Some or all exact significances cannot be computed because there is insufficient memory.

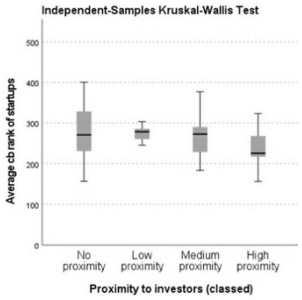


Figure 3: Pairwise Comparison of H2

The third hypothesis (H3) posits that universities with closer relationships with early-stage investors have a relatively higher founding rate of start-ups. Again, this hypothesis was tested using the Kruskal-Wallis test, due to the non-normal distribution of the data. For H3, the groups based on the proximity of universities to investors are compared based on the relative founding rate. The relative founding rate is captured in the variable cb start-ups per 100 students that divids the count of start-ups in the given data set per university by the number of students the university had in December of 2020. The results of the K-test show an asymptotic significance of 0.003 (see Table 7), which indicates that the null hypothesis can be rejected. In other words, the groups of universities with different proximity to investors show statistically significant differences in relative founding rates. Of particular interest is the pairwise comparison, which reveals a statistically significant difference between universities with no proximity to investors and those with high proximity (see Table 7). Although other pairwise comparisons exhibit a similar trend—especially the group with high proximity—they do not reach statistical significance. This lack of significance could be attributed to the relatively small sample size of universities in the dataset.

Table 6: K-test Results for H3

Ranks

	Proximity to investors (classed)	N	Mean Rank
cb Startups per 100 students	No proximity	45	36.20
	Low proximity	6	38.00
	Medium proximity	18	45.94
	High proximity	17	62.18
	Total	86	

Test Statistics[a,b,c]

	cb Startups per 100 students
Kruskal-Wallis H	13.820
df	3
Asymp. Sig.	.003

a. Kruskal Wallis Test
b. Grouping Variable: Proximity to investors (classed)
c. Some or all exact significances cannot be computed because there is insufficient memory.

Table 7: Pairwise Comparisons of Proximity to investors (classed)

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
o proximity-Low proximity	-1.800	10.852	-.166	.868	1.000
No proximity-Medium proximity	-9.744	6.964	-1.399	.162	.970
No proximity-High proximity	-25.976	7.109	-3.654	<.001	.002
Low proximity-Medium proximity	-7.944	11.771	-.675	.500	1.000

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
Low proximity-High proximity	-24.176	11.857	-2.039	.041	.249
Medium proximity-High proximity	-16.232	8.445	-1.922	.055	.328

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .050. a. Significance values have been adjusted by the Bonferroni correction for multiple tests.

To accurately interpret this result, one must consider the potential confounding effect of the number of start-ups affiliated with a university. This variable likely influences both the proximity score and the cb start-ups per 100 students score. Specifically, a higher number of start-ups at a university will naturally elevate the cb start-ups per 100 students score. Concurrently, a greater number of start-ups tends to attract more investors, thereby increasing the proximity score between universities and investors (see Figure 4 and Figure 5). To address this potential confounder, we conducted a comparison of the proximity groups with respect to the natural logarithm of the number of start-ups associated with each university. This K-test resulted in even higher explanatory values for the group with no proximity (Table 7). At the same time, it does not show the strong tendency for the universities with high proximity to investors compared to the cb start-ups per 100 students (Table 8).

Table 8: Pairwise Comparisons of Proximity to investors (classed)

Sample 1-Sample 2	Test Statistic	Std. Error	Std. Test Statistic	Sig.	Adj. Sig.[a]
No proximity-Medium proximity	-26.000	6.894	-3.771	<.001	.001
No proximity-Low proximity	-27.806	10.744	-2.588	.010	.058
No proximity-High proximity	-40.507	7.038	-5.756	<.001	.000
Medium proximity-Low proximity	1.806	11.654	.155	.877	1.000
Medium proximity-High proximity	-14.507	8.361	-1.735	.083	.496
Low proximity-High proximity	-12.701	11.739	-1.082	.279	1.000

Each row tests the null hypothesis that the Sample 1 and Sample 2 distributions are the same. Asymptotic significances (2-sided tests) are displayed. The significance level is .050. a. . Significance values have been adjusted by the Bonferroni correction for multiple tests

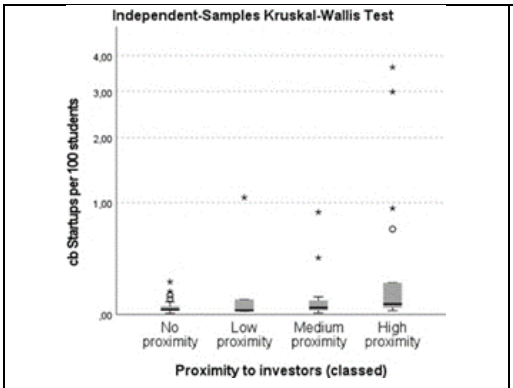


Figure 4: Pairwise Comparison for H3

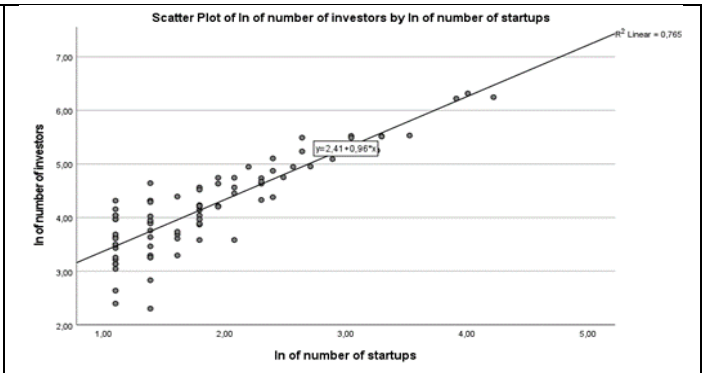


Figure 5: Scatterplot of ln of Number of Startups and ln of Number of Investors Associated with this University

This mixed result permits various interpretations. For instance, despite the increased sensitivity of the proximity score for universities with fewer start-ups and consequently fewer investors, universities with a very low number of start-ups do not exhibit high proximity scores to investors. This may be because universities with few start-ups are less attractive to investors, or because the lack of investor focus leads to fewer start-ups being founded by students at these universities. This contradictory interpretation underscores a significant limitation of this finding, namely that it does not establish causality.

5. Discussion

As presented in "4. Results" in detail, the test for H1 does not show statistically significant correlation between higher proximity scores of investors to universities and the success rates of their start-up investments, but they do hint towards the right tendency. For H2, the test results in a statistically significant correlation between higher proximity scores of universities to investors and the success rates of start-ups from former students of these universities. For H3, the tests show mixed results with statistically significant explanatory values for universities with no proximity to investors having lower founding rates of start-ups among their former students." The findings suggest practical implications for both universities and investors. Universities should foster relationships with early-stage investors to enhance start-up success and founding rates. For investors, focusing on universities with strong entrepreneurial programs could yield better investment outcomes. Universities can enhance their entrepreneurial ecosystems by providing resources and support to facilitate start-up formation. This includes creating incubators, hosting pitch events, and connecting students with potential investors. Investors, in turn, can benefit from focusing on universities with strong entrepreneurial cultures and support systems, which are likely to produce more successful start-ups. The findings align with existing literature on the importance of networks and social capital in entrepreneurial ecosystems (Alexy et al. 2012; Gompers et al. 2020). Strong relationships between universities and investors can enhance the flow of information, resources, and support, leading to higher success rates for start-ups. The proximity score developed in this study provides a quantifiable measure of the relationship between universities and investors. Higher proximity scores indicate stronger relationships and higher levels of interaction, which can positively impact start-up success and founding rates. This score can be used as a benchmark for universities and investors to assess and improve their collaborative efforts.

6. Conclusion

This study underscores the importance of proximity between universities and early-stage investors in enhancing start-up ecosystems. The findings suggest that universities with strong relationships with investors tend to produce more successful start-ups and have higher founding rates. Future research should explore larger datasets and additional variables to confirm these findings. The limitations of this study include the focus on German start-ups and the use of the Crunchbase 500 ranking, which may introduce a success bias. Additionally, the proximity score is a simplified measure and may not capture all aspects of the relationships between universities and investors. Despite these limitations, the study provides valuable insights into the dynamics of entrepreneurial ecosystems and highlights the need for strong collaborations between universities and early-stage investors. Overall, fostering closer collaborations between universities and investors can significantly enhance the entrepreneurial ecosystem. Future research should aim to establish causality and expand the dataset for more comprehensive insights.

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Masters Research Papers

How do Startups use AI? A Q-Methodology Approach to Understanding Adoption Patterns

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Abstract: Artificial Intelligence (AI) can move beyond mere task automation and can actively foster the very process of innovation. As startups are the organizational entities which rely heavily on creativity and innovation, it is intriguing to evaluate the use of AI in startups and in the entrepreneurship field. As AI is already becoming increasingly pervasive and indispensable in the startup ecosystem, the question arises, how exactly startups are using AI. We used the Q-methodology to investigate this topic empirically. This methodology was chosen because it combines the strengths of both qualitative and quantitative methods. The Q-samples (i.e., set of statements) were developed from secondary sources like literature and primary sources like interviews. In this context three in-depth-interviews with entrepreneurs were conducted to comprehensively cover the topic. The concourse comprised a set of 43 statements, that each provided one aspect of "How do startups use AI?". The collection of the Q-Samples was then followed by the Q-sorting, in which participants were asked to rank the items according to their degree of agreement. In this study 30 entrepreneurs from different startups in Germany were interviewed. The interviews were conducted online via a video chat to give participants the chance to comment on their ranking. We used the QMethod Software for data collection and analysis. The research illuminates current AI practices among startups, identifies common fields and highlights areas for further development. The findings of this study reveal the prioritization of operational efficiency as the driving force behind AI implementation. However, it is quite concerning that ethical considerations are largely ignored, posing risks of potential ethical oversights in AI utilization. Furthermore, most startups see AI as a facilitator of human creativity rather than a replacement. Overall, this paper is relevant to a diverse audience interested in understanding the current landscape, challenges, and opportunities associated with the usage of AI technologies within the startup ecosystem. This audience includes entrepreneurs, investors, researchers, educators, and policy makers.

Keywords: Artificial intelligence, Entrepreneurship, Startups, Q-methodology

1. Introduction

In the past years much research has focused on Artificial Intelligence. In this context it can also be noted that the integration of Artificial Intelligence (AI) technologies has become a hallmark of innovation within the startup ecosystem (Chalmers et al., 2021). Using AI could disrupt entrepreneurship practices and create new opportunities and challenges. It can change how startups operate and how they get information (Lévesque et al., 2022; Schiavone et al., 2023). Nevertheless, most research has focused on the opportunities for AI in startups; it remains unclear whether these opportunities reflect the reality. The research question of this study is "How do startups use AI?".

2. Literature Review

2.1 Artificial Intelligence

AI is defined as a system interpreting external data to achieve goals through adaptable approaches (Kaplan & Haenlein, 2019). It encompasses various types and techniques, notably machine learning and deep learning. Machine learning involves designing algorithms that enable computers to act without explicit programming (Ashri, 2020; Dua & Du, 2016). On the other hand, deep learning utilizes neural networks to process data-driven learning approaches (Sheikh et al., 2023). Unlike machine learning, deep learning does not rely on human-labelled training data but autonomously extracts features from raw data through algorithms (Bini, 2018; Taye, 2023).

AI´s roots trace back to the mid-20th century (Sheikh et al., 2023), but recently AI has gained widespread public interest. Notably in 2023, marked by significant breakthroughs in generative AI. Large language models (LLMs) like OpenAI's ChatGPT, Claude2 and Alpaca serve as notable examples of generative AI, exhibiting core mental capabilities such as reasoning and creativity (Dou et al., 2023; Bubeck et al., 2023). AI is transforming

various sectors by personalizing services, updating products, and optimizing business processes, with notable effects seen in customer service and marketing (Sheikh et al., 2023; Kaplan & Haenlein, 2019). While all industries are expected to face disruption, those heavily reliant on knowledge, such as finance, pharmaceuticals, and education, are likely to experience profound changes due to AI (Chui et al., 2023).

2.2 Artificial Intelligence in Startups

For the purposes of this study, a startup is defined as an early-stage organization prioritizing innovation and technology for new products or markets (Skala, 2019). Furthermore, a startup is usually not older than three years, as beyond this timeframe, most startups tend to lose their distinctive startup characteristics (Cockayne, 2019). Startup activities include idea generation, creativity, innovation, and opportunity recognition (Markovic & Salamzadeh, 2012).

According to the extant research, the role of AI in the startup processes is focused on improving operational efficiency and enhancing human capabilities in opportunity identification, data analysis and decision-making (Giuggioli & Pellegrini, 2023; Kisielnicki et al., 2022). In detail AI stands for streamlining research, analysing markets, and fostering innovative idea creation (Schiavone et al., 2023; Gerlling et al., 2022).

AI also enhances marketing, financial planning, customer service (Huang et al., 2019; Schiavone et al., 2023). and customer needs identification (Giuggioli & Pellegrini, 2023). However, over-reliance on AI predictions may limit entrepreneurs' adaptability to unforeseen events (Kisielnicki et al., 2022; Townsend, 2023).

While the implementation of AI in startups offers many benefits, it also poses significant challenges. A key challenge is the lack of transparency and trust in AI results (Kisielnicki et al., 2022). Ethical concerns, such as legal implications of AI-generated content and data privacy risks, are also prominent (Chalmers et al., 2021; Townsend, 2023). Additionally, many startups limit AI use due to factors like limited knowledge and cost concerns (Ahmad Mashat, 2020; Townsend, 2023). Overall, according to the literature AI adoption in startups presents opportunities for efficiency and innovation, but entrepreneurs must navigate challenges to maximize its benefits.

3. Research Methodology

As the goal of this paper is to give an answer to the question “How do startups use AI” getting insights from founders and co-founders is especially important. Since the Q-methodology combines the strengths of both qualitative and quantitative methods in research (Brown, 1996), it can provide the necessary insights.

The Q-methodology is widely applied across various fields, such as psychology, political science, communication, health sciences, and education (Brown, 2000). The decision in favour of the Q-methodology results from the fact that the study requires subjective experiences and attitudes (Kamal et al., 2014).

The Q-Methodology relies on the Q-sort technique, which involves ranking a set of statements collected as Q-samples. Participants rank the items based on their level of agreement. According to McKeown & Thomas (2013), the methodology includes developing the Q-samples, selecting the P-set, conducting the Q-sort, analysis of the Q-sort-data, and factor interpretation.

3.1 Developing the Q-Samples

The Q-samples are representative statements from a larger concourse (McKeown & Thomas, 2013). In this study they were developed from both secondary and primary sources. This examination included a review of ten research papers related to the use of AI in startups. Additionally, interviews were conducted with three founders who were asked about the current state of AI usage in their startups, as well as their opinions on the limitations and opportunities of AI in the entrepreneurship field. To ensure diversity in the views represented, a structured approach was used to select Q-samples. This involved including both positive and negative aspects, as well as various types of AI usage across multiple fields. Each Q-sample was formulated as a simple, short phrase. Q-methodology based studies commonly employ between 40 and 80 Q-samples (Watts & Stenner, 2013), in this study 43 statements were included (shown in Table 1).

3.2 Selecting the P-set

In Q-methodology, the P-set (participants), is purposefully selected to encompass diverse and comprehensive views relevant to the study (McKeown & Thomas, 2013). As this process emphasizes the selection of participants with expertise and knowledge of the research topic (Kamal et al., 2014), certain criteria were applied to the selection process. The role of the participants in the startups should either be a co-founder or a

founder. In addition, the startups should be under three years old. The participants were recruited from the entrepreneurship center of the Hochschule München University of Applied Sciences in Munich. As according to Brown (1980), a suitable number of participants is 20 to 40, in this study 30 participants were interviewed.

3.3 Conducting the Q-Sort

During the Q-sorting procedure, participants arrange statements (Q-samples) based on their degree of agreement, from "most disagree" to "most agree" (Brown, 1996). Within this sorting-procedure the participants should also provide reasons for their ranking (Kamal et al., 2014). The instructions encouraged the participants to give their subjective opinion. The QMethod Software was used to create a predefined grid for the participants (an example is depicted in figure 1). As for the grid a range of -5 to +5 was chosen, because according to Brown (1980) this range is suitable for 43 Q-samples.

The interviews were conducted from January to March 2024 online via a video chat, allowing participants to comment on the ranking of the items. Each interview lasted between 45 and 60 minutes. All interviews were recorded and transcribed for later data interpretation. The outcome of the Q-sort is a pyramid of sorted statements that is used for subsequent data analysis (Kamal et al., 2014).

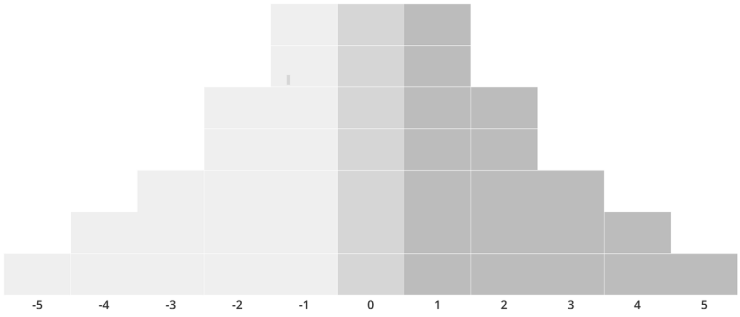


Figure 1: Example for a grid (framework) for the Q-sorting-procedure

3.4 Analysis of Q-Sort Data

The goal of the analysis is to identify factors (Churruca et al., 2021), which represent groups of participants with similar views (Brown et al., 2008). To identify these factors, the QMethod Software was utilized to conduct three statistical procedures: correlation of Q-sorts, factor analysis, and factor rotation. The spearman coefficient was used as the correlation coefficient in this study. As it is common to attempt various rotations and factor consolidations to find the most interpretable solution (McKeown & Thomas, 2013), several solutions were explored and analysed in this study. Each solution was verified and checked for plausibility. In the final factor analysis, the centroid factor analysis was utilized, followed by the varimax rotation method. Ultimately, three distinct factors were extracted.

4. Empirical Results and Interpretation

4.1 Results

After completing the analysis, the total weighted scores (z-scores) for each item gives an initial insight into the viewpoint of each factor, revealing the items that are most strongly and weakly related within each factor (table 1). For example, as shown in table 1, statement 1 is strongly related to factor 2, but not so much to factor 1 and 3. This is the starting point for the last step in Q-methodology, the interpretation by examining their differences and similarities of factors.

The three factors identified in this study, are described below, each accompanied by a memorable label and a short clarifying phrase.

- Factor 1 - Dedicated Optimizer: AI boosts efficiency, legal and ethical concerns can be disregarded.
- Factor 2 – Cautious Cost Saver: AI leads to cost-benefits but has risks of dependency and mistrust.
- Factor 3 - Selective Enhancer: AI enhances operations and marketing but is not a suitable search tool.

Regarding the P-set of this study, the first factor comprises 15 participants, the second factor includes ten participants and the third represents five participants

Table 1: Z-score for each statement

Statement Number	Statement	Factor 1 Z-score	Factor 2 Z-score	Factor 3 Z-score
1	AI is applied individually, without being integrated into the overall structure of the company	-0.06705	142.352	0.02698
2	AI lacks integration with other operational processes	-0.24348	0.50413	-114.761
3	AI is utilized as an advanced search tool for acquiring a comprehensive understanding of new emerging topics	160.717	124.307	-140.064
4	AI serves the purpose of quickly providing definitions when confronted with unfamiliar subjects	116.212	106.361	-0.02228
5	AI is used for marketing and helps with crafting or enhancing textual content for websites	11.531	0.65233	193.652
6	AI is employed for translation purposes	186.681	228.422	136.644
7	The application of AI extends to the transcription of meetings	0.86285	0.17413	0.85079
8	AI proves indispensable in the analysis and prediction of markets and trends	-0.79498	-0.90058	-0.66375
9	AI systematically analyzes datasets and can recognize patterns	0.42583	0.44803	165.812
10	AI is used for testing purposes for the product	-163.151	-194.984	-0.8367
11	The utilization of AI extends to refining existing solutions or conceiving similar alternatives	0.40523	0.47399	0.82887
12	Within the design process, AI is employed to come up with various design possibilities	-0.63368	0.20605	-0.39587
13	AI plays an important role in the development of innovative and unforeseen solutions	0.08544	-108.102	-0.42421
14	AI is utilized in generating potential problem statements	-0.67844	-132.863	153.033
15	AI plays a crucial role in enabling startups to navigate and adapt to market changes	-0.43353	-100.073	-0.40038
16	AI serves as an intelligent auto-corrector, streamlining processes and conserving time	178.366	0.72154	195.973
17	The incorporation of AI aids startups in formulating impactful communication strategies	-0.58565	-0.04716	0.01766
18	AI takes charge of operational tasks and optimizes efficiency	206.361	-0.44292	15.329
19	Startups deploy AI to automate processes and repetitive tasks	145.502	0.41581	0.42224
20	AI finds application in programming, for both code creation and correction	123.425	0.76547	0.34716
21	AI is instrumental in crafting presentations, especially image creation	-0.28714	0.07607	-0.54673
22	AI is strategically employed in the formulation of comprehensive business plans	-109.639	-0.57105	-0.26422
23	For financial planning, AI is utilized to refine financial plans and improve cash flow prediction	-170.864	-121.733	0.00649
24	AI serves as a valuable asset in communicating with investors	-0.3784	-161.012	-139.433
25	AI facilitates objective and data-driven decisions	-0.10427	-0.43765	-0.29212
26	AI reduces uncertainty during the decision-making process, with intelligence prediction	0.32152	-117.019	-0.70396
27	AI is utilized to summarize large amounts of data sets	0.53093	0.64466	0.22275
28	AI plays a crucial role in identifying and predicting customer needs	0.14971	-202.022	-0.71051
29	AI can be utilized for personalizing and enhancing customer service	-0.20804	0.66575	0.29487
30	AI finds application in efficient prototyping	-142.143	-0.35201	-0.2598
31	The integration of AI in HR simplifies the process of identifying and hiring qualified employees	-0.9052	-158.053	0.29402
32	The adoption of AI results in product benefits	-0.11247	-0.05984	0.74096

Statement Number	Statement	Factor 1 Z-score	Factor 2 Z-score	Factor 3 Z-score
33	The usage of AI leads to cost benefits	103.566	173.822	0.41882
34	The challenge of AI is the lack of transparency	0.33273	0.19281	-191.512
35	There is a lack of trust in the results of AI	-0.04975	0.78956	-0.69312
36	The tendency of AI to produce generic ideas highlights that AI cannot replace human creativity	-0.04882	0.45039	-0.81486
37	AI is used with pleasure and great anticipation	0.8247	0.78719	0.1453
38	The majority of Startups limit their use of AI to a basic level, because the lack of knowledge about AI	-0.60309	0.0202	0.83756
39	A lot of startups only use AI on a basic level, because of costs	-0.57672	-0.37284	-123.112
40	With the use of AI legal challenges regarding AI-generated content emerge	-150.447	-0.07095	0.41771
41	Over-reliance on AI can restrict the creative freedom and the problem-solving skills of entrepreneurs	-0.62485	135.727	-0.52967
42	The use of AI in startups raises concerns about data privacy and the risk of data breaches	-113.135	0.03763	110.178
43	Applying AI in a startup comes with profound ethical challenges	-1.471	-0.92201	-231.098

4.2 Interpretation

Although the z-scores indicate how each statement loads on each factor, interpreting the results based solely on these numbers is challenging. Merely focusing on the items with the highest and lowest ranking is insufficient for Q-methodology. Therefore, a crib sheet should be utilized to enable a comprehensive interpretation. A crib sheet includes four categories: it lists the highest and lowest ranked items in a factor array, as well as items that that relevant factor has ranked higher or lower than any of the other factors in the study. These categories help researchers identify the most prominent issues (Watts & Stenner, 2013).

4.2.1 Factor 1 - Dedicated Optimizer: AI boosts efficiency, legal and ethical concerns can be disregarded.

The “Dedicated Optimizer” revolves around the topic of AI-driven operational optimization within startups. This factor emphasizes the role of AI in enhancing efficiency and streamlining various tasks. The highest-ranking statements within factor 1 include its utilization in operational tasks, translation services, auto-correction mechanisms, and advanced search capabilities, as displayed in table 2. These statements reflect the perception that AI serves as a valuable tool for optimizing processes and conserving time. One participant in this factor claimed, that he uses AI instead of Google, as a search tool to understand new topics faster. Another participant stated that AI is mainly used for literature research, in order to get a quick overview of a topic. Conversely, the lowest-ranking statements within factor 1 are topics related to financial planning, product testing, legal challenges, and ethical considerations associated with AI. As the items financial planning and prototyping are ranked lower than in any other factor, it suggests a lesser emphasis on these aspects within the narrative of operations. In addition, participants in this factor generally don't view ethical and legal challenges associated with AI implementation as significant. Most participants in this factor simply see AI as an assistant and don't even think about legal or ethical aspects. Regarding the challenge of false information, a participant claimed, that it is just important to use other sources of information as a reference. In summary, factor 1 portrays a narrative of AI-driven operational optimization, while not acknowledging the ethical and legal complexities that accompany its use.

Table 2: Crib sheet for factor 1

Statement number	Statement	Ranking
	Highest ranking	
18	AI takes charge of operational tasks and optimizes efficiency	5
6	AI is employed for translation purposes	4
16	AI serves as an intelligent auto-corrector, streamlining processes and conserving time	4
3	AI is utilized as an advanced search tool for acquiring a comprehensive understanding of	3

Statement number	Statement	Ranking
	new emerging topics	
	Lowest ranking	
23	For financial planning, AI is utilized to refine financial plans and improve cash flow prediction	-5
10	AI is used for testing purposes for the product	-4
40	With the use of AI legal challenges regarding AI-generated content emerge	-4
43	Applying AI in a startup comes with profound ethical challenges	-3
	Higher ranking than in any other factor	
18	AI takes charge of operational tasks and optimizes efficiency	5
19	Startups deploy AI to automate processes and repetitive tasks	3
26	AI reduces uncertainty during the decision-making process, with intelligence prediction	1
33	The usage of AI leads to cost benefits	2
	Lower ranking than in any other factor	
23	For financial planning, AI is utilized to refine financial plans and improve cash flow prediction	-5
30	AI finds application in efficient prototyping	-3
40	With the use of AI legal challenges regarding AI-generated content emerge	-4
42	The use of AI in startups raises concerns about data privacy and the risk of data breaches	-3

4.2.2 Factor 2 - CautiousCost Saver: AI leads to cost-benefits but has risks of dependency and mistrust.

Factor 2, described as the "Cautious Cost Saver" highlights the practical applications of AI, such as its role in translation services, advanced search capabilities, and cost-saving measures, as shown in table 3. These statements focus on efficiency improvements and financial gains. Participants in this factor point out that AI saves time for the employees and leads to fewer mistakes, which also leads to cost savings.

Statements regarding the potential drawbacks of over-reliance on AI and the lack of trust in AI-results receive high attention within this factor. This reflects concerns regarding the dependency on AI and its implications for creative freedom and problem-solving skills among entrepreneurs. Furthermore, factor 2 distinguishes itself from other factors by consistently ranking statements related to the missing integration of AI into organizational processes higher than any other factor. Conversely, statements concerning AI's role in investor communication, customer needs identification, and HR processes receive lower rankings within factor 2 compared to other factors, suggesting a lesser emphasis on these aspects within the narrative of organizational integration. For example, one participant claimed, that even though AI can predict a lot of theoretical things, customer needs are very complex, and therefore the reliability of AI in this area is questionable. In summary, factor 2 highlights the cost benefits of AI while also acknowledging the need for careful consideration of its integration to avoid pitfalls such as over-reliance and trust issues.

Table 3: Crib sheet for factor 2

Statement number	Statement	Ranking
	Highest ranking	
6	AI is employed for translation purposes	5
33	The usage of AI leads to cost benefits	4
1	AI is applied individually, without being integrated into the overall structure of the company	4
3	AI is utilized as an advanced search tool for acquiring a comprehensive understanding of new emerging topics	3
	Lowest ranking	
10	AI is used for testing purposes for the product	-5
28	AI plays a crucial role in identifying and predicting customer needs	-4
24	AI serves as a valuable asset in communicating with investors	-4

14	AI is utilized in generating potential problem statements	-3
	Higher than any other factor	
33	The usage of AI leads to cost benefits	4
1	AI is applied individually, without being integrated into the overall structure of the company	4
41	Over-reliance on AI can restrict the creative freedom and the problem-solving skills of entrepreneurs	3
35	There is a lack of trust in the results of AI	1
	Lower than any other factor	
24	AI serves as a valuable asset in communicating with investors	-4
28	AI plays a crucial role in identifying and predicting customer needs	-4
14	AI is utilized in generating potential problem statements	-3
31	The integration of AI in HR simplifies the process of identifying and hiring qualified employees	-3

4.2.3 Factor 3 - Selective Enhancer: AI enhances operations and marketing but is not a suitable search tool.

As displayed in table 4, for factor 3, statements which emphasise the operational benefits of AI, such as its role as an intelligent auto-corrector and its ability to optimize efficiency by streamlining processes are important. In addition, it also highlights the significance of AI in marketing, particularly in crafting and enhancing textual content for websites. Some participants even claim that they haven't written a marketing text without generative AI since they are able to use it. As this underscores the role of AI in bolstering marketing strategies and improving customer engagement through personalized and optimized content creation, this factor is called the "Selective Enhancer".

Conversely, statements highlighting the challenges of lack of transparency and the usage of AI as a search tool receive lower rankings within factor 3, compared to other factors. Insights from the interviews explain that participants in this factor think that the transparency is not lacking, because they are only interested in the results. At the same time, they are using AI less as a search tool in comparison to other factors because they fear that the tool cannot deliver up-to-date information.

Table 4: Crib sheet for factor 3

Statement Number	Statement	Ranking
	Highest ranking	
16	AI serves as an intelligent auto-corrector, streamlining processes and conserving time	5
5	AI is used for marketing and helps with crafting or enhancing textual content for websites	4
9	AI systematically analyses datasets and can recognize patterns	4
18	AI takes charge of operational tasks and optimizes efficiency	3
	Lowest ranking	
43	Applying AI in a startup comes with profound ethical challenges	-5
34	The challenge of AI is the lack of transparency	-4
3	AI is utilized as an advanced search tool for acquiring a comprehensive understanding of new emerging topics	-4
24	AI serves as a valuable asset in communicating with investors	-3
	Higher than any other factor	
5	AI is used for marketing and helps with crafting or enhancing textual content for websites	4
9	AI systematically analyses datasets and can recognize patterns	4
42	The use of AI in startups raises concerns about data privacy and the risk of data breaches	2
14	AI is utilized in generating potential problem statements	3
	Lower than any other factor	
43	Applying AI in a startup comes with profound ethical challenges	-5

Statement Number	Statement	Ranking
3	AI is utilized as an advanced search tool for acquiring a comprehensive understanding of new emerging topics	-4
39	A lot of startups only use AI on a basic level, because of costs	-3
2	AI lacks integration with other operational processes	-3

5. Conclusion and Implications

5.1 Conclusion

The presented research explored the different usage of AI in startups in Germany. To achieve this, Q-methodology was utilized for data collection, analysis, and interpretation. Findings show that there are many different views and practices regarding the usage of AI in startups. Among the 30 interviewed startups three factors could be extracted, these are “Dedicated Optimizer: AI boosts efficiency, legal and ethical concerns can be disregarded”, “Cautious Cost Saver: AI leads to cost-benefits but has risks of dependency and mistrust”, “Selective Enhancer: AI enhances operations and marketing, but is not a suitable search tool”. When comparing these factors, it is interesting, that all participants recognize the improvement of efficiency. According to insights from the interviews, some startups use AI to become more efficient in their daily operations, describing AI as a kind of robot that streamlines processes. Particularly, factor 2 focuses on the cost benefits, as participants in this factor anticipate that they won´t have to hire as many employees as startups did five years ago, thanks to AI.

In contrast, attitudes regarding AI in terms of ethical considerations and mistrust, vary among startups. Most participants reported that they use AI without thinking about ethical challenges, prioritizing the positive impact of AI. Furthermore, most participants claimed that they don´t let AI make a final decision. Every result of AI is checked by someone in the end. Therefore, ethical considerations are not ranked high.

It should be noted that statements highlighting the innovative nature of AI, such as “The utilization of AI extends to refining existing solutions or conceiving similar alternatives” and “AI plays an important role in the development of innovative and unforeseen solutions” are often placed in the middle of the distribution. This indicates that AI is primarily used to improve efficiency but plays a limited role in the innovative idea generation of startups. Participants stated that the creativity of AI is contingent upon human creativity, meaning it mainly supports humans in idea generation. Additionally, some participants mentioned that, so far, humans have been slightly more creative than AI, and that AI requires substantial information to generate appropriate ideas. Furthermore, one participant stated, that start-ups can be way more creative in talking to other people than in chatting with AI. Statements regarding the identification of customer needs were consistently ranked in the middle or negatively across all three factors. Participants commented that understanding customer needs is an area where direct interaction with real people is essential.

While existing research broadly sketches out the impact of AI on startups, this study delves deeper to reveal how German startups perceive and prioritize AI's capabilities. Both existing literature and our findings highlight AI's proficiency in automating and streamlining operations within startups. This reinforces the well-established value of AI in optimizing processes, saving time, and maximizing resources. However, this study unveils a key distinction from the literature's portrayal of AI as an innovation engine. Our findings suggest a more limited role for AI in generating groundbreaking ideas within German startups. Participants emphasized AI's role as a supporter of human creativity, underscoring the critical need for human-centric approaches. Furthermore, while the literature emphasizes the importance of ethical frameworks, the reality paints a different picture. Many startups prioritize the immediate benefits of AI, potentially overlooking the associated ethical challenges.

5.2 Practical Implications

This analysis and interpretation serve as basis for several practical implications. As operational efficiency thanks to AI is ranked continuously high in this study, it suggests that startups prioritize the optimization of their operational processes and resource utilization through AI implementations. Consequently, it underscores the significance of AI as a tool for reducing manual effort, and enhancing productivity, all of which are crucial for the success and sustainability of startups operating in competitive environments. Therefore, this finding emphasizes the practical importance of efficiency gains as a driving force behind AI adoption strategies among startups.

The finding that ethical considerations with AI are often overlooked by most startups implies a potential risk of neglecting ethical dimensions of AI. Consequently, there is a substantial risk of unintended consequences, such as biased algorithms or privacy violations, due to this lack of ethical oversight.

Participants highlighted that AI primarily supports, rather than replaces human creativity, suggesting that AI still plays a complementary role in the creative process. This suggests that while AI technologies can enhance the efficiency and effectiveness of idea generation processes, they are predominantly viewed as tools that support and facilitate human ingenuity, not as autonomous generating ideas. This underscores the importance of maintaining human agency and creativity in the innovation processes, even with the presence of AI capabilities. Startups should recognize the collaborative potential of human-AI interaction, leveraging AI tools to augment and amplify human creativity rather than supplanting it.

6. Limitations and Future Research Directions

While providing valuable insights into AI usage in startups, this study has limitations that affect interpretation and generalizability. Firstly, this study was constrained by its location-specific participants, as the insights derived from interviews with startups from Munich. This may limit the results and implications to the viewpoints of this region. Secondly, external factors beyond the scope of the study may have influenced participants' responses while assessing the use of AI in their startup. Current events, cultural shifts in the startup, or individual circumstances occurring during the study period may have shaped participants' perspectives in ways that were not fully captured.

Future research in this fast-paced field could explore several avenues to deepen our understanding of AI adoption in startups and its implications. First, a cross-cultural-comparison could be insightful. Comparing AI adoption practices and perceptions across diverse cultural contexts and exploring how cultural factors influence ethical considerations and innovation processes, could yield valuable insights for the global startup ecosystem. Furthermore, the impact of AI adoption on organizational culture warrants investigation. This could involve investigating how AI technologies shape values and practices within startups and identifying strategies to foster a culture of innovation and ethical responsibility in AI-driven environments. Moreover, analyzing startups that have successfully integrated AI into their operations could be highly beneficial. By scrutinizing the strategies, challenges, and outcomes of AI adoption in these cases, researchers can identify best practices and valuable lessons for other startups.

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The Emergence and Transformation of the Lithium-ion Battery Industry in Shenzhen

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Abstracts: This paper has charted the dynamic evolution of Shenzhen's lithium-ion battery (LiB) industry through four distinctive stages, thereby elucidating the complex interplay between industrial growth, policy interventions, and technological advancements. The framework illustrated not only the vital role of resource pool at each stage of the LiB industry's evolution but also underscored how shifts in industry trends reciprocally influenced the structure of resource pool. In the first stage, the nascent LiB in Shenzhen was driven by local companies, operating on a traditional manufacturing model based on public knowledge. It benefited from the urban development advantages of Shenzhen, including its strategic location, industrial structure, and supportive government policies, setting the stage for subsequent evolution. The second stage marked the formation of a comprehensive industry chain, encompassing both upstream and downstream sectors, driven by the increasing demand for LiBs and the proliferation of consumer electronics manufacturing in Shenzhen. The expansion was not just in capacity but also in the scope, fostering a more interconnected and resilient industry ecosystem. The third stage witnessed a strategic shift from low value-added consumer electronic batteries to high value-added power batteries, propelled by national policy guidance and increased R&D investments. This shift was crucial in transitioning from conventional consumer electronics batteries to more sophisticated and lucrative energy solutions for automotive and industrial uses. The current stage, the fourth, is characterized by continuous innovation, talent development, and an emphasis on synergistic innovation between universities and enterprises. The establishment of intermediary organizations helped to promote the integration of resources and standardized division of labour within the innovation ecosystem. Throughout these stages, Shenzhen's LiB industry has navigated through varying challenges and opportunities, demonstrating remarkable adaptability and resilience. The LiB industry has continually responded to changes in the resource pool, adjusting interaction mechanisms to catalyse growth and innovation. Meanwhile, transformations in the industry have informed resource pool establishments, creating a dynamic feedback loop.

Keywords: Lithium-ion Battery Industry, Innovation ecosystem, Industrial upgrading

1. Introduction

Shenzhen, a special economic zone in China, has been at the forefront of modern industrialization with its manufacturing industries playing a vital role in the city's economic growth over the last three decades. Recognizing the limitations of relying solely on low-skill, low value-added manufacturing for sustainable growth, both national and municipal governments have been driving economic restructuring and industrial upgrading since the 2000s. A prime example of this transformation is the rise of the LiB industry in Shenzhen.

Initially, in 2000, Japan dominated the global LiB market with a production of 500 million units, accounting for over 95%. By 2021, China's LiB industry had captured 60% of the global market, producing approximately 324 GWh, with Shenzhen contributing two-thirds of this output (Xu, 2022). This dramatic shift, where Shenzhen quickly caught up and surpassed Japan's long-held dominance within two decades, is considered an industrial miracle. The city's government played a crucial role by supporting high-tech enterprises, maintaining the manufacturing industry as the city's economic foundation, and innovating in investment attraction and resource allocation. As a result, Shenzhen's GDP surged from 0.22 trillion yuan in 2000 to 2.77 trillion yuan in 2020. Furthermore, among China's 139 listed LiB companies, 21 are based in Shenzhen, each with a market value over 10 billion yuan (Peng, 2023).

The success of Shenzhen's LiB industry can be analyzed through the lens of innovation ecosystems, which have evolved from traditional innovation systems research focusing on institutional roles to more dynamic, habitat-oriented models that emphasize evolution (Zeng et al., 2013). This ecosystem evolves through four stages: birth, expansion, leadership, and self-renewal (Chen et al., 2014; Moore, 1993). In its nascent stage, Shenzhen's LiB industry refined the "pioneer-followers model," integrating it with opportunity studies to map out the best strategies for value creation and market entry (Ardichvili et al., 2003). The expansion stage saw collaborative innovations that drove sustainable development and product upgrading within the industry (Humphrey et al., 2000). Rabelo and Bernus (2015) also noted that most attempts at building an innovation ecosystem fail, which makes the case of the LiB industry in Shenzhen even more interesting and unique. Thus, this paper explores the

competitive advantages and transmission mechanisms of Shenzhen's LiB industry from the perspectives of industrial upgrading and innovation ecosystems. It also investigates how this specific industry has built and sustained its innovation ecosystem in conjunction with its industrial upgrading models, offering unique insights into why some LiB enterprises succeed while others fail.

2. Literature Review

2.1 Industrial Upgrading

In 1998, Dieter Ernst first introduced the concept of industrial upgrading when he analyzed the successful experience of the development of the Korean electronics industry. By integrating international trade and industrial upgrading, Gereffi et al. (1999) defined industrial upgrading as "a process of improving the ability of a firm or an economy to move to more profitable and/or technologically sophisticated capital and skill-intensive economic niches". Afterward, the concept of global commodity chains has been gradually replaced by global value chains. Humphrey and Schmitz's study describes the three different phases of up-grading that industrial firms must undertake: channel upgrading, process upgrading, product upgrading, and functional upgrading.

2.2 Ecosystems Theory

An innovation ecosystem is a typical socioeconomic system that makes innovation happen (Fransman,2010). Business ecosystems are often based on geographical boundaries, and can be classified as local, regional, national, and international levels (Pombo-Juárez et al., 2017). In the regional level, Roundy (2017) introduced the concept of entrepreneurial ecosystems in small towns, with seven elements that constituted the ecosystems: capital, markets, networks, support, culture, finance, and politics. From a dynamic perspective, an ecosystem life-cycle model evolves in four distinct stages: emergence, expansion, leadership, and self-renewal (Chen et al., 2014; Moore, 1993).

Existing research on business ecosystems has been developed to explore mechanisms, structures, and strategic options in different industries and countries, but there are very few studies focused on Asian countries. (Rong et al., 2018). In the context of China, previous innovation ecosystems work in the field of sustainable development are mainly focused on new energy vehicles (NEVs) from a national perspective (e.g. Rong et al., 2017, Wu and Yang, 2018, Gong, 2023), while fewer are from a regional point of view (e.g. Shang and Shi, 2013). Since LiB is often passed over as part of NEV rather than being explored in depth, the emergence and transformation of LiB innovation ecosystem from a regional perspective is still worth researching.

2.3 LiB Product and Industry

A modern LiB is a materially complex, manufactured product designed for a particular end market rather than a fully fungible commodity. In terms of historical development, the initial theoretical breakthrough of LiB technology was accomplished by the United States in the 1950s, while the industrialization of LiB originated in Japan. In terms of production, Japan used to lead the world in mass production of LiB, but was later overtaken by South Korea (Gong, 2023). By 2015, China surpassed both South Korea and Japan to become the top exporter of LiB. Currently, China has been the single largest LiB producer for seven consecutive years. It is also the world's undisputed king of battery production, with Shenzhen has contributed to about 2/3 of the total national output.

3. Method

The data comes mainly from primary data based on field research and interviews, and secondary data based on third-party reports, company annual reports, media news, company websites and existing literature, and all data used are cross-validated to ensure authenticity. Furthermore, based on the single case analysis and cross case analysis, grounded theory is utilized to investigate the coevolutionary relationship between the upgrading pattern of Shenzhen's LiB industry and its innovation ecosystem. Additionally, Term Frequency-Inverse Document Frequency (TF-IDF) was used to extract keywords from news media data and create word clouds to validate the proposed developmental stage frameworks.

4. Case Study

4.1 A Case Study on BYD

The initiation of China's LiB industry began with BYD. The innovation of BYD's LiB business can be divided into three main phases.

4.1.1 Establishment and rapid expansion (1998-2002)

BYD commenced its journey in 1995 with nickel-cadmium batteries and entered the lithium-ion consumer battery market in 1998. By 2002, the company had established itself as a significant player, becoming the first Chinese LiB supplier to Motorola in 2000 and to Nokia in 2002. This period marked BYD's swift production scale-up and its initial forays into high-energy-density lithium-ion materials research, setting the foundation for future advancements.

4.1.2 NEVs and breakthroughs in power batteries (2003-2016)

Post-2003, following its acquisition of QinChuan Automobile, BYD intensified its focus on NEVs and power batteries. The company innovated with iron-phosphate and NCM LiB, launching its first iron-phosphate power battery in 2005. Significant public and private sector collaborations bolstered BYD's standing, particularly in Shenzhen, a city keen on establishing itself as a hub for electric vehicles and associated technologies. Strategic initiatives like the public transport electrification in Shenzhen underscored this phase.

4.1.3 Platformization and technological innovation (2017-Present)

Since 2017, BYD has sought external breakthroughs, accelerated its open supply system, and partnered with companies like Changan Automobile. The introduction of its "e-platform" in 2018 encapsulated various technologies, including power batteries and low-voltage control, in one system. BYD's strategic transition to a platform-based approach facilitated by an open and collaborative economic environment in Shenzhen led to significant milestones such as the unveiling of the highly safe "Blade Battery" in 2020, aimed at addressing safety concerns in the market.

4.2 A Case Study on Sunwoda

Sunwoda was established in Shenzhen in 1997 and is one of the earliest enterprises in China to engage in the LiB industry. Sunwoda's evolution in the LiB sector unfolds over three distinct phases.

4.2.1 Rapid development during China's "Golden Decade" of consumer electronics (1997-2008)

Established in 1997 in Shenzhen, Sunwoda quickly became a pioneer in China's LiB industry, embracing the mobile communications boom. Early successes included becoming a customized mobile battery producer for Konka in 1999 and entering the international market with Philips in 2003. By 2005, Sunwoda had formed significant partnerships with global giants like Haier and Lenovo, and by 2007, its battery modules were integrated into Apple's supply chain, marking significant industry penetration.

4.2.2 Establishment of power battery technology and revenue growth from consumer electronics batteries (2009-2018)

In 2009, Sunwoda established a power battery division, focusing on the design, development, and testing of power batteries. This period saw significant R&D advancements, supported by governmental projects and certifications. In 2011, Sunwoda’s power battery testing laboratory received CNAS accreditation, underscoring its dedication to cutting-edge technology and sustainability.

4.2.3 Full industry chain layout and development of an independent brand ecosystem (2019-Present)

Confronting fluctuations in raw material costs, Sunwoda strategically secured upstream mining interests to stabilize its supply chain. This era is defined by intensified R&D, driven by market needs and customer focus. Key achievements include becoming a battery supplier for Renault-Nissan in 2018 and initiating the development of high-performance solid-state batteries in 2016. By 2022, Sunwoda's role in developing a sophisticated battery industry chain ecosystem was acknowledged, with its intelligent battery manufacturing industry park recognized as a key project in Shenzhen's strategic "20+8" industrial clusters.

4.3 A Case Study on BAK

BAK's evolution in the LiB industry, marked by rapid growth and strategic shifts, can be summarized into three phases.

4.3.1 Expansion in consumer electronics batteries (2001-2007)

Established in Shenzhen in 2001, BAK rapidly became one of the top three lithium cell producers globally by 2005, challenging the dominance of Japanese giants like Sony and Sanyo. This period was characterized by aggressive production expansion to meet the booming demand for mobile batteries, with daily production

capacity reaching 500,000 units by 2003. Despite its rapid growth, the company initially lacked a focus on technological innovation and intellectual property, which it began to address in 2004 by establishing a post-doctoral workstation and a technical school, moving towards innovation-driven growth.

4.3.2 Industry position decline and power battery transition (2008-2014)

As one of China's pioneers in power batteries and lithium iron phosphate cells, BAK developed the first lithium iron phosphate battery in partnership with A123 in 2004. However, disagreements over technological direction led BAK to prioritize high-energy-density LiBs. Despite entering the power battery market in 2006 and establishing China's first automated 18650 battery cell production line, the company's lack of a distinct strategic focus resulted in a "me-too" strategy that ultimately did not translate into a leading market position.

4.3.3 Financial volatility and development of cylindrical power batteries (2015-Present)

With the resurgence of the NEVs market in 2015, BAK experienced a surge in capacity and sales, driven by capital inflow. The company focused on cylindrical batteries to diversify its applications beyond automotive to sectors like electric bikes and tools, mitigating financial risks. In 2021, BAK launched the large cylindrical 4680 battery, marking significant advances in performance, cost, and safety, and re-established its position in the high-end electric vehicle market.

4.4 A Case Study on OptimumNano

OptimumNano, established in Shenzhen in 2002, was one of China's earliest companies to successfully develop and mass-produce lithium iron phosphate batteries for NEVs. OptimumNano's journey can be segmented into two main phases:

4.4.1 Rapid growth period (2002-2016)

OptimumNano's founder, Li Yao, previously a senior manager at BYD, established OptimumNano in 2002. The company targeted bus companies and focused on developing, producing, and selling lithium iron phosphate power batteries. Despite early challenges in a nascent market, by 2006, OptimumNano gained recognition from the Shenzhen government as a "High-tech Enterprise" and began to significantly impact the market during the 2010 Shanghai World Expo as a technical supporter for electric buses. OptimumNano's growth continued with government support, allowing it to expand production and achieve large-scale applications.

4.4.2 Transition to power batteries and decline (2008-2019)

Initially, OptimumNano was among the first in China to engage in power battery production, including lithium iron phosphate cells. However, as the market shifted towards higher energy density batteries, OptimumNano's focus on lithium iron phosphate, known for its safety but lower energy density, became a disadvantage. Substantial changes in subsidy policies and market demands exacerbated financial strains, leading to bankruptcy in 2019. Despite attempts to innovate and adapt, OptimumNano struggled with technological shifts and market dynamics, ultimately unable to sustain its business under the changing landscape of China's NEVs policies.

5. Analysis and Discussion

5.1 Stage 1: 1998-2002

The early development of Shenzhen's LiB industry marked a significant advancement, primarily driven by local companies exploiting city-specific advantages and public knowledge. Located near Hong Kong, Shenzhen quickly became a key site for foreign investment and manufacturing, enhancing its manufacturing capabilities and positioning itself at the centre of the burgeoning mobile technology demand. This period saw local manufacturers like BYD leverage cost efficiencies and growing expertise to capture significant market opportunities.

Shenzhen's supportive policies towards technological innovation and entrepreneurship also played a crucial role in the industry’s development. The city's dynamic environment encouraged entrepreneurs like Wang Chuanfu of BYD to innovate and expand rapidly, despite high risks. This entrepreneurial spirit helped establish a robust business framework and spurred further industry participation.

At the enterprise and manufacturing capabilities from zero to one, uncertainty and high possibility of failure made electronics companies hesitate to enter this new industry, but with BYD being the first mover, its success gave them confidence promoting followers to identify business opportunities and offering reference for their business model design and market identification logic (Figure 1-1). Meanwhile, the commercial success of

follower companies reciprocally laid the foundation for Shenzhen to form a Lib industry cluster and enhanced the market loudness (Figure 1-2). Through collaborative R&D with end customers such as Nokia, this group of companies achieved domestic manufacturing of LiB in Shenzhen, fostering the initial development of an upstream and downstream industry chain.

In this phase, the financial support of the government for technological innovation became the early sources of operating capital for companies (Figure 1-3), while the direction of R&D was primarily driven by the market demands of end customers (Figure 1-4).

However, the initial innovation ecosystem was limited by the scant involvement of broader research institutions and venture capitals, which somewhat hindered potential growth and technological advances. Despite these challenges, the government, pioneering companies, and the resulting upstream and downstream supply chains have formed the minimum viable ecosystem for the LiB industry in Shenzhen (Adner,2013).

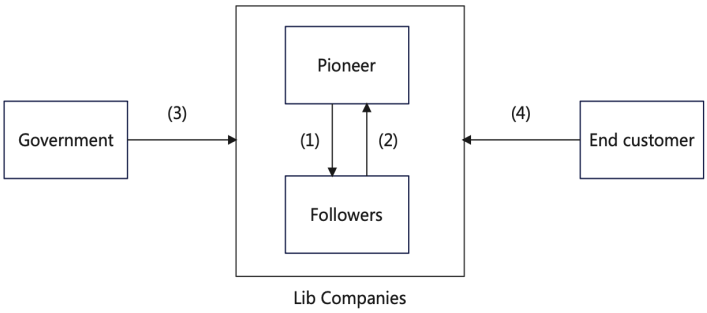


Figure 1: Interaction mechanisms in the first stage

5.2 Stage 2: 2003-2010

During this period, the demand for LiBs surged due to their widespread use in consumer electronics like mobile phones, digital cameras, gaming consoles, and laptops, further boosted by the introduction of 3G services in China in 2008. Shenzhen emerged as a major production hub for LiBs, benefitting from the growth in the consumer electronics sector (Figure 2-1). This demand led to increased LiB production and fostered collaborations between battery manufacturers and electronics companies, enhancing R&D in battery technology and stimulating growth in related sectors. This created a virtuous cycle that reinforced Shenzhen's role as a significant player in the global LiB market.

Simultaneously, Shenzhen developed a comprehensive LiB industry network encompassing manufacturing, materials, equipment, and recycling, supported by its prowess in applied electronics and information technology. This network facilitated further specialization in the LiB industry and the development of NEVs (Figure 2-2).

Another notable characteristic of this period was the formation of clustering bases for the LiB industry in Shenzhen, supported by government policies and funding (Figure 2-3). Meanwhile, LiB had become an important pillar industry in Shenzhen (Figure 2-4). However, the industry also faced challenges such as the proliferation of small-scale factories, inconsistent product quality, lack of coordinated planning, and a shortage of core technologies. Despite substantial local government support, national support was perceived as lacking, and Shenzhen-based companies were less involved in national forums or funding programs focused on new energy, compared to firms from other cities with stronger academic and research ties.

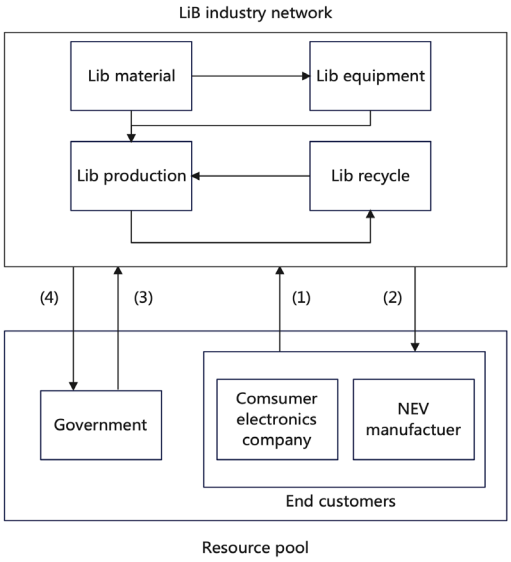


Figure 2: Interaction mechanisms in the second stage

5.3 Stage 3: 2011-2017

During this stage, Shenzhen's LiB industry has undergone significant transformation, upgrading from low value-added consumer electronic batteries to high value-added power batteries, facilitated by intensive research and development (Figure 3-1). This shift aligns with China's 2009 identification of the NEVs industry as one of its seven strategic emerging industries with substantial growth potential (Figure 3-2). Various regions, including Shenzhen, have endeavoured to develop their own power LiB production systems, leveraging their established strengths in consumer battery technologies (Figure 3-3). This early groundwork allowed Shenzhen to rapidly advance and take a leadership position in the power LiB sector (Figure 3-4).

As stated by Wang Mingwang (Ji, 2022), founder of Sunwoda, the transition to power batteries, despite its complexities in manufacturing, capital, human resources, and technology R&D, is a natural progression due to the similarities in the research and development systems of both consumer and power batteries (Figure 3-5).

Another key feature of this stage is the significant impact of national guidance and research support policies. National policies like subsidies for new energy have catalyzed the industry's evolution, leading to market differentiation and the exclusion of companies like OptimumNano that failed to meet high-end market criteria (Figure 3-6). Additionally, major national research projects have started aligning with Shenzhen's industry needs (Figure 3-7), as evidenced by the success of the "Graphite and Graphene Materials for High-Performance LiBs" project at Tsinghua University's Shenzhen campus, which underscores the region's advanced R&D capabilities under national policy guidance (Figure 3-8).

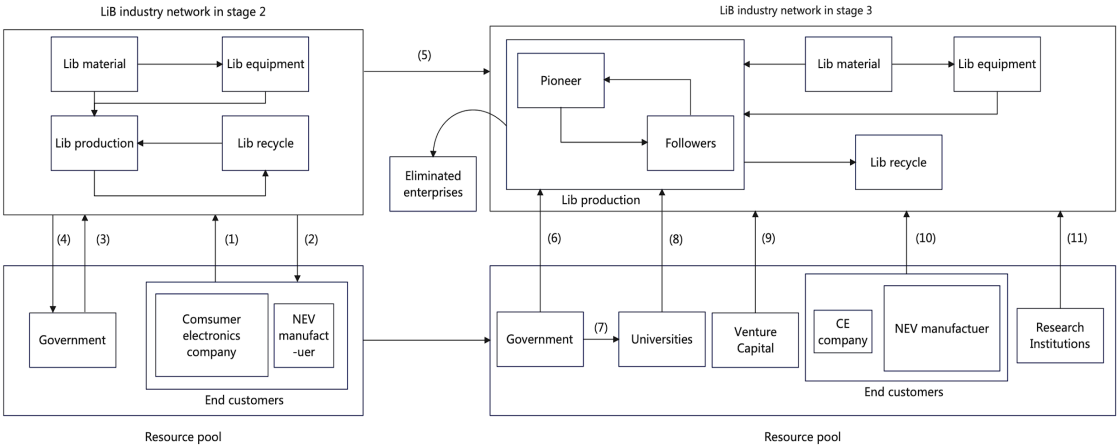


Figure 3: Interaction mechanisms in the third stage

5.4 Stage 4: 2018-Present

The rapid advancement of Shenzhen's LiB industry is largely due to technological breakthroughs and continuous innovation, facilitated by national regulations and local government efforts to attract and retain key talent (Figure 4-1). Shenzhen has become a hub for R&D in new energy and materials by creating favorable conditions for talent, which drives innovation in the LiB sector. As Ren Jianguo from BTR notes (Liang et al., 2019), retaining R&D headquarters in Shenzhen leverages its rich talent resources (Figure 4-2). The "Peacock Plan" by the Shenzhen government has successfully attracted high-level overseas talents, enhancing the city's innovation capacity, as seen with Dynanonic's establishment of a postdoctoral innovation practice base in 2021, offering tax-free subsidies to researchers (Figure 4-3).

Shenzhen has also improved its innovative talent management and professional title evaluation system, introducing a "LiB engineer" title in 2021 to support technical personnel needs in new technology fields (Figure 4-4). The phase marked a shift towards synergistic innovation between universities and enterprises, exemplified by collaborations like the Tsinghua-BYD Joint Laboratory and the establishment of the Shenzhen Battery Industry College in 2023 through partnerships among Shenzhen Polytechnic, the local battery industry association, and leading LiB enterprises (Figure 4-5). This "Shenzhen Model" provides technological support and assures talent for the LiB industry's development, creating a mature innovation ecosystem that standardizes talent cultivation and resource integration (Figure 4-6).

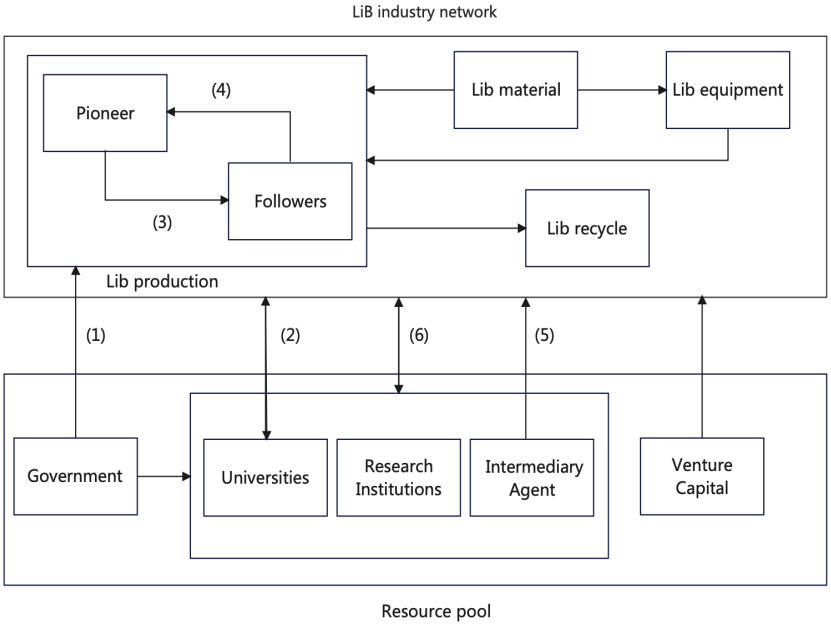


Figure 4: Interaction mechanisms in the fourth stage

5.5 Evidence from Social Media

In the initial phase of the LiBindustry in Shenzhen, keywords such as "BYD," "charging," "R&D," and "enterprise" prominently appeared in the word cloud. These terms highlighted BYD unveiling the development of the LiB industry in Shenzhen, establishing a foothold in the market through cost efficiencies and increasing expertise. This also indicates that in this phase, BYD's market leadership and pioneering role as a leading enterprise were significant.

In the second stage, keywords such as "consumer electronics" and "industry" saw a surge in demand for LiBs due to their widespread use in consumer electronics. The term "collaborations" signifies the growing partnerships between battery manufacturers and electronics companies. "Government policies" reflect the supportive measures that facilitated the formation of industry clusters and the establishment of Shenzhen as a major production hub for LiBs.

The third stage marks a transformation with the shift towards high value-added power batteries, as evidenced by keywords like "power batteries," "NEVs." The emphasis on "R&D" highlights the intensive research and development efforts that enabled Shenzhen to transition from consumer electronic batteries to power batteries.

This stage also underscores the importance of national guidance and research support policies in fostering market differentiation and technological advancements.

In the current stage, keywords such as "breakthroughs," "innovation," "talent," and "government" are prominent. These terms highlight the role of continuous innovation and the importance of attracting and retaining key talent in driving the industry's growth, signifies the ongoing technological advancements that have positioned Shenzhen as a hub for R&D in new energy and materials.

The longitudinal analysis of keywords across the four stages shows a clear progression in the focus areas of the LiB industry. Initially, the emphasis was on establishing manufacturing capabilities and early R&D efforts. As the industry matured, the focus shifted towards collaborative efforts, government support, and specialization in consumer electronics. The transition to power batteries marked a significant milestone, driven by national policies and intensive R&D. In the current stage, continuous innovation and talent attraction have become the primary drivers of growth.

Cross-sectionally, the word cloud of each stage provides a snapshot of the main themes at that time. In the early stages, companies primarily relied on government support to achieve initial success. The middle stages emphasized cooperation along the supply chain and strategic shifts toward new energy applications, while the later stages highlighted technological advancements and talent acquisition. The recurring themes of R&D, government support, and industry collaboration throughout the stages underscore the consistent factors that have driven the industry's evolution.

This evidence form social media clearly shows a picture of the Shenzhen's LiB industry during 1998 – 2023 and also supports the previously described 4 stages of it's development.



Figure 5: The word cloud for each stage

5.6 Discussion

The bankruptcy of OptimumNano highlights the dangers of over-reliance on government subsidies and unchecked rapid expansion, underscoring the need for sustainable, market-oriented business models. Similarly, BAK's experiences emphasize the importance of a flexible supply chain to maintain operations despite market fluctuations. Sunwoda's proactive approach in diversifying products and tapping into new market segments illustrates the benefits of adaptability in a rapidly changing market environment.

BAK's cautionary tale of premature investment without fully understanding market readiness also demonstrates the necessity of strategic and measured market entry and expansion. Companies must evaluate their capabilities and market conditions thoroughly before diving into new ventures and must consider timing their market entry to coincide with both product readiness and market demand maturity.

In Shenzhen's LiB innovation ecosystem, the roles of government and intermediary organizations have been crucial at different stages of development. Initially, the local government was instrumental in propelling the fledgling industry by offering financial incentives and policy support, which helped to attract businesses and foster innovation. As the industry matured, the local government facilitated the expansion of the industry value chain, while the national government played a pivotal role in steering the industry towards advanced battery technologies with strategic policies and support for research and development.

Intermediary organizations emerged as vital components in later stages, acting as facilitators that connected various stakeholders within the ecosystem, including government bodies, universities, and businesses. They

provided platforms for knowledge exchange, business cooperation, and industry promotion, helping to integrate resources and drive innovation. These organizations filled crucial gaps in the ecosystem, especially as the industry evolved towards more standardization and continuous innovation, highlighting the importance of collaborative networks in sustaining industry growth, and fostering a competitive market environment.

6. Conclusion

Over the past few decades, Shenzhen's LiB industry has undergone significant evolution, driven by government policies, market dynamics, talent development, and continuous innovation. Initially, from 1998 to 2002, the industry benefited from Shenzhen's strong manufacturing base and government support for technological innovation, establishing a foundation centred on local business-driven manufacturing.

From 2003 to 2010, the LiB industry saw substantial growth due to rising demand in consumer electronics, supported by both local government initiatives and private sector market forces. However, this period also revealed challenges such as product homogeneity and a shortage of core technologies, highlighting the need for more strategic national support.

Between 2011 and 2017, the industry experienced a significant transformation, shifting from low to high value-added power batteries. This shift was marked by an alignment of national research resources with Shenzhen's burgeoning R&D capabilities, moving the industry towards more active, company-led innovation and establishing Shenzhen as a leader in China’s LiB sector.

Since 2018, the industry has been characterized by technological breakthroughs and strategic talent acquisition. Government initiatives like the "Peacock Plan" have bolstered Shenzhen as an R&D hub, with enhanced collaboration between universities and enterprises leading to the formation of key educational and research institutions. This has standardized interaction within the industry’s innovation ecosystem and facilitated resource integration, signalling the industry's move towards maturity.

This analysis provides an analytical framework for understanding the dynamic interaction between the industry’s development and the resource pool, illustrating how changes in one can reciprocally influence the other, thereby fostering a cycle of growth and innovation.

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Exploring the Potential of AI to Increase Productivity in Small Marketing Teams

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Abstract: Marketing scientists as well as practitioners believe that artificial intelligence (AI) holds the promise of productivity gains for organizations. However, there has been little scientific research into these theories. This study investigates the role of AI in enhancing marketing productivity, deriving insights from a case study conducted with the marketing team of an industrial software start-up. Drawing upon Case Study Analysis by Yin (2018) and Participatory Action Research by Kemmis and McTaggart (2007), the study employs a combination of survey interviews, AI tool research and AI tool testings. Key findings indicate that productivity gains are more likely than productivity impairments with the use of marketing AI tools. This effect is even stronger when knowledge workers possess high levels of AI skills and utilize AI tools with suitable capabilities. Having closely analyzed six marketing disciplines, particularly SEO / content and design demonstrated significant productivity gains including generative AI (GAI) tools the team already subscribed to like ChatGPT 4 and Canva, but also new AI solutions. While an AI tool's level of integration only showed a weak positive productivity impact, future studies are suggested to further investigate this variable by comparing the effects of less advanced but more accessible tools like generative AI versus highly advanced, but less accessible business AI. Having navigated the vast and dynamic landscape of AI tools, insights further emphasize the importance of AI experience sharing and informed decision-making, implying knowledge of own user rights and always staying updated on AI advancements. Zooming out from process level, the work's literature review further highlights the role of environmental and organizational AI enablers, like budget allocation, fostering AI trust and mindset, but also implementing AI routines and responsibilities. Overall, this research underscores the imperative for companies, especially startups and SMEs, to explore AI technology as a means to enhance productivity and gain a competitive edge.

Keywords: Artificial Intelligence, Large language model, ChatGPT, Case study, Marketing productivity

1. The Interest of (Small) Businesses in AI

AI seems to be of substantial value for businesses – not only from a product perspective, but also a productivity perspective. The OECD describes *productivity* as "ratio between the volume of output and the volume of inputs" (OECD iLibrary, no date). What makes studying AI's impact on productivity so relevant, is the aim of countries, companies and our analyzed startup case to improve business productivity by optimizing their relation of input factors like HR, time and costs, and output factors, namely high quality and quantity results and, eventually, turnover. Further, the investigated startup has gone through layoffs resulting in a HR decrease of 30 % company-wide and 60 % within the marketing team down to three employees. So while input resources were extensively cut, the start-up did not want to accept equally high marketing output losses. One answer to this situation was the use of AI tools in daily operations.

Late studies confirm how input and output aspects of productivity drive AI adoption: IBM (2022) finds that 42 % of companies worldwide adopt AI because they want to reduce costs, Salesforce (2023) evaluates marketing time savings through AI of roughly 32.5 days per year, and Dell'Acqua et al (2023) show how consultants who were using ChatGPT produced 40 % higher quality results than those who did not. According to Chui et al (2023), such effects are especially high in marketing and sales, where the use of generative AI (GAI) has the potential to generate $760 to $1,200 billion in value – significantly more than other functions such as customer operations ($340 to $470 billion) ranking second, and R&D ($230 to $420 billion) ranking third. With such productivity potential and a general AI hype, it is no wonder AI adoption rates among marketing teams go up to 87 %.

As to the latter, SMEs or startups, indeed show lower AI adoption rates between 26 % and 36 % than bigger companies (Constant Contact, 2023; Unbounce, 2022). Despite a generally high interest of SMEs in adopting AI amounting to 74 %, their top concerns are data security (44 %), high costs to implement AI (41 %) and that it would take too much time to learn or adopt it (33 %), as Unbounce's survey of 486 US American SME managers with less than 250 employees showed. This brings up, what can be called an *AI dilemma of smaller companies* and teams: Those who are in biggest need of AI productivity effects have the least resources and higher constraints to adopt it, which again holds back their potential for growth and more sophisticated AI. So while AI could, in the long run, free up much time and thus save personal and financial resources, there must be an initial

minimum investment to implement and educate on the technology. SMEs must take on this debt before they can benefit sustainably from AI. This explicitly applies to more integrated and costly business AI, but does not exclude less integrated GAI tools, which are a good starting point for SMEs as they are usually free or inexpensive, user-friendly, accessible, and have many use cases.

Mirroring the status quo of the analyzed startup, the following research question was posed:

RQ: How does Artificial Intelligence influence productivity in small marketing teams?

To answer this question along with the marketing team of an industrial software startup, an explorative, embedded Single Case Study by Robert Yin (2018) was performed. This includes an initial literature review which supported the derivation of propositions to guide the study and answer the research question. Then, data was collected by conducting semi-standardized survey interviews with each marketer. Based on these interview evaluations and requested 'AI tickets', AI tools were then researched, tested and presented to the team in nine meetings for a period of three months in orientation to the PAR method by Kemmis and McTaggart (2007). Eventually, all data sets including the interviews and AI tool testings were merged in a triangulating manner resulting in 20 practical implications. Lastly, based on these results and literature insights, an AI White Board was created to help the startup and other small (marketing) teams leverage AI for productivity gains in the future.

2. Theoretical Background

2.1 AI Productivity Potential on Organizational and Process Level

Literature has different answers to how marketing or more broadly business productivity can be increased using AI. Starting on organizational level, a number of scientists highlight the *requirements* teams must fulfill to successfully adopt AI. So do Enholm et al (2022) in their TOE framework theorize how technological enablers (data and technology infrastructure), organizational enablers (top management support, organizational readiness, culture, employee AI trust, AI strategy and tech-task-compatibility), and environmental enablers (ethical and moral aspects, regulations and environmental pressure) will lead AI to positive productivity effects.

At process level, hands-on recommendations are made by practice: Kaput (2021) defines steps on how marketing teams can systematically *find performant AI tools*: Firstly, teams must evaluate their use cases such as 'create blog post', 'create newsletter' etc. Out of all use cases, one should be picked, e.g. 'create blog post', which then must be broken down into many steps, e.g. brainstorm topics, pick topics that perform, build an editorial calendar etc. Turned to keywords, one can then research AI provider's websites, AI tool review pages and articles. The next step involves testing the most interesting tools by registering online, signing up for demos or waitlists and, lastly, building an AI strategy for the chosen tool/s including budget allocation and a rollout with all stakeholders.

There further exist several guidelines on *how to prompt* in order to quickly receive high quality output e.g. by Bozkurt and Sharma (2023) who define ten rules to consider when prompting: (i) define the objective, (ii) understand the model's capabilities, (iii) be clear and concise, (iv) provide context, (v) provide examples, (vi) fine-tune, optimize and debug, (vii) specify the format, (viii) include key details, (ix) test and iterate, and (x) consider safety and ethics. But also instructions by the most used and known providers like OpenAI and Google can and should be trusted, as they pass on even more detailed and technical tips such as "use delimiters to indicate distinct parts of the input", "specify each step required to complete a task", or "ask the model if it missed anything on previous passes" (OpenAI, no date).

What moreover supports AI to unleash its productivity potential is a proper *setup of the AI tools* themselves (MacDonald and Harris, 2024). This includes (i) making use of a shared prompt library to apply or copy and paste prompts, (ii) feeding the document library or 'custom instructions' with data on the company, target group, content samples, past campaigns and corporate design, (iii) including approval flows ensuring generated content gets checked e.g. on biases, and (iv), if relevant, security suites to keep content private before publishing. If wished, teams should further make use of the possibility of (v) setting up time frames for prompt auto-deletion, and (vi) opting out of data processing.

These last two settings would not exist in many AI tools, if *privacy laws* like the GDPR (2022) and the CCPA (State of California, 2023) did not defend user rights, hence, knowing of them is key when using AI. In accordance with these two laws, and considering the data privacy terms of the biggest AI providers, in the present study the researchers made sure the following legal aspects were covered when checking out AI tool websites: (i) tools have privacy policies, data protection terms or FAQs, (ii) offer information on how long data is stored, ideally

not exceeding three months, (iii) comply with known data privacy regulations, (iv) show user access controls on how prompts can be deleted, or data storage be refused, (v) encrypt data before processing or when in transit, and (vi) show data ownership (e.g. that data was shared with LLM providers like OpenAI).

2.2 How the Technology Influences AI Productivity Potential

Taking the technology's perspective, it is sensible looking at the different *types of AI tools* and how their characteristics impact productivity. As to Davenport et al (2021), the level of intelligence decides whether a tool uses 'only' automation as the least intelligent type of AI, or machine learning as the most intelligent type of AI. The second dimension on their 'Four kinds of marketing AI' matrix is the level of integration, differentiating between isolated and integrated tools. Process-wise, marketing teams would start with the first cluster of "stand-alone task automation tools" and gradually implement more intelligent and more integrated AI tools until the fourth cluster of "integrated machine learning apps" is reached "which has the potential to create the most value" (Davenport et al, 2021) and was, hence, considered for proposition 5.

A much more prevalent categorization of AI, however, is the one into generative AI (GAI) and non-GAI. Susarla et al (2023) define GAI as "a category of AI systems capable of creating apparently new content through text, images, or other forms of media". Little and Lucas (2023) delimit non-GAI or 'classical AI' as "the subset of AI models that does not generate new content but rather focuses on tasks such as classification, recognition, and prediction". So while the ability to quickly generate content holds great productivity potential for marketing teams, non-GAI is still critical for key tasks like analysis (e.g. sentiment or KPI analysis) or personalization (e.g. ad targeting or customer segmentation in CRM systems). In an interview for onlinemarketing.de, Dr. Markus Wübben, who has been involved with AI in businesses since the 1990s, has a clear opinion on the value of GAI and non-GAI, stating: "By the way, AI-supported data analysis and decision optimization ultimately determine the success of a campaign far more than the AI-generated visuals and ad texts, I'm sure of that. So if companies are planning to use AI, they should never equate AI with ChatGPT or other generative tools – business AI is in a completely different league." (Lewanczik, 2023).

Besides different levels of integration and intelligence, also the *capabilities of an AI* were shown to positively impact productivity effects. Having 758 consultants execute easier and more difficult tasks with and without AI, Dell'Acqua et al (2023) found that easier tasks were 40 % better and 25 % faster solved by the consultants who were supported by AI, whereas the more complex tasks were better off without AI, as consultants using AI were 19 % less likely to produce correct solutions. Hence they figured that AI indeed has the potential to improve productivity, but the degree depends on the AI tool's capabilities, which for some tasks are higher and for others lower. Moreover, Bozkurt and Sharma's (2023) second rule for prompting is 'understand the model's capabilities'. According to them, familiarizing oneself with the AI's strengths, limitations, and the types of queries it performs well on, helps crafting prompts that align with the model's expertise.

2.3 How Users Influence AI Productivity Potential

Moving away from the technology's expertise towards the *user's expertise*, Dell'Acqua et al (2023) further found that less experienced consultants increased their performance with the use of AI to 43 %, whereas more skilled worker's performance with AI only increased by 17 %. This is consistent with the findings of an online experiment by MIT researchers Noy and Zhang (2023). They evaluate that with the help of ChatGPT, writing professionals who received a low grade on a first writing task increased in grades and decreased in time spent on a second task, while workers who initially received a high grade only maintained their grade level.

Further, different AI productivity studies place emphasis on the variable *'AI skills'*. Different from the variable 'personal expertise' which refers to a worker's operational abilities for tasks, 'AI skills' investigates a workers abilities in working with and getting the most of AI tools. Whereas several studies found that employees are concerned of not having enough AI skills or time to acquire them (Constant Contact, 2023; Salesforce, 2023; Wamba-Taguimdje et al, 2020), other studies support such concerns suggesting that today's executives and leaders in fact expect their employees to assess AI skills. For instance, EdX (2023) concludes that 87 % of 800 US C-level managers say they have a hard time acquiring talent with AI skills while 79 % are worried of being unprepared for the future of work, if employees do not improve AI skills. Such skills can be prompting skills and knowing where to add custom instructions, but also knowing how to double-check LLM answers (talking 'explainable AI') or to recognize and avoid biased output (talking 'responsible AI'). While acquiring such skills seems doable, dealing with more integrated machine learning requires data maintenance skills e.g. for deduplication or data enrichment that marketers might find more challenging.

In accordance with the literature presented, the following propositions were posed:

Table 1: Research propositions derived from literature

	Propositions
P1	There is a higher potential to *increase productivity* than to decrease it via AI.
P2	The lower the *user's expertise* for a task, the higher the productivity gains via AI.
P3	The higher the *user's AI skills*, the higher the productivity gains via AI.
P4	The higher the *AI's capabilities* for a task, the higher the productivity gains.
P5	The more *intelligent and integrated* an AI is, the higher the productivity gains.

3. Methodology: Yin's (2018) Case Study and Kemmis and McTaggart's (2007) PAR

To answer the research question, an explorative, embedded single case study (type) was conducted on how AI influences productivity (phenomenon) for the different tasks (analysis unit) of a startup's marketing team (case) influenced by selected AI context factors (propositions), as can be seen in figure 1.

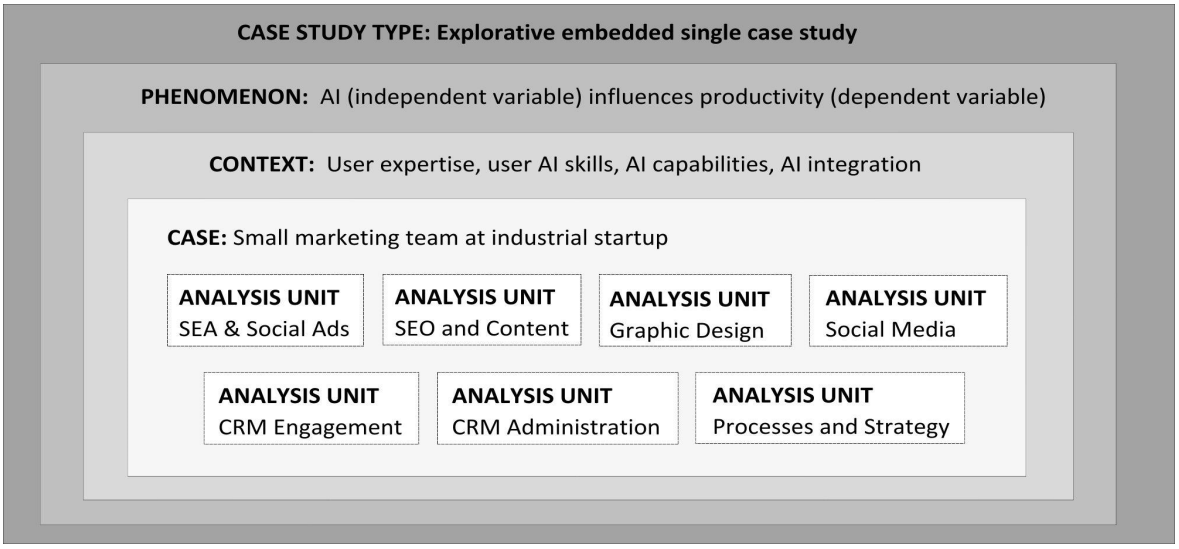


Figure 1: The research design – Components of the embedded single case study based on Yin (2018)

After the 'research design' was set up in step one of the case study, step two involved the 'preparation of data collection' and with that the creation of an Asana Board that acted as case study protocol and database. It helped showing the course of the study and important deadlines for both researchers and participants e.g. when the next AI tool presentation happens or until when the survey interviews should be returned. During step three, the 'collection of data', the Asana board supported the participants in handing in 'AI tickets' such as titled "AI to help design the perfect sign-up page" or "AI transcribing and summarizing meetings". This way, participants could describe marketing issues which the researchers would then seek AI tools for, test them and evaluate their productivity potential by commenting on the Asana task or during the 'Weekly AI updates'. Further marketing issues were collected from the answers of three survey interviews conducted with all participants.

In accordance with the method of Participatory Action Research (PAR) by Kemmis and McTaggart (2007), the data collection in step three happened in a collective and interactive, reflexive and action-oriented manner between researchers and participants. The method holds "the belief that those who are most impacted by research should be the ones taking the lead in framing the questions, the design, methods, and the modes of analysis of such research projects" (Torre, 2009). PAR is originally grounded in social justice and critical theory (e.g. feminist or indigenous perspectives) which aims to actively include minorities into research to challenge power dynamics for positive change. While the startup marketing team is neither an oppressed group within the company, nor suffering from top-down-management, it is the idea of "bring[ing] people together to learn from each other's experiences" (Kemmis and McTaggart, 2007), which appeals to the present case. In this context, the PAR's 'spiral of self-reflective cycles', as shown in figure 2 and adopted during the whole data collection period, suits this case study very well.

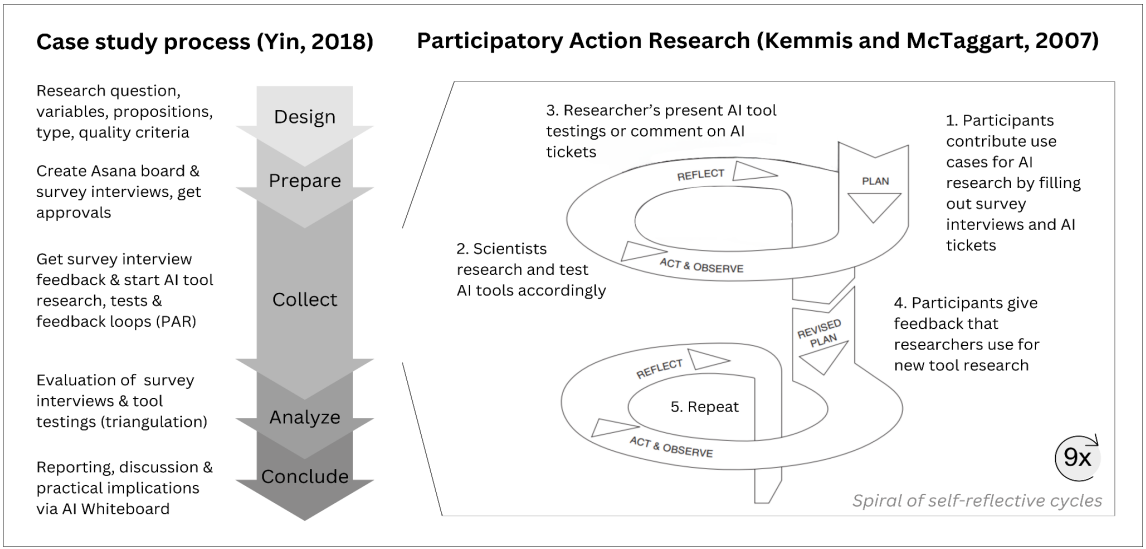


Figure 2: Overview of the case study process

After three months of data collection, in step four of the case study the sources of evidence were analyzed along all five propositions and in a triangulating manner to pay tribute to the quality criteria of qualitative research. Eventually, these insights then were reported, discussed and translated into 20 practical implications as well as a proposal of an AI board for small (marketing) teams to use for their purposes.

4. Research Results

The evaluation of the three survey interviews showed that respondents saw the highest urge for productivity gains through AI in graphic design, SEO / content, and processes / strategy. Accordingly, most AI tools were researched in these analysis units. The following table, on the one side, visualizes selected issues and use cases that participants mentioned in three survey interviews and 21 AI tickets. On the other side, based on all 49 AI tool testings and 22 tools that were more closely checked out but not tested, the researchers propose promising AI solutions rated with a high productivity score of 3, 4 or 5 out of 5 including suggestions from literature. In the tool research process, AI features, apps or extensions of tools which the start-up already uses like Notion, HubSpot, Canva, Slack, Wordpress or Google Workspaces were preferred towards new tools. Furthermore, review websites such as thereisanaiforthat.com and AI newsletters like the one from the Marketing AI institute supported a mostly search engine driven research via Google.

Table 2: Selected AI issues and solutions as derived from survey interviews, AI tickets and AI tool testings

Issues: Input from survey interviews & AI tickets	**Solutions: Promising tool testings & literature**
Interview: "I am pretty sure that they [*data*] are not used for training the model itself"	Legal education: This statement was proven wrong as the data privacy terms of OpenAI and Google showed
Interview: "the first *prompt* doesn't work, you edit it, but results are not getting any better"(prompting trap)	Prompting practice and education (e.g. Bozkurt and Sharma, 2023; OpenAI, no date)
Interview: "It's harder to get great *German language texts*."	Neuroflash or Mindverse (also trained on German datasets); GPT4 prompt "take care of natural German"
Interview: "they struggle with creating correct in-depth metal-*industry specific content*"	Create a customized GPT in ChatGPT 4, that answers technical questions like expert colleagues ('NateGPT')
Design ticket: "Create quicker and better videos"	Text-to-speech: Canva apps 'Voiceover' for natural overlays or 'Deepreal' for realistic, speaking avatars URL-to-video: Pictory (uses stock images & page text) Video-to-shorts: VidyoAI (5 shorts from 1 video)

Issues: Input from survey interviews & AI tickets	**Solutions: Promising tool testings & literature**
SEO/SEA ticket: “automate keyword clusterization”	GPTs like Keyword Clustering GPT by juliangoldie.com
CRM Administration ticket: “deduplicate CRM records”	HubSpot marketplace apps like Koalify, or integrated deduplication features in HubSpot
Process ticket: “summarize communication channels”	Slack AI (announced, not yet in-app), Spoke.AI for Slack and bundling channels (public beta available)
CRM Engagement ticket.: “AI to calculate & automate newsletter sendings for each contact’s optimal sending time”	HubSpot app ‘Email delivery optimization’

Besides this list of promising AI solutions, there were 13 solutions with a score of 1 or 2 out of 5 considered rather lowering productivity. For example, did the three LLMs with search engine access ChatGPT 4, Microsoft Copilot and Google Gemini perform similarly poorly, when asked to generate short, up-to-date news of the German metal industry for Q1 2024. Either the output was referring to the wrong time frame or the attached sources were outdated or irrelevant. Another tool which seemed promising, but disappointed is ChatSpot. Intended to act as LLM for the CRM System HubSpot, unfortunately it is not yet capable of executing prompts such as “Which 10 companies opened our newsletters most often the past 30 days?” reliably.

Ultimately, with regard to the propositions of the survey, P1 can rather be supported. Even though in the survey interviews respondents only rated productivity gains through AI with a 6 out of 10, the tool testings painted a brighter picture as the majority of testings resulted in productivity gains instead of impairments. While the analysis units Design and Content / SEO profited the most of mostly GAI tools with productivity scores of each 4 out of 5, CRM administration tools usually consisting of non-GAI tools showed the lowest productivity potential with 2 out of 5 productivity points.

Also P2, which suggests that higher AI skills improve productivity can rather be supported. Though in the survey interviews respondents were rather confident that, besides AI struggles, they do not need extra AI training, the majority of tool testings showed that AI education leads to more and better results - may it be due to prompting skills in GAI tools or being able to quickly navigate in more complex non-GAI tools.

The impact of general expertise as stated in P3 was harder to be proven in this context. Insights here are mixed. On the one hand, people with a high experience in their field of expertise profited more from AI, as they know which task-specific problems need to be solved in what way by an AI. On the other hand, less experienced people benefit from AI tools as they can help solve tasks better and faster. For example, ChatGPT 4 saved the coding-inexperienced researchers a lot of time when trying to create HTML email templates. Nonetheless, general expertise is nothing that, for the perks of AI, should be actively tackled, but rather it is a moderating factor with differing effects.

Switching from the user’s to the technology’s perspective, AI indeed for some use cases shows higher capabilities than for others which accordingly influences productivity and therefore supports P4. Thus, users should learn which kind of tools have what kind of capabilities for which tasks, and which do not. For example, remembering that the big LLMs are simply not (yet) able to give trustable news content, or that CRM LLMs like ChatSpot are not (yet) able to answer or execute prompts with CRM data, can already save a lot of time.

Lastly with regard to P5, the level of intelligence and integration of AI tools does not seem to matter much for small marketing teams as data heavy tools like the HubSpot CRM, Asana or ChatSpot and their AI features were not automatically more performant. Though much potential is seen in integrated tools that machine-learn from huge amounts of internal data, their execution is on many levels – especially regarding data quality, time, costs, expertise – much more difficult than simply using less integrated tools, which often happen to be GAI tools.

5. Limitations and Future Work

Though the exploratory case study approach was a suitable choice for the case and researcher’s resources, it came with limitations. Firstly, the method requires many different sources of evidence for triangulation and reliable results. While the researchers considered adding a ChatGPT4 analysis of all prompt inputs and AI outputs for a month, this idea was soon rejected for different reasons. Though some LLM tool testings consisted of

analyzing prompts, adding a more extensive standardized prompt analysis would have enriched the results even more.

Following on here, one could criticize that, despite the collaborative PAR method, AI tool testings were mostly up to the researchers. Future works would profit even more from PAR's ideas of collective learning, if AI tool testings were distributed more across all participants. This way, the Weekly AI Updates could have been presented by another person each week.

Further criticizable is the small sample size of participants. Though semi-structured interviews were all the more extensive and in-depth, it was not possible to cover all analysis units. For example, one social media interview was missing due to the researcher not having attended, and the input of designers who were dismissed before. At least, thanks to the work's multi-method approach, this social media and design gap could be filled through respective tool testings.

Furthermore, besides extensive testing of GAI tools, the present study could just to a limited degree test more integrated, often non-GAI, like ChatSpot, or HubSpot Marketplace apps. Also, literature and news coverage on integrated AI is scarce which lead participants to not even seeing this kind of AI as noticed in the survey interviews. Therefore, future studies should more often research on marketing use cases like predictive analytics, segmentation and personalization, that can just hardly be covered by GAI tools like ChatGPT.

6. Practical Implications and Conclusion

The question of how AI can increase productivity in small marketing teams is an extensive one. This qualitative case study represents an approach to systematically tackle project AI. Insights were generated not only in the data analysis phase, but throughout the entire course of the case study. Based on all findings, 20 implications were documented as part of an AI whiteboard, which is intended as a practical guide for SMEs as visible in figure 3.



Figure 3: AI Whiteboard for SMEss for orientation and adaption

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Work in Progress Papers

Digital Work Instructions in Sheltered Workshops

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Abstract: This research-in-progress explores the impact of digital work instructions (DWI) in sheltered workshops, environments designed to provide employment opportunities for individuals with disabilities. The research commenced with a literature review on studies that compared digital to paper-based instructions. The review highlighted several potential benefits of DWI. Next, semi-structured interviews were conducted with C-level managers of sheltered workshops who are early adopters of DWI technologies. The interview findings provided real-world insights into the application of DWI in sheltered workshops, confirming several benefits identified in the literature. Notably, enhancements were observed in rapid interpretation of instructions, reduced training duration, increased employee autonomy, fewer execution errors, and a diminished need for prior knowledge. Future research steps include a second round of semi-structured interviews and a focus group to validate and synthesize the findings.

Keywords: Digital work instructions, Sheltered workshops, Disabled workers, Assembly processes

1. Introduction

Incorporating individuals with disabilities into meaningful and productive employment remains critical, yet challenging due to diverse impairments. Sheltered workshops play a pivotal role in facilitating this inclusion by customizing work processes tailored to individual needs and capabilities. Such setups help balance productivity with inclusivity, addressing the specific needs of disabled workers to foster their participation in the workforce (Bächler & Behrendt 2023).

In recent times, the complexity of assembly processes in manufacturing has escalated significantly due to the trend toward mass customization (Leder et al. 2023), a challenge that also extends to sheltered workshops. Therefore, the demand for context-aware assistance systems has surged. These systems are crucial in offering cognitive support and guiding workers through their tasks, improving workflow efficiency. Traditional paper-based instructions often create a complicated correlation between directions and actions. By adopting digital work instructions (DWI), these challenges can be significantly alleviated, simplifying processes and enhancing productivity (Pimminger, Neumayr, Panholzer, Augstein & Kurschl 2020).

This work-in-progress reports on the preliminary findings of a DWI project in Flanders, Belgium. The research investigates DWI in sheltered workshops and compares them to their paper-based counterparts. It concerns a comprehensive project that is funded by Flanders Innovation and Entrepreneurship, consisting of several work packages and objectives. The project focuses on a technology scan, DWI competencies for individuals with disabilities, experimental setups, and implementation strategies. The present paper discusses the implementation and implications at the organizational level. An in-depth discussion of the available technologies, effects at the individual level, and experimental results is out of scope.

This research project contributes to the exploration of the multifaceted impacts of digital innovation. More concretely, DWI can be analyzed within the framework of the Triple Bottom Line (TBL) (Elkington 1999), including economic, social, and environmental sustainability. Economically, the project investigates how DWI can streamline manufacturing processes, potentially reducing production times, decreasing costs, and enhancing output, thereby improving overall operational efficiency. Socially, the focus is on the implementation of these digital systems in sheltered workshops, examining their role in creating meaningful and economically beneficial employment opportunities for individuals with disabilities. Environmentally, the research extends beyond the mere reduction of paper use. It can uncover how DWI can lead to more

sustainable practices by pinpointing and diminishing inefficiencies in the consumption of energy, water, and raw materials, thereby fostering a smaller ecological footprint.

2. Methods

We aim to explore the employment of DWI within sheltered workshops. To the best of our knowledge, this area has received limited academic attention. To address this gap, we will employ a multi-faceted approach, beginning with a literature review. Because we are not aware of research on DWI in sheltered workshops, academic publications on DWI in mainstream industries will serve as a foundational framework. The rationale is that insights from experiments conducted within regular companies might offer valuable perspectives for the applications and benefits of DWI within sheltered workshops.

To further enrich our understanding of DWI implementation and its effects, we will proceed with semi-structured interviews. This first round of interviews targets early adopters which we define as sheltered workshops that currently have operational activities relying on DWI. As these sheltered workshops have experience with DWI, it will allow us to validate and corroborate the findings obtained from the literature review. Moreover, we might also capture insights and perspectives that extend beyond the scope of existing academic literature.

Next, we will proceed with a second round of semi-structured interviews targeting sheltered workplaces that are participating in the experiments within this research project. Distinguishing them from the first group, these workplaces have not yet commenced operational activities with DWI. Instead, their experience is solely based on their participation in experimental trials. Despite not having operational activities with DWI, we posit that their engagement in the experiments equips them with valuable insights and perspectives regarding the implementation and potential effects.

Finally, we will convene a focus group as the final step of our methodology. Building upon the insights gleaned from the literature review and the semi-structured interviews with two groups of sheltered workplaces (i.e., respectively operational experience and experimental experience), the focus group serves as a platform for comprehensive validation and synthesis of our research findings.

3. Preliminary Findings

This research-in-progress includes the literature review and the first round of semi-structured interviews. The second round of semi-structured interviews and the focus group were not completed yet.

3.1 Literature Review

A literature review was conducted to assess the impact of DWI as compared to traditional paper-based methods. Utilizing the SCOPUS database, a targeted search was performed using the term "digital work instructions", yielding 36 scientific studies. Conforming the research objective, only those studies that explicitly compared digital and paper-based work instructions were included. This refinement process led to the exclusion of 28 studies, resulting in a core set of eight academic contributions. Notably, all identified studies were conducted within the regular economy; none were carried out in sheltered workshops. The technologies deployed in these studies varied, including AR headsets, AR projections, touchscreens, and monitors. They focused predominantly on assembly tasks across diverse industries such as machinery, automotive, and aerospace. Each study was examined to extract the potential effects of DWI. The findings are synthesized in Table 1, which lists the effects identified from each article. For each study, the observed effects are indicated with an “X”. The absence of an "X" does not necessarily imply the contrary; it could simply indicate that the potential effect was beyond the scope of the study.

Table 1: Effects of DWI compared to paper-based instructions identified in academic literature

	(Gors et al. 2021)	(Leder et al. 2023)	(Li et al. 2018)	(Lotsaris et al. 2021)	(Papetti et al. 2023)	(Pimminger et al. 2020)	(Yang et al. 2023)	(Zogopoulos et al. 2022)
Accelerated creation of instructions	X							
Enhanced adherence to instructions						X		
Accelerated execution				X	X	X	X	
Improved user experience				X	X			
Accelerated interpretation							X	
Improved retention							X	
Accelerated training processes		X				X		
More objective training		X				X		
Facilitated management of diverse production			X					
Reduced perceived workload			X					
Increased employee autonomy	X							X
Reduction in execution errors	X			X	X			X
Enhanced employee confidence				X				
Reduced requirement for prior knowledge	X							X

3.2 Semi-Structured Interviews (Round 1)

Following the literature review, a series of semi-structured interviews were conducted to investigate the applicability of DWI effects observed in the regular economy to sheltered workshops. For the initial round, C-level managers of sheltered workshops in Flanders recognized as early adopters of DWI were targeted. These individuals were identified through a LinkedIn search, resulting in 24 potential candidates. Of these, invitations were sent, and eight interviews were successfully conducted. The interview protocol was designed to ensure comprehensive data collection, including items such as the introduction of the study's purpose, background questions to establish the context of each sheltered workshop, specific questions about the use and impacts of DWI, and open-ended questions allowing respondents to elaborate on their experiences. Rather than systematically reviewing the list of DWI effects identified in the literature, participants were asked to discuss the effects they had observed within their own operations. Conducted in Dutch, these interviews were recorded and transcribed using Microsoft Teams, and the transcripts were subsequently analyzed using Nvivo to compare against the DWI effects outlined in the literature review. The findings from this analysis are presented in Table 2. For each interviewee, the observed effects are indicated with an “X”. The absence of an "X" does not necessarily imply the contrary.

Table 2: Effects of DWI compared to paper-based instructions identified in sheltered workshops

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5	Interviewee 6	Interviewee 7	Interviewee 8
Accelerated creation of instructions								
Enhanced adherence to instructions								
Accelerated execution	X		X	X	X	X	X	
Improved user experience								

	Interviewee 1	Interviewee 2	Interviewee 3	Interviewee 4	Interviewee 5	Interviewee 6	Interviewee 7	Interviewee 8
Accelerated interpretation	X	X	X			X	X	X
Improved retention								
Accelerated training processes	X	X		X	X		X	X
More objective training								
Facilitated management of diverse production								
Reduced perceived workload								
Increased employee autonomy	X	X	X	X		X	X	X
Reduction in execution errors	X		X	X	X	X	X	X
Enhanced employee confidence								
Reduced requirement for prior knowledge	X	X		X	X	X	X	

4. Preliminary Discussion

The C-level managers observed several key effects of DWI that align with the academic literature, albeit within the unique context of sheltered workplaces. Firstly, accelerated interpretation and execution was highlighted, with managers noting a marked decrease in the time required for employees to understand and carry out the instructions. Secondly, the accelerated training processes effect was evident, as managers observed that DWI significantly shortened the training period, enhancing the speed of skill acquisition among new employees. This is particularly beneficial in sheltered workshops where varying capabilities may necessitate more dynamic training approaches. Additionally, an increase in employee autonomy was noted, suggesting that DWI empowers employees by providing them with the tools to manage their tasks more independently. This empowerment is linked to the reduction in execution errors, another effect managers observed. This underscores the precision and reliability that DWI brings to task execution. Finally, the managers recognized a reduced requirement for prior knowledge, indicating that DWI allows employees to perform tasks with less dependence on pre-existing knowledge. This is an important finding as it might broaden the scope of tasks the employees can undertake.

It is important to acknowledge that some effects highlighted in the literature did not surface in discussions with C-level managers. This discrepancy may arise because certain effects are less apparent in real-world settings as opposed to controlled experimental environments. Effects such as "improved retention," "reduced perceived workload," and "enhanced employee confidence" exemplify this possibility. Additional research is necessary to further explore and clarify these observations.

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Understanding Patient Attitudes Towards the Use of AI in Medical Diagnosis Using Necessary Conditions Analysis

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Abstract: The recent years have brought a rapid growth in the use of artificial intelligence (AI), particularly in medical applications. One of the areas where AI can find application is in medical diagnostics. AI has the potential to revolutionize the field of medical diagnostics by improving the predictive accuracy, speed and efficiency of the diagnostic process. The literature provides many studies on the applications of AI in medical diagnostics, including the attitudes of medical personnel towards this technology. However, few studies focus on evaluating the use of AI in medicine from the perspective of consumers. The article concerns the issue of using artificial intelligence in medical diagnostics. The authors analyse the attitudes of potential patients towards medical applications of AI. They examine the factors determining social acceptance of AI usage in medical diagnostics. They use a new research method based on necessity logic - Necessary Condition Analysis (NCA).

Keywords: AI, Medical diagnostics, Trust to AI, NCA

1. Introduction

Acceptance of artificial intelligence (AI) applications in medical diagnostics is crucial for the future of healthcare. Despite some concerns and challenges, AI has the potential to transform the way we diagnose and treat diseases by improving diagnostic accuracy, reducing waiting times for test results, and increasing access to healthcare (Rawat et al., 2023).

Understanding patient preferences, addressing concerns, and highlighting the benefits of artificial intelligence in diagnostics are crucial for the successful integration of AI technology in healthcare.

Positive attitudes and social trust are essential for the widespread adoption of AI in medical diagnostics (Kumar et al., 2023).

Incorporating trust-building measures, data categorization guidelines, and risk level assessments can further enhance the effectiveness of AI solutions in medical diagnostics (Wolff et al., 2021).

2. Research Methods and Results

The authors of the article designed and conducted a survey study among a group of 1063 adult respondents in Poland in June 2023.

Based on the survey statements, the following research hypotheses, which are necessity hypotheses, were formulated:

Main Hypothesis (H1): Patients' belief that AI will improve healthcare is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Sub-Hypotheses:

Ha: Patients' belief that AI will improve the quality (accuracy) of medical diagnoses is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Hb: Patients' belief that AI will improve the relationship between patients and doctors is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Hc: Patients' belief that AI will improve the accuracy and appropriateness of selected treatment methods is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

Hd: Patients' belief that AI will improve their health condition is a necessary condition for building trust in AI as a tool in diagnostic and treatment processes.

To verify the hypotheses, Necessary Condition Analysis (NCA) (Dul, 2024) was applied. NCA identifies conditions that must be met for a specific outcome (effect, result) to occur. Individual necessary conditions act as bottlenecks to achieving the outcome. If such a condition is not met, achieving the outcome is impossible, as it cannot be compensated for by the presence of other factors. However, meeting the necessary condition does not guarantee success, meaning that a necessary condition is not always sufficient.

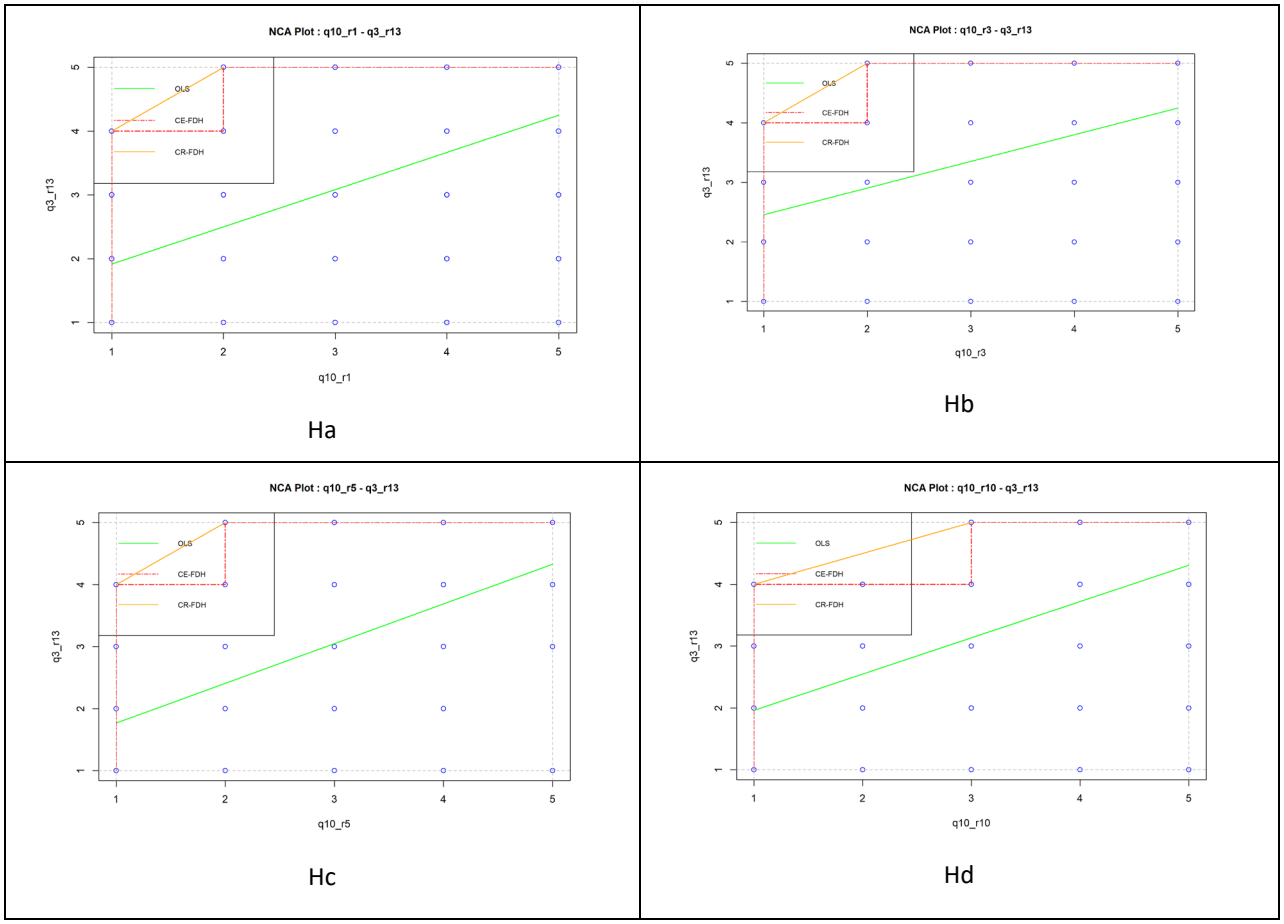
Table 1 presents the effect size of the necessary condition for the formulated sub-hypotheses.

Table 1: Effect size of the necessary condition for the formulated sub-hypotheses (determined using the CE-FDH method)

Hypothesis	The value of the necessary condition effect
Ha	0.06
Hb	0.06
Hc	0.06
Hd	0.12

Source: Own study on the basis of conducted research

For the hypotheses, a ceiling line was presented (Fig. 1).



Source: Own study on the basis of conducted research

Figure 1. Ceiling lines determined by the CE-FDH method for research hypotheses

The obtained results can be interpreted as follows: the most powerful necessary condition for building trust in the medical applications of AI is the patient's belief that AI will improve the patient's health status. As for the other factors, necessary conditions of lesser strength include the patient's belief that AI will improve the quality (accuracy) of medical diagnoses, improve patient-doctor relationships, and enhance the accuracy and effectiveness of selected treatment methods.

Additional information is provided by the constraint analysis (Table 2), built on the basis of the determined ceiling line.

Table 2: Required minimum levels of necessary conditions for various desired levels of achieved outcomes

The response variable (trust in AI as a tool in diagnostic and therapeutic processes) as a percentage of the observed values range		0	10	20	30	40	50	60	70	80	90	100
Explanatory variables, as % of the range of observed values	a	NN	NN	NN	NN	NN	NN	NN	NN	25	25	25
	b	NN	NN	NN	NN	NN	NN	NN	NN	25	25	25
	c	NN	NN	NN	NN	NN	NN	NN	NN	25	25	25
	d	NN	NN	NN	NN	NN	NN	NN	NN	50	50	50
NN – Not Necessary												

Source: Own study on the basis of conducted research

The results from Table 2 indicate that the necessary condition for patients to trust medical AI applications is:

- patients' belief that AI will improve the quality (accuracy) of medical diagnoses at a level of 25%,
- patients' belief that AI will improve the patient-doctor relationship at a level of 25%,
- patients' belief that AI will improve the accuracy and effectiveness of selected treatment methods at a level of 25%,
- patients' belief that AI will improve the patient's health status at a level of 50% of the adopted research scale.

3. Conclusion

The aim of the conducted research was to identify the necessary conditions for building trust in AI as a tool in diagnostic and therapeutic processes. Four potential factors were examined as necessary conditions for such behaviour among patients (hypotheses Ha-Hd).

The results obtained showed that a high level of trust in AI for diagnosis or treatment is conditioned by the patient's belief that AI will improve the quality of diagnoses, the relationship between the patient and the doctor, the accuracy and effectiveness of selected treatment methods, and above all, the patient's health status. This means that in order to build trust in AI among patients, it is crucial to focus on raising awareness among patients about the benefits of medical AI applications mentioned above, as they constitute necessary conditions.

The value of the research conducted is the use of a relatively new method (NCA) that can be useful for analysing issues concerning the identification of the necessary factors that determine certain human behaviours (in this case, acceptance of AI).

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The Impact of Organisational Culture on Transportation Behaviours: An Exploratory Analysis

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Abstract: By annually accommodating a growing number of students, higher education institutions contribute significantly to the daily flow of individuals. This flow exerts a significant impact on greenhouse gas emissions caused by transportation. Several studies have addressed promoting sustainable transportation at the individual level, while little attention has been drawn to examining the impact of organisations in this realm. This paper proposes a model of organisational influences on pro-environmental behaviours. Therefore, we thus identify a set of variables within organisations that expect to influence these behaviours. Among these variables, organisational culture appears as a major predictor. Organisational culture is a set of values, norms, beliefs, meanings and behaviours. Based on this definition, we propose to study organisational culture through measurable elements such as the organisation's values, norms and perceived practices. Additionally, we have identified variables directly influenced by organisational culture, such as leadership and organisational trust. Further variables, including personal norms and facilitating conditions, interact with the organisational culture and provide a more precise understanding of pro-environmental behaviours. This framework will be used to investigate student transportation behaviours. The results are expected to provide valuable insights for developing a culture of sustainable transportation at the organisational level.

Keywords: Organisational culture, Transportation, Pro-environmental behaviour, Sustainability, RSE, leadership

1. Introduction

Growing awareness of environmental challenges should lead organisations to adopt more sustainable practices. These practices depend on organisational culture, which is rather difficult to capture in its complexity. This study aims to model organisational culture's impact on stakeholders' environmental behaviour. We introduce this model in Figure 1 and explain it step by step afterwards.

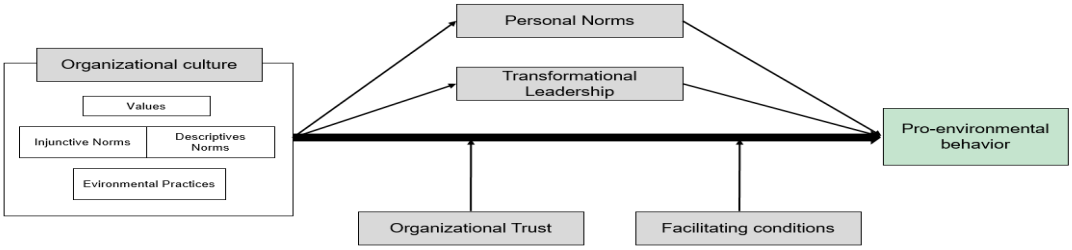


Figure 1: Representation of the Model: Effect of organisational culture on environmental behaviours

2. Organisational Culture and Environmental Behaviours

Pettigrew (1979) defines organisational culture as a set of values, norms, beliefs, meanings, and behaviours. In this spirit, we approach organisational culture by combining organisational social norms, which define acceptable behaviours and practices, values underlying those norms, and practices resulting from them. These three elements are often measured independently to identify an organisation's culture, perhaps limiting a more comprehensive understanding. We, therefore, propose to integrate these variables to the same extent.

For Cameron and Quinn (2011), understanding organisational values highlights organisational internal dynamics. These authors model organisational culture by focusing on two axes of opposite values: internal vs external focus and stability vs flexibility. This model maps four major organisational cultures: Clan, Adhocracy, Hierarchy and Market. Perennial organisations have their own cultures that spread in each quadrant. Concerning our subject, it appears that Adhocracy, Clan and Hierarchy cultures facilitate the integration and anchoring of environmentally friendly practices (Osei et al., 2023).

Each of the four major organisational cultures defined by Cameron and Quinn (2011) carries specific values that promote distinctive social norms within the organisation. Social norms refer to socially valued behaviours in a group (Cialdini, 1990). They can be divided into injunctive and descriptive categories (Cialdini, 1990). Injunctive norms are related to organisational concerns and prescribed practices. Descriptive norms, meanwhile, deal with practices actually implemented (Norton et al. 20,14; Mouro & Duarte, 2021). Social norms affect the environmental behaviour of members of the organisation (Thogersen, 2006). Indeed, they mediate the relationship between environmental policies and green behaviour (Norton et al., 2014).

On the other hand, organisations also frequently implement a corporate social responsibility (CSR) policy as part of the organisational culture (Aguinis, 2011, p. 855). These practices have a tangible impact on stakeholder behaviour (Aguinis, 2011). CSR strengthens employees' engagement and organisational identification (Turker, 2009). High-perceived CSR affects environmental behaviour (Lin et al., 2010). Green culture and green management practices within organisations standardise green behaviours, leading employees to be more likely to adopt green practices (Paillé et al., 2013; Pinzone et al., 2016).

3. Elements Influenced by Organisational Culture

We explore two variable categories constantly intertwined with organisational culture to identify how culture influences environmental behaviours. The first is related to individual-organization interaction, such as transformational leadership and trust; the second is to individual and material characteristics, such as personal norms and facilitating conditions. Both are significant predictors of environmental behaviours and cannot be overlooked.

Transformational leadership is defined as a process of social influence (Bass, 1985) that relies on vision and values (Wang et al., 2018). It predicts the adoption of environmental behaviours in the workplace (Robertson & Barling, 2013). Robertson and Barling (2013) identified descriptive norms as the antecedent of leadership, suggesting that transformational leadership mediates the relationship between organisational culture and environmental behaviours.

Organisational trust is a psychological state where individuals accept vulnerability based on their beliefs about the intentions or actions of others (Rousseau et al., 1998). The development of organisational trust depends on the social exchange process and perceptions of leader decisions (Singh & Srivastava, 2016). When organisational trust is strong, its members are less suspicious of leaders' actions and guidance (Singh & Srivastava, 2016), which can influence pro-environmental behaviours. We anticipate a moderating effect of organisational trust on environmental behaviours.

Personal norms refer to behaviour individuals feel morally obligated to have (Schwartz, 1992). There are significant predictors of environmental behaviours (Javaid et al., 2020; Stern, 1999) and are partially predicted by social norms (Stern, 1999). We expect them to mediate the relationship between organisational culture and environmental behaviours.

The facilitating conditions refer to infrastructures, equipment's, and adaptations designed to promote the desired behaviour. When members perceive infrastructure and equipment as easily accessible, they tend to act more responsibly (e.g., Adams et al., 2017). We anticipate these conditions will moderate the relationship between organisational culture and environmental behaviour.

4. Conclusion

This paper proposes a model of organisational influences on pro-environmental behaviours. To show this relation, we start by defining organisational culture and identifying the variables that compose it, like norms, values, and practices. We also enrich this relationship with mediators and moderators, which can influence it. We will apply this framework to transportation behaviour. Indeed, in 2019, the transport sector in France emitted the highest amount of greenhouse gases (GHGs), totalling 136 million metric tons of CO2 equivalent. This represents 31% of the national GHG inventory, compared to 22% in 1990 (Notre Environment, 2022). In France, the number of students in higher education has risen sharply over the past thirteen years, contributing to the daily flow of people. More attention should be paid to the impact of organisations, including higher education institutions, on student transportation patterns.

We aim to investigate the effect of higher education institutions' culture on their students' transportation behaviours. We therefore plan to run a survey among our institute's students. Our campuses are distributed all over France, some of them in locations that don't seem favourable for adopting sustainable modes of transport

(no on-campus accommodation, limited or no distance learning, etc.). We aim to investigate the impact of this organisational culture on student behaviour in this type of institution. The results are expected to offer valuable insights into promoting a sustainable transportation culture within organisations and identifying individual and situational factors that affect transportation behaviour. Additionally, we strive to engage institutions, individuals, local authorities, and policymakers in confronting this global challenge by promoting sustainable transportation practices at the organisational level.

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Between Control and Complexity: RRI in the Norwegian Biotechnology Advisory Board

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Abstract: This paper investigates the integration of Responsible Research and Innovation (RRI) principles with focus on public engagement within the Norwegian Biotechnology Advisory Board (NBAB). RRI, as an inherently relational set of practices, requires flexibility and adaptability from the State to promote responsible innovation. The NBAB case study provides insights into the complexities and tensions of State intervention, highlighting the necessary shift from rigid control to a more flexible approach. This shift is crucial for effectively fostering RRI among citizens, firms, and organizations. By examining NBAB's role in evaluating and advising on the ethical implications of biotechnology, this study demonstrates the importance of inclusive and deliberative governance. The findings suggest that public institutions must adapt to changing societal needs and engage diverse stakeholders to promote responsible innovation practices effectively.

Keywords: RRI, Biotechnology, Public engagement, Norwegian biotechnology advisory board

1. Introduction

Responsible Research and Innovation (RRI) is a framework that aims to align the processes and outcomes of research and innovation with societal values, needs, and expectations. RRI emerged in response to the increasing complexity and societal impact of technological advancements (Owen, Bessant, and Heintz 2013), particularly in fields like biotechnology. Modern biotechnology and gene technology raise numerous ethical questions, necessitating ongoing interaction between science and society (Solbu 2021).

The concept of RRI goes beyond traditional ethical considerations, integrating public engagement, ethical reflection, and anticipatory governance (Von Schomberg 2013). It requires researchers, innovators, and policymakers to be responsive to societal concerns and to work collaboratively with various stakeholders, including the public, industry, and academia. This relational approach necessitates flexibility and adaptability, challenging the conventional top-down regulatory frameworks (Stilgoe, Owen, and Macnaghten 2013).

As the State is involved in various research and innovation processes, both directly and indirectly, it faces the challenge of navigating a complex and diverse landscape of responsibility. This paper explores the implementation of RRI principles within the context of the Norwegian Biotechnology Advisory Board (NBAB). The NBAB, established by the Norwegian government, is tasked with evaluating the ethical, social, and legal implications of biotechnological advancements. By analyzing the NBAB's processes and practices, this study aims to provide insights into how public institutions can operationalize RRI and foster responsible innovation.

2. Literature Review

The concept of RRI has evolved significantly over the past decades (Rip and Rip 2018), reflecting broader shifts in the governance of science and technology. Initially framed within the Ethical Legal and Social Aspects (ELSA) of emerging technologies, RRI has expanded to address the complex interplay between innovation and society. The European Union has been at the forefront of promoting RRI, embedding it in its Horizon 2020 framework to tackle Grand Societal Challenges (European Commission 2012).

RRI includes four dimensions, including anticipation, inclusiveness, reflexivity, and responsiveness (Stilgoe, Owen, and Macnaghten 2013). Anticipation involves foresight and the identification of potential impacts of research and innovation. Inclusiveness emphasizes the involvement of a diverse range of stakeholders, ensuring that different perspectives are considered. Reflexivity requires researchers and innovators to critically reflect on their practices and assumptions. Responsiveness entails adapting research and innovation processes based on societal needs and concerns.

The literature highlights the importance of public engagement in RRI, arguing that involving citizens in decision-making processes enhances the legitimacy and social acceptability of innovations (Chilvers and Kearnes 2015). However, putting RRI into practice remains challenging, requiring institutional support and cultural change within organizations.

This paper builds on existing literature by examining the integration of RRI principles within a specific institutional context, NBAB. It contributes to understanding how public institutions can foster responsible innovation through inclusive and adaptive governance.

3. Methods

This study uses an interpretative case study approach, focusing on the NBAB. Established in 1991, NBAB serves as an independent advisory body to the Norwegian government, evaluating the ethical, social, and legal implications of biotechnological advancements. The case study methodology allows for an in-depth exploration of the NBAB's processes and practices, providing insights into their implementation of RRI principles. This case was chosen to understand a broader issue: aligning innovation processes with societal needs, values, and expectations to promote responsible practices at the national level.

Data collection involved qualitative methods, including semi-structured interviews with NBAB members, analysis of official documents, and participant observation of public events organized by NBAB. The interviews aimed to capture the perspectives and experiences of NBAB members regarding the integration of RRI principles in their work. Document analysis provided additional context and understanding of NBAB's mandate and activities. Participant observation allowed for direct insights into the NBAB's deliberative processes and stakeholder engagement practices.

The data were analyzed using thematic analysis (Clarke and Braun 2017), identifying key themes and patterns related to the implementation of RRI principles. The analysis focused on how NBAB incorporates anticipation, inclusiveness, reflexivity, and responsiveness in its evaluations and practices. The study also examined the challenges and tensions encountered by NBAB in public engagement in biotechnology development.

4. Case Study: NBAB

NBAB plays a crucial role in evaluating the ethical, social, and legal implications of biotechnological advancements in Norway. Established by the Norwegian government, NBAB’s mandate extends to various tasks: providing independent advice on biotechnology-related issues, fostering public debate and informing the public about biotech developments.

For internal discussions and governmental consultations, NBAB relies on evidence-based science and reports from reputable organizations. NBAB’s efforts to balance expert opinions with public concerns involve a range of stakeholders, including scientists, ethicists, policymakers, and industry representatives. NBAB organizes public events, often in a format of panel debates, and provides an option on their website for submitting questions and comments. In its activities, NBAB focuses on disseminating knowledge about recent developments in biotechnology. While ensuring the legitimacy of information generated in research centers and universities is more routinized and structured, the collection of diverse opinions still has room for improvement.

The case study of NBAB highlights several key challenges in implementing RRI principles within a national framework. One significant challenge is balancing the need for expert knowledge with the importance of public engagement. It is crucial to recognize that a substantial portion of the population lacks interest in specific biotechnology topics, often relying on experts and elected officials to handle such matters. Therefore, NBAB must navigate the tensions between scientific expertise and public values, ensuring that its recommendations are both scientifically sound and socially acceptable. While solutions to these challenges are not yet fully developed, the NBAB continues to adopt a scientific approach when evaluating new knowledge.

Another challenge is maintaining flexibility and adaptability in the face of evolving biotechnological advancements. NBAB must continuously update its knowledge base and adapt its processes to address new ethical and social issues. Encouraging public participation in these discussions becomes even more challenging as individuals with high professional knowledge struggle with extrapolation. Operationalizing a broad, holistic debate proves to be a difficult and resource-demanding task. The challenge in discussing controversial topics lies in reconciling different values and beliefs, creating an environment for dialogue, and acknowledging diverse arguments.

Despite the NBAB's shortcomings in engaging the public, it possesses resources such as time, information, and expertise that the public lacks. Provided a different strategy is adopted, NBAB might be able to effectively represents public interests within the biotechnology domain.

5. Discussion

The case study of NBAB offers valuable insights into the complexities and challenges of implementing RRI principles within a national framework. The study highlights the importance of flexibility, adaptability, and stakeholder engagement in fostering responsible innovation.

A key finding is the need for public institutions to move beyond rigid control mechanisms and adopt a more relational approach to governance. RRI calls for a shift from traditional top-down regulatory frameworks to more inclusive and adaptive practices (Von Schomberg 2013). The NBAB case underlines that a focus on rapid development of knowledge-based industries may lead to the neglect of responsible governance practices. An excessive reliance on scientific expertise can undermine the primary goal of RRI– establishing trust between science and society. Overreliance on biotech experts may encourage siloed thinking, restricting the scope of discussions and limiting participation of the public in the evaluation of science and technology.

Another important finding is that engaging mainly with experts can obscure the diversity of societal concerns. The current formats of intentional dialogue with citizens – such as panel debates and written feedback – often result in one-way communication, lacking opportunities for reaction, reflection, or response. The NBAB, as a governmental agency, lacks participatory architecture necessary to support RRI activities effectively. RRI activities require a communicative framework and an institutional platform to facilitate engagement between civil society, stakeholders, and both the policy and technical communities.

Finally, shifting from a unidirectional flow of information to genuine interaction involves more than just generating a chaotic array of opinions. While diverse viewpoints are valuable, establishing a platform for structured debate is crucial. The goal of RRI isn't merely to collect a multitude of opinions, but to facilitate a continuous exchange that prompts a reevaluation of the existing status quo. Consequently, integrating mechanisms for interactivity and feedback into public engagement becomes imperative for the collaborative construction of knowledge in biotechnology domain.

6. Conclusions

In conclusion, integrating RRI principles into public institutions like the NBAB requires a shift from traditional bureaucratic practices to more adaptive and inclusive approaches (Owen et al. 2021). Currently, the evaluation of emerging technologies in decentralized and profit-oriented technology development settings is limited to a group of individuals.

The findings from this case study highlights the need for a broader understanding of the State's responsibility in fostering responsible innovation through flexibility, stakeholder engagement, and ethical reflection. The findings above strengthen the emerging argument that RRI should be understood within the framework of New Public Governance, rather than New Public Management (Loeber et al. 2022). The latter approach does not appear compatible with the demand for flexibility inherent in the relational work required by the implementation and diffusion of RRI practices. To move beyond reliance on experts and enhance public participation, it is necessary to re-think institutional boundaries. This will enable the development of responsible yet flexible governance in biotechnology, rather than a strict set of managerial principles, which may hinder the actual collaborative process of fostering RRI practices among private actors.

Further research should explore the potential role of national public institutions as platforms for communication between society and biotech stakeholders, emphasizing a network-based approach that fosters collective and relational responsibility. Additionally, the identification of RRI practices and interpretations across key organizations in the biotech industry should be investigated. This can reveal variations and commonalities in how responsibility is perceived and enacted.

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Initial insights from Innovation Strategy Development in Wales

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Abstract: This paper presents insights from emerging work to support the development of a Culture of Innovation in Wales. The region has been subject of much public policy debate, not least for Innovation Policy during the 20 years since a previous Welsh Government Innovation Strategy. This work focuses on how innovation culture intersects with government policy to develop and implement the Innovation Strategy across all sectors of WG responsibility. The co-production approach adopted by WG presents an open approach to public policy, informed through written submissions, public events, and other stakeholder-specific fora. Drawing upon themes from academic literature and those identified and explored through the consultation, the paper explores the level of alignment between stakeholders and the potential actions to enhance conditions for innovation within Wales. The Wellbeing of Future Generations (Wales) Act 2015 provides a unique context for this work, which resonates with the United Nations Sustainable Development Goals. It forms part of a broader and longer-term study intended to support the refinement and delivery of the Innovation Strategy.

Keywords: Innovation, Public policy, Wales, Strategy

1. Introduction

Wales has been transitioning from an economy, and society dominated by coal and steel production. At the turn of the millennium, the Welsh economy was weak, despite its comparatively vibrant and productive manufacturing sector. Since the 1970s, when coal and steel sectors were still significant, Wales' GDP broadly tracked overall UK performance, but at a lower level. This persistent relative gap meant, until Brexit that Wales qualified for the highest level of EU Regional Aid (Objective 1 in 2000, to Convergence funding in 2017). The ending of strong foreign direct investment (1980s/90s) exposed the challenges of deindustrialisation and weak underlying economic performance, including limited home-grown enterprise and low levels of Business investment in Research and Development (BERD) (Mom et al., 2012). The relatively limited indigenous business base limited the scope to capitalise upon Open Innovation (Chesbrough and Appleyard, 2007) and Smart Specialisation (Foray et al., 2009) (Morgan, 2013). Combined with persistently lacking higher-level skills availability this has presented an enduring challenge (RLP, 2013).

Devolution gave Wales responsibility for regional economic policy, leading to strategies (WAG, 2004, WAG, 2005, WAG, 2010), aiming to harness innovation to nurture technology-focused clusters (WAG, 2003). Weak BERD brought focus to the regional science base, consisting primarily of university research output (WAG, 2009). This led to research and policy debate (Salvador and Harding, 2006, Abbey et al., 2008), including comparison with other devolved UK nations (Cooke and Clifton, 2005). It also emphasised the 'triple helix' (Leydesdorff and Etzkowitz, 1998) with the role of government and academia to support innovation and development of a knowledge-based economy. This questioned these connected roles supporting the potential effectuation proposed by Sarasvathy (2001), from state through to firm levels.

Innovation, a central policy thread from Welsh Assembly Government's (WAG) 2001 ten-year economic development plan 'A Winning Wales' (updated 2003), presented a vision of '*a prosperous Welsh economy that is dynamic, inclusive and sustainable, based on successful, innovative businesses with highly skilled, well-motivated people*.' This focus is being revisited, though amidst very different local and global contexts of a post-Brexit Wales following the Covid-19 pandemic and ensuing economic turmoil. An important development since earlier policies has been the Wellbeing of Future Generations (Wales) Act 2015, bringing a new lens to legislation and actions of public bodies. This required longer-term and more integrated actions, with consideration of broader societal and environmental impacts. The role of broader civic society and citizens also extends the helices into the quadruple and n-tuple (Leydesdorff, 2012). It therefore relates to fundamental consideration of modern roles and relationships of the public, private and third sectors, as discussed by Mazzucato (2011) (Mazzucato and Li, 2018).

An enduring challenge for Wales to achieve these ambitions has been the development of an indigenous culture of innovation and enterprise. A broad description of culture as shared values, perspectives and customs (Moussa et al., 2018) resonates with looking across these helices in the shared geography, economy and society in Wales.

This carries importance as the impact and nature of innovation within a country relates to national culture (Waarts and Van Everdingen, 2005) (Taylor and Wilson, 2012) (Efrat, 2014) (Strychalska-Rudzewicz, 2016). This presents the question of understanding how policy may interpret and address the question of innovation culture within Wales, forming the basis of this work.

2. Approach

The open consultation undertaken to support the strategy development offered a unique data collection opportunity to explore innovation culture in Wales. This presents a pragmatic ontological, epistemological and methodological approach. Routed in the pragmatist paradigm, the works reflect '*solving practical problems in the real world*' (Yvonne Feilzer, 2010), supporting the translation of insight for policy into programmes and projects. Combined with direct researcher engagement, the work lends itself to Action Research (Stringer, 2013), being embedded in the environment with continuous access to data and participants. Based upon this position, the following phases outline the planned approach to creating a research space and question for exploration;

> *The strategy aims to create a culture of innovation in Wales, one which collaborates, shares risk, encourages participation and supports the ecosystem to innovate.*
>
> *What does an innovation culture mean to you? What is needed to develop an innovation culture in Wales?*

The following section presents a high-level examination of responses across the stakeholder groups, which are being fed into further analysis to inform strategy and delivery plan development.

3. Responses/Findings

The consultation attracted 153 unique responses from across Wales and generated discussion notes from five focus groups. Of these responses, 101 submissions included contributions relating to the Innovation Culture questions. These data were extracted and analysed using NVivo. Of the relevant submissions and focus group notes, there were 684 comments linked to culture. The comments were coded using an inductive coding method, against topics identified from the literature and relating to WG policy development. Focus group discussion data were coded, though presented separately as they could not be attributed to specific stakeholder groups, for sessions were openly promoted through a range of channels.

Table 1: Consultation Responses by Group

Type of respondent	Number of responses
Citizens	4
Advisory/Lobbying Organisations	6
Private Sector	14
Third Sector	10
Academic/Research Organisations	20
Public Sector	31
Unknown	16

As shown in Table.1 above, the consultation attracted responses from a broad range of stakeholders. Public sector organisations provided the largest proportion of responses, although this is perhaps unsurprising because of their propensity to engage in the policy agenda. However, private sector organisations and advocacy groups (e.g. industry sector fora) provided significant contributions, helping ensure effective consultation.

From the data collected, Figure 1 shows that at a high level, across all stakeholders, the most frequently noted topics were Skills and Training, followed by Funding & Finance. There was a notable range of topics, suggesting a level of complexity in unpicking innovation culture.

The frequency of issues being raised offered a level of insight, although becoming more nuanced at the level of stakeholder groups. Tables 2 and 3, following, show how the comments from each theme are grouped by sector, or stakeholder group, reflecting the proportion of comments from each theme originating from respondents identified within a sector or stakeholder group. The 'unknown' group represents those written responses that opted not to include this information with their response, while focus groups involved diverse respondents, and hence are considered separately.

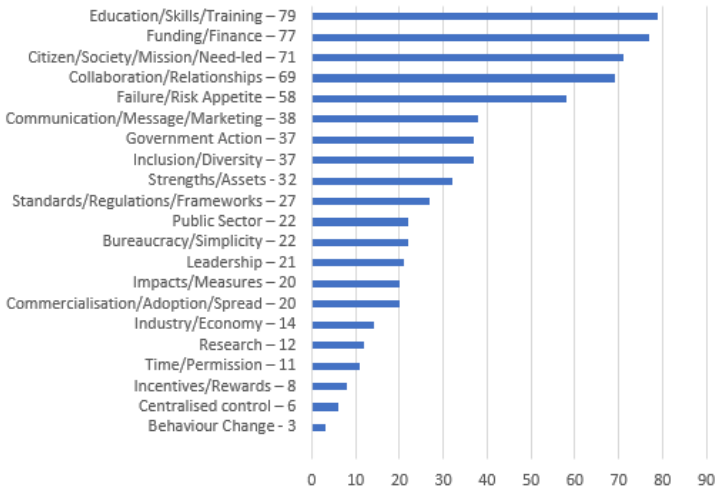


Figure 1: Frequency of responses by topic

Table 2: Balance of responses by topic and stakeholder group

Topic/Code	Citizens	Advisory/ Lobbying	Private Sector	Third Sector	Academic/ Research Org	Public Sector	Unknown	Focus Groups
Education/ Skills/ Training	0	6.30%	6.30%	10.10%	29.10%	24%	14%	10.10%
Funding/ Finance	0	3.90%	10.40%	14.30%	32.50%	19.50%	5.20%	14.30%
Citizen/Society/ Mission-led	0	2.80%	2.80%	16.90%	18.30%	16.90%	9.80%	32.40%
Collaboration/ Relationships	1.40%	7.20%	13%	4.30%	33.30%	16%	11.60%	13%
Failure/Risk Appetite	1.70%	1.70%	5.20%	0	12.10%	32.70%	10.30%	36.20%
Communication / Message	0	0	5.30%	10.50%	15.80%	21.10%	13.20%	34.20%
Government Action	0	2.70%	10.80%	5.40%	32.40%	27%	0	21.60%
Inclusion/ Diversity	0	2.70%	8.10%	16.20%	24.30%	10.80%	2.70%	35.10%
Strengths/Assets	0	9.40%	0	3.10%	28.10%	25%	18.80%	15.60%
Standards/ Regulation	0	18.50%	3.70%	7.40%	11.10%	29.60%	7.40%	22.20%
Public Sector Action	0	0	13.60%	13.60%	4.50%	59.10%	4.50%	4.50%
Bureaucracy	0	0	0	0	18.20%	27.30%	9.10%	45.50%
Leadership	0	4.80%	14.30%	4.80%	4.80%	47.60%	9.50%	14.30%
Impact/ Measures	0	10%	15%	5%	25%	20%	15%	10%
Translation	0	20%	10%	5%	20%	40%	0	5%
Industry/ Economy	0	0	21.40%	0	28.60%	21.40%	21.40%	7.10%
Research	0	25%	8.30%	25%	41.70%	0	0	0
Time/ Permission	0	9.10%	0	0	18.20%	36.40%	9.10%	27.30%
Incentives/ Rewards	0	25%	12.50%	0	12.50%	25%	12.50%	12.50%
Centralised Control/Body	0	0	0	16.70%	83.30%	0	0	0
Behaviour Change	0	0	0	33.30%	0	0	0	66.70%

Table 3: Normalised balance of responses by topic and stakeholder group

Topic/Code	Citizens	Advisory/ Lobbying	Private Sector	Third Sector	Academic/ Research Org	Public Sector	Unknown	Focus Groups
Education/ Skills/ Training	-	1.11	0.48	1.07	1.54	0.82	0.93	2.14
Funding/ Finance	-	0.69	0.79	1.52	1.72	0.67	0.34	3.03
Citizen/Society/ Mission-led	-	0.49	0.21	1.79	0.97	0.58	0.65	6.87
Collaboration/ Relationships	0.371	1.27	0.98	0.46	1.76	0.55	0.77	2.76
Failure/Risk Appetite	0.45	0.30	0.39	-	0.64	1.12	0.68	7.67
Communication/ Message	-	-	0.40	1.11	0.84	0.72	0.87	7.25
Government Action	-	0.48	0.82	0.57	1.72	0.92	-	4.58
Inclusion/ Diversity	-	0.48	0.61	1.72	1.29	0.37	0.18	7.44
Strengths/Assets	-	1.66	-	0.33	1.49	0.85	1.25	3.31
Standards/ Regulation	-	3.27	0.28	0.78	0.59	1.01	0.49	4.71
Public Sector Action	-	-	1.03	1.44	0.24	2.02	0.30	0.95
Bureaucracy	-	-	-	-	0.96	0.93	0.60	9.65
Leadership	-	0.85	1.08	0.51	0.25	1.63	0.63	3.03
Impact/ Measures	-	1.77	1.14	0.53	1.33	0.68	0.99	2.12
Translation	-	3.53	0.76	0.53	1.06	1.37	-	1.06
Industry/ Economy	-	-	1.62	-	1.52	0.73	1.42	1.51
Research	-	4.42	0.63	2.65	2.21	-	-	-
Time/ Permission	-	1.61	-	-	0.96	1.24	0.60	5.79
Incentives/ Rewards	-	4.42	0.95	-	0.66	0.85	0.83	2.65
Centralised Control/Body	-	-	-	1.77	4.41	-	-	-
Behaviour Change	-	-	-	3.53	-	-	-	14.14

Public Sector and Academia stakeholder groups contributed the largest proportion of commentary across most codes. Across stakeholder groups, there was discussion of aspects such as Funding/Finance. Further common areas include collaboration, relationships, and leadership, where government policy may also foster innovation culture without requiring significant investment during particularly challenged times for public expenditure. However, certain considerations, such as centralised functions or standards and incentives, were more focused

amongst from specific groups. This suggests some misalignment in at least some priorities, if not approach, for fostering an innovation culture.

4. Integration and Implications

The helix models, from triple though to n-tuple (Leydesdorff, 2012) highlight the interconnection of stakeholders. Therefore, this presents a complex challenge across the broad range of identified topics and differing emphasis across the groups presents. This complexity reflects in considering how effectuation (Sarasvathy, 2001) can be realised, including specifically for the desired innovation culture.

5. Next Steps for Research and Practice

Initial review of the consultation responses has shown a complex picture amongst relatively diverse stakeholders involving a range of issues. However, deeper review of the data will be undertaken to examine the issues in greater detail.

This will include reflection against academic literature and practice from other regions to identify behaviour and actions supporting positive culture development. This will allow subsequent stages of policy formulation and delivery actions to be defined.

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A Druckerian Framework for Understanding and Leveraging Digital Ecosystems

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Abstract: This paper explores the transformative potential of digital ecosystems through the lens of Peter Drucker's management philosophy. By examining case studies of Audi, M-PESA, and Apple CarPlay, it identifies several key success factors such as a clear vision, customer-centricity, effective leadership, robust technology, a supportive culture, strategic partnerships, and data-driven insights. These elements are crucial for driving innovation and maintaining a competitive edge. The study integrates Drucker's principles with contemporary strategies, emphasizing innovation, customer focus, leadership, and the role of knowledge workers. It offers valuable insights for organizations aiming to thrive in the digital age and outlines a comprehensive business model to navigate digital transformation successfully.

Keywords: Digital transformation, Digital ecosystems, Innovation management, Strategic leadership, Customer-Centric approach, Business model development

1. Introduction

The advent of digital technologies has fundamentally transformed business operations, leading to the rise of interconnected digital ecosystems. These ecosystems have revolutionized traditional business models, creating unprecedented value opportunities. Sussan and Acs (2017) describe the digital entrepreneurial ecosystem as "self-organizing, scalable, and sustainable." Companies such as Amazon, Google, and Alibaba have set new benchmarks for digital integration and ecosystem development (Reinartz et al., 2019). The COVID-19 pandemic further accelerated digital transformation, underscoring the imperative for businesses to adapt to interconnected digital networks.

Despite their transformative potential, there remains a critical gap in the literature regarding comprehensive frameworks for developing and managing digital ecosystems. Senyo, Liu, and Effah (2019) underscore the need for a holistic framework that captures the key components and interrelationships of digital business ecosystems. The critical gap impedes businesses from fully leveraging digital ecosystems for sustainable competitive advantage. This research addresses the gap by integrating Peter Drucker's management principles with contemporary digital strategies, by examining case studies of Audi, M-PESA, and Apple CarPlay. This study demonstrates the practical application of Drucker's principles in modern digital contexts (Hein et al., 2020) and not only identifies critical success factors but also offers actionable recommendations for sustainable growth.

Jacobides, Cennamo, and Gawer (2018) lament the lack of a coherent framework to study ecosystems systematically. This research aims to fill the void by providing a structured approach that merges Drucker's timeless principles with cutting-edge digital strategies. By doing so, it offers invaluable insights for businesses striving to foster innovation and maintain a competitive edge in the digital age.

2. Literature Review

The digital revolution has significantly transformed business ecosystems, challenging traditional management principles. This literature review integrates Drucker's management principles (1985, 1993), digital ecosystem theory (Hein et al., 2020), digital transformation strategies (Vial, 2019), and organizational capabilities (Paul et al., 2024) to create a comprehensive framework for managing digital ecosystems. The aim is to bridge the gap between traditional management and the demands of the digital era, providing both theoretical grounding and practical perspectives.

Combining these concepts serves three key purposes: Drucker's principles (1985, 1993) offer foundational insights into enduring management challenges; digital ecosystem theory sheds light on modern business structures (Hein et al., 2020); and research on digital transformation and organizational capabilities provides practical strategies for adaptation (Vial, 2019; Paul et al., 2024). This synthesis aids in understanding how organizations can effectively navigate and leverage digital ecosystems.

Foundational Management Principles

Drucker's (1993, p.8) insights on the knowledge economy and innovation form the theoretical bedrock of this study. His assertion that "Knowledge has become the key economic resource and the dominant—and perhaps even the only—source of competitive advantage" is particularly relevant in digital ecosystems, where knowledge and information flow are paramount. Additionally, Drucker's emphasis on systematic innovation as a core business process offers valuable insights for managing digital transformations (Drucker, 1985).

Digital Ecosystem Dynamics

Hein et al. (2020, p.88) define digital ecosystems as "sociotechnical networks of digital platforms and complementors," highlighting their interconnected nature. This underscores the need for integrated management approaches aligned with Drucker's holistic view of organizations. Jacobides et al. (2018, p. 2256) further refine our understanding of the structure and dynamics of ecosystems, complementing Drucker's insights on organizational strategy and innovation.

Digital Transformation Strategies

Vial's (2019) review highlights the need for strategic management frameworks in digital ecosystems, aligning with Drucker's emphasis on strategic vision and leadership. Paul et al. (2024) advocate for multidisciplinary approaches that consider technological, organizational, and strategic factors, resonating with Drucker's holistic approach.

Empirical Insights and Critical Perspectives

Empirical studies, such as Dremel et al.'s (2017) analysis of Audi's digital transformation and Morawczynski's (2009) examination of M-PESA, provide practical insights into digital ecosystem management, aligning with Drucker's principles on innovation and social responsibility. Zuboff (2019) warns about surveillance capitalism, challenging researchers and practitioners to consider the ethical implications of digital transformation, aligning with Drucker's emphasis on responsible management.

Organizational Capabilities and Industry Insights

Li et al.'s (2022) examination of digital transformation in SMEs highlights the role of dynamic capabilities in navigating digital ecosystems, resonating with Drucker's focus on adaptability and innovation. Additionally, industry reports, such as McKinsey & Company's (2023) on AI adoption, underscore the practical importance of effective digital ecosystem management, aligning with Drucker's focus on innovation and practical management solutions.

3. Methodology

This research examines case studies of Audi, M-PESA, and Apple CarPlay to explore the complex nature of digital ecosystems. It aims to provide a comprehensive understanding of successful digital ecosystems by integrating theoretical perspectives. An extensive literature review identified relevant studies and frameworks related to digital ecosystems and Drucker's management principles, including works by Morakanyane et al. (2017), Vial (2019), Hess et al. (2016), and Drucker (1985, 1993).

The PRISMA flow diagram (Page et al., 2021) guided the systematic review process, ensuring a structured approach through identification, screening, eligibility, and inclusion phases. Ultimately, 20 high-quality and relevant recent articles were selected, offering comprehensive insights into digital transformation and ecosystems aligned with Drucker’s philosophy (Figure 1).

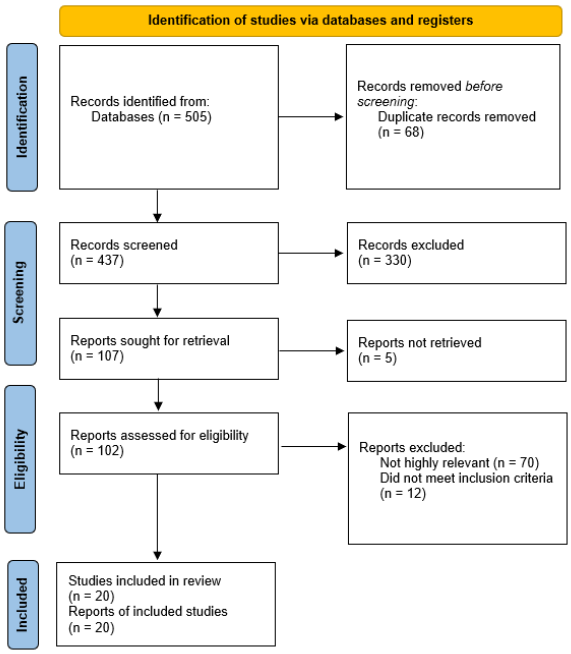


Figure 1: PRISMA flow diagram (PRISMA, 2020)

4. Detailed Analysis of Case Studies

The selection of Audi, M-PESA, and Apple CarPlay as case studies was deliberate and strategic, aimed at providing a diverse yet complementary set of examples. Audi represents a traditional industry undergoing digital transformation, showcasing how established companies can leverage digital ecosystems to enhance customer experiences and operational efficiency. M-PESA illustrates a digital ecosystem's potential in emerging markets, highlighting its capacity for significant social impact, particularly in financial inclusion. Apple CarPlay demonstrates how a technology giant can extend its ecosystem into new sectors, exemplifying cross-industry digital integration. This diversity allows exploration of digital ecosystems across different contexts, industries, and scales, enhancing the generalizability and robustness of our findings.

This process entailed an in-depth examination of each case individually, followed by a comparative analysis to identify common themes and divergences. Subsequently, we mapped these themes to Drucker's management principles, ensuring a theoretical grounding for our findings. This systematic approach yielded seven critical attributes of successful digital ecosystems: clear vision, customer-centric approaches, effective leadership, robust technology, supportive culture, strategic partnerships, and data-driven insights. By analyzing and comparing these diverse cases with Drucker's principles, we can highlight the enduring relevance of innovation, customer-centricity, and visionary leadership in the digital age.

4.1 Audi: Digital Showroom Transformation

Audi's digital transformation turned traditional car showrooms into immersive digital experiences (Table 1), significantly boosting sales and customer satisfaction. This shift, aligning with Drucker's focus on innovation and customer-centricity, allowed customers to explore the full model catalog through digital interfaces, increasing sales by 60% in some areas (Dremel et al., 2017). The digital showrooms offered a personalized experience, enhancing customer satisfaction and enabling car customization and visualization. Additionally, they reduced the need for large physical inventories, cutting costs and improving resource allocation.

Table 1: Key Findings from Audi's Digital Showroom Transformation

Key Findings	Details
Sales Increase	60% increase in sales in some regions
Enhanced Customer Satisfaction	Personalized experiences through digital interfaces
Inventory Cost Reduction	Reduced need for Physical inventories due to virtual models

4.2 M-PESA: Financial Inclusion and Economic Growth

M-PESA revolutionized mobile financial services in Kenya, demonstrating the potential of digital ecosystems to enhance financial inclusion and economic growth (Table 2). Developed by Vodafone and Safaricom, M-PESA transformed the financial landscape by offering accessible and convenient services to millions. Before M-PESA, only 25% of Kenyans had access to formal financial services. M-PESA increased financial inclusion to 80%, reaching millions of previously unbanked individuals (Jelassi & Ludwig, 2016). Its ease of use and accessibility drove widespread adoption, with users growing to 30 million. This expansion significantly boosted Kenya's economy by improving financial access and enabling various economic activities. Businesses and individuals benefited from secure and efficient transactions facilitated by M-PESA.

Table 2: Key Findings from M-PESA's Financial Inclusion and Economic Impact

Key Findings	Details
Increased Financial Inclusion	Financial inclusion rose from 25% to 80%
User Growth	The number of users grew to 30 million
Economic Impact	Significant economic benefits through enhanced financial access

4.3 Apple CarPlay: Seamless In-Car Experience

Apple CarPlay linked vehicles to customers' iPhones, providing a seamless in-car experience and integrating Apple's ecosystem with the automotive industry. This solution enhanced vehicle functionality and drove sales. The integration of Apple CarPlay contributed to a significant increase in vehicle sales, with sales growing from 861,000 units in 2015 to 37 million units by 2020 (WEF, 2020). Apple CarPlay improved customer satisfaction by offering familiar and user-friendly interfaces, which enhanced safety through hands-free controls and better integration with vehicle systems. Additionally, Apple established partnerships with over 20 automotive manufacturers, expanding the reach and adoption of CarPlay. These strategic partnerships facilitated the widespread availability and integration of the technology, further driving its success.

Table 3: Key Findings from Apple CarPlay Integration Impact

Key Findings	Details
Vehicle Sales Growth	Vehicle sales increased from 861,000 units in 2015 to 37 million units by 2020
Improved Customer Satisfaction	Enhanced safety and user experience through integrated functionalities
Established Partnerships	Partnerships with over 20 automotive manufacturers

5. Integrating Drucker's Framework into a Comprehensive Business Model for a Digital Ecosystem

Peter Drucker's management principles, especially from "Innovation and Entrepreneurship" (1985) and "Post-Capitalist Society" (1993), provide a solid framework for managing digital ecosystems. Key principles like innovation, customer-centricity, effective leadership, knowledge workers, strategic vision, and continuous improvement are crucial for digital transformation. Integrating these ensures a technologically advanced, strategically aligned and customer-focused business model supported by strong leadership and innovation.

A comprehensive digital ecosystem business model includes Vision and Strategy, Customer-Centric Approach, Leadership and Governance, Technology and Infrastructure, Organizational Culture and Skills, Partnerships and Collaborations, Data and Insights, Customer Engagement and Channels, Value Creation and Delivery, and Continuous Improvement. This model aligns with Drucker's principles and modern digital strategies. Figure 2 shows this interconnected framework, where each component supports and influences the others, creating a cohesive digital ecosystem.

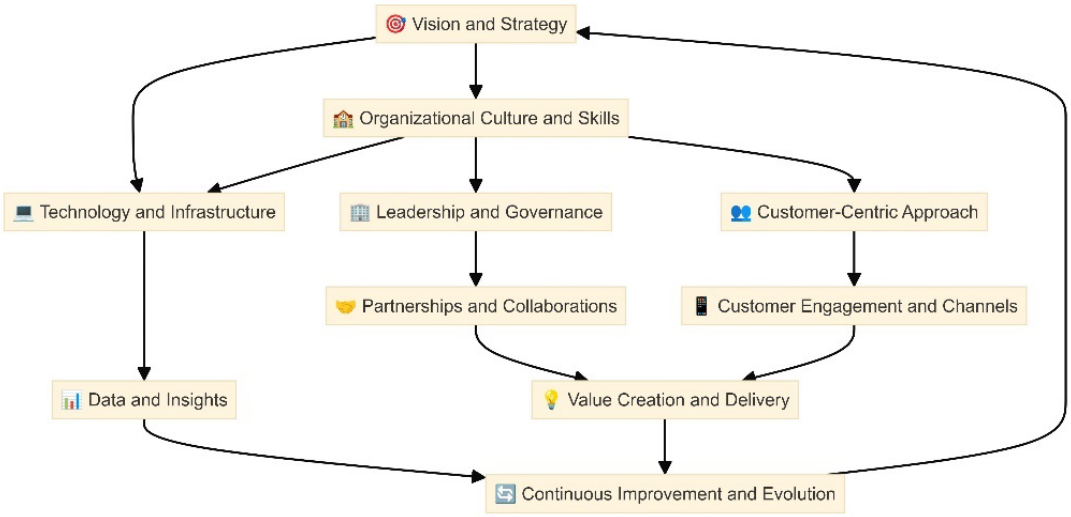


Figure 2: Comprehensive Business Model for a Digital Ecosystem by integrating Drucker's Framework

The integration of these key concepts with our proposed framework (Figure 2) is both seamless and synergistic. The comprehensive Business Model for a Digital Ecosystem presented in Figure 2 synthesizes these attributes into a cohesive structure, illustrating their interdependencies and collective impact. For instance, the 'vision and strategy' attribute forms the core of the model, influencing all other components, while 'data and insights' permeate throughout, informing decision-making at all levels. This integration demonstrates how Drucker's principles can be effectively adapted and applied in the digital age.

6. Discussion

Considering the evolving digital landscape, this study examines the intricate dynamics of digital ecosystems through the prism of Peter Drucker's seminal management principles. By analyzing the case studies of Audi, M-PESA, and Apple CarPlay, we have distilled key attributes that underpin successful digital ecosystems, thereby illuminating the path for organizations navigating this complex terrain.

Our proposed Business Model for Digital Ecosystems offers a structured framework that harmonizes the identified components, providing organizations with a blueprint for sustainable digital transformation. This model not only contributes to the theoretical understanding of digital ecosystems but also offers pragmatic insights for organizations embarking on digital transformation journeys.

Future research should explore the long-term impacts of digital ecosystems across industries, and the role of artificial intelligence in enhancing their efficiency and innovation. Longitudinal studies could deepen our understanding of the evolution of digital ecosystems.

7. Conclusion

This research integrates Drucker's management principles with contemporary digital transformation strategies, offering a unique perspective on managing digital ecosystems. Through detailed case studies, it identifies critical success factors and provides actionable recommendations for achieving sustainable growth. A comprehensive business model for digital ecosystems is introduced, emphasizing key elements such as vision, customer-centricity, leadership, technology, culture, partnerships, data insights, customer engagement, value creation, and continuous improvement.

In conclusion, this research bridges the gap between Drucker's timeless principles and modern strategies, making significant contributions to both theory and practice. It offers valuable insights for businesses to innovate and secure a competitive advantage in the digital era.

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Late Submissions

Establishing an Incubator: Accelerating Sustainable Fashion SMMEs

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Abstract: The South African Clothing and Textile manufacturing industry has encountered substantial hurdles, notably job losses attributed to imports from regions with lower wage rates and inefficiencies within the value chain, exacerbated by the COVID-19 Pandemic. This situation underscores the potential for industry rejuvenation, particularly in light of escalating costs associated with importing clothing, encompassing labour and transportation expenses. A significant impediment to the industry's advancement is the absence of a robust design sector capable of generating innovative designs. The forthcoming research will delve into an exploration of literature pertaining to international fashion incubators, fashion districts, and fashion clusters. The insights gleaned will serve as the foundation for crafting a model aimed at expanding a clothing and fashion technopreneurship hub located in Cape Town, South Africa, with the specific aim of supporting graduates in the fields of clothing, textiles, or fashion. This strategic approach involves active engagement with emerging entrepreneurs to expedite their journey towards achieving pivotal economic objectives such as innovation and sustainability, thereby augmenting their competitive edge. Furthermore, this initiative aids these entrepreneurs in navigating the complexities associated with launching small businesses by facilitating access to pertinent best practices and customized technology support services tailored to their unique requirements.

Keywords: Fashion; clothing, Entrepreneurship, SMMEs, Incubators, Sustainable fashion

1. Introduction

The South African clothing sector has come under severe strain over the last few years especially due to low cost imports entering the country from low wage areas. It was reported in the Business Day (Phakathi, 2012) that the clothing sector had been affected by cheap imports from China and that it had then lost at least 50 000 jobs in a period of 10 years. The South African clothing sector has since its early days been mainly production and not designed orientated i.e. companies sent their buyers and designers to the leading European fashion shows, exhibitions and store visits from which they would return to replicate what they saw and try to produce it cheaper. In 2009 the South African Minister of Economic Development, Mr. Ebrahim Patel in an address to the clothing industry employers and labour emphasized that the industry had to develop a new survival strategy which he termed the "high-road of development" (Crotty, 2009). Mr. Patel a former General Secretary of the Southern African Clothing and Textile Workers Union(SACTWU) noted that the opportunities for South Africa was to develop a high value-add industry using one or more factors "that may include quality, design, innovation, new product development, speed-to-market, or short-run production." One fashion designer can stimulate the creation of many more jobs than one manufacturer. e.g. a leading design centre in Cape Town provides work to at least 30 subcontracting (CMT) firms employing on average 30 people per firm. The paper therefore proposes the establishment of a Fashion Incubator or "Design Park" to develop and grow sustainable emerging fashion designers.

2. Literature Review

2.1 Incubators in the Fashion Industry

Fashion incubators are specialized entities that cater to the unique needs of fashion start-ups. They address specific challenges such as high production costs, supply chain complexities, and the necessity for creative design and marketing strategies (Hausmann & Heinze, 2016).

Mills (2012) notes that business skills taught in design programmes were valuable but "designers who were associated with a fashion incubator reported engaging in what could be described as entrepreneurship education". In addition, "the incubator experiences were most successful at providing the social capital needed to access start-up resources". Mills, (2011) in a previous article highlight "the creativity-business tension". Mills then proposes a "triangular enterprise orientation" as a way to navigate this "creativity-business tension", viz. the creative enterprise orientation (CEO), the creative business orientation (CBO) and the fashion industry orientation (FIO) as depicted in figure 1.

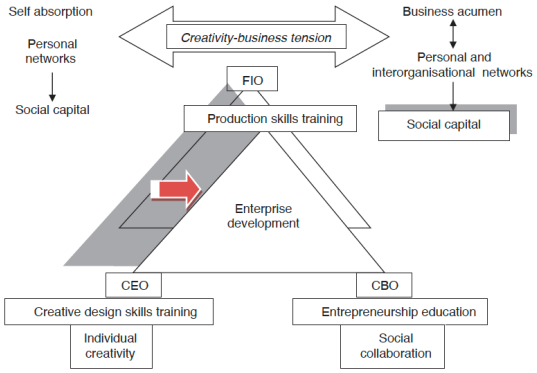


Figure 1.
Education and enterprise: bringing it all together

Figure 1: CBO & FIO

In Figure 1 Mills (2012) to capture the shift and the relationships between the key concepts viz. enterprise orientation, creativity-business tension, social capital, business acumen, individual creativity, design education and collaborative action and entrepreneurship education in the shift from a CEO towards a CBO. Mills (2012) notes that this requires more entrepreneurship education of the sort found in incubators (i.e. education in enterprise) and the shift from CEO to CBO, involves a move from a preoccupation with individual creativity towards collaborative action, which is what is required to innovate (i.e. exploit creative ideas). Fashion incubators offer tailored support, including access to design studios, manufacturing facilities, and industry-specific mentorship. Successful examples include the Fashion Incubator San Francisco and the British Fashion Council's Designer Fashion Fund, which have significantly contributed to the growth of emerging designers (Wong, 2017).

2.2 Establishing a Sustainable Fashion Incubator

Establishing a sustainable fashion incubator involves several critical steps:

1. Needs Assessment: Understanding the specific needs of sustainable fashion SMMEs, including resource requirements, market access, and training needs (Peters & Becker, 1999).
2. Funding and Resources: Securing funding from public and private sources, and providing access to sustainable materials, manufacturing facilities, and design tools (Mian et al., 2016).
3. Mentorship and Training: Offering specialized mentorship and training programs focusing on sustainable practices, business management, and market strategies (Schwartz & Hornych, 2010).
4. Networking and Partnerships: Facilitating networking opportunities with industry stakeholders, including suppliers, retailers, and investors, to create a supportive ecosystem (Hausmann & Heinze, 2016).
5. Monitoring and Evaluation: Implementing monitoring and evaluation mechanisms to assess the impact of the incubator and continuously improve its services (Bergek & Norrman, 2008).

3. Methodology

The paper reviewed literature and websites related to support for SMME fashion designers internationally as well as analysis of current data available from fashion SMME support organisations in Cape Town.

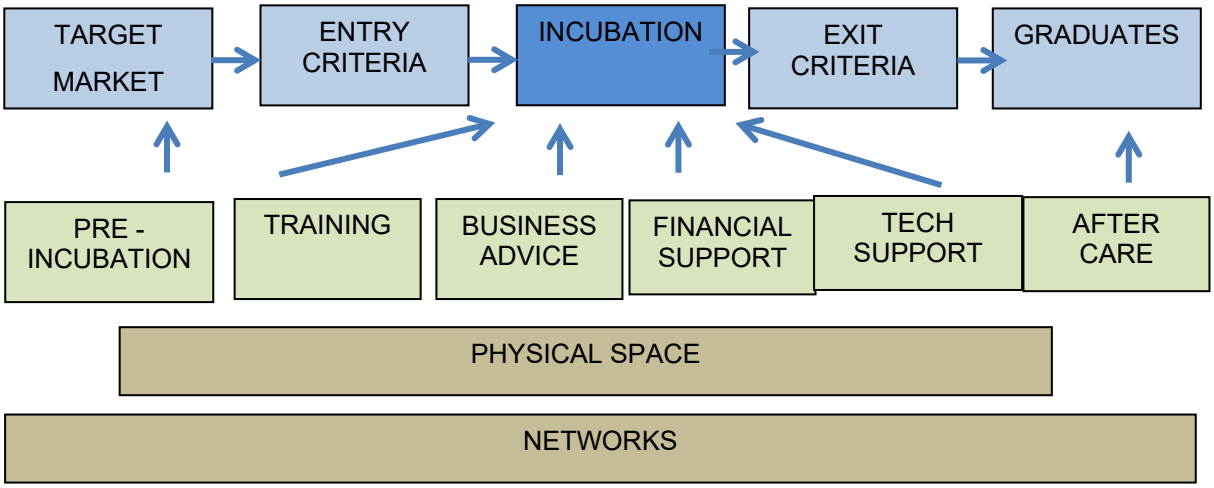
3.1 Incubators

Incubators have evolved over time and meant different things to different stakeholders. It was initially established to promote and develop high level innovation and therefore efforts were concentrated on science, engineering and information technology development. The Centre for Strategy and Evaluation Services in a report to the European Commission's Enterprise Directorate General (2002:9), defines an incubator as "an organisation that accelerates and systematises the process of creating successful enterprises by providing them with a comprehensive and integrated range of support, including: Incubator space, business support services, clustering and networking opportunities".

Entrepreneurship support centres have evolved over the years with many types of support centres arising to accommodate different needs. International Business Innovation Association (INBIA): https://inbia.org/) based in the USA has identified and defined the following types of support centres.

Incubators	Charge monthly program or membership fees or dues for office/desk space and access to program offerings such as mentoring, education/training, and informal learning opportunities. They host events to provide networking and learning opportunities for member companies and the local community. Member companies must apply and meet the incubator's criteria e.g. industry, stage of development, demographics, etc. Normally a graduation policies is in place based on achievement criteria and residence is for 1-3 years
Co-working spaces	Open, collaborative, community-based workspace for like-minded individuals or early-stage companies. Flexible workspaces in the form of hot desks, private (dedicated) desks or offices. Member businesses pay for their space through rent or membership dues. Co-working spaces typically do not offer formal programs, although they may have speakers, meetups or other optional, informal learning opportunities. Members are encouraged to stay or retained as a sustainable revenue stream.
Economic Development Center or Organization	Responsible for creating, managing and supervising programs and activities that promote, assist and enhance economic development. The focus being on economic development efforts on the creation of jobs and new investment in a region.
Higher Education Academic Department	Housed in institutions of higher education and may provide space for student entrepreneurs while offering courses and curricula focused on entrepreneurship. Attendance in courses is mandatory for students to pass/graduate, and some as well as offering events for networking, pitching, or demonstrating products.
Makerspace	Non-program-based community workspaces providing equipment for specific sectors of manufacturing (e.g., technology, 3D printing, woodworking, food) as well as tools, training and specialized equipment necessary for creating and building physical products.
Pre-Accelerator	Do not have equity-based funding, however, they may have grant funds available or access to a community-based evergreen fund. Pre-accelerators have a competitive application process, have mandatory attendance and include a culminating event at the end of the program.
SBDC	Small Business Development Centers (SBDC) are cooperative service-based centers that are subsidized. SBDCs provide learning opportunities and mentoring for small businesses in any industry. There may be a fee to participate in SBDC training/educational programs. Some centers may have space available for rent, although most are walk-in counseling or training center configurations. The goal of a SBDC is to support small business growth and foster local and regional economic development
Seed Accelerator	Highly competitive application process, and will invest equity capital in selected companies. Short-term, ranging from 3-6 months. provide learning opportunities and intense mentoring to each company, with a culminating graduation /pitching event to present concept or product in front of investors and other key stakeholders. Space can be provided for the duration of the program, or can run virtually with attendance at educational or networking events.
Student Entrepreneurship Center	Programs offered by institutions of higher education (e.g., universities, colleges) and provide entrepreneurship learning opportunities and mentoring to foster entrepreneurship development among students. Some centers offer space while others do not. Participation is open to students enrolled in the institution and could have a competitive application processes.
Super Hub	Blend of several models of entrepreneurial growth listed into a single location, supporting entrepreneurs with a wide range of critical services. It is often the anchor hubs for urban innovation districts
Technology Transfer or Commercialization Office	Technology transfer and commercialization offices are focused on providing information, guidelines and resources to faculty, students or staff interested in commercializing research or intellectual property developed at the university through spin-out or technology startup companies.

In a World Bank initiative known as, Information for Development Programme (Infodev: 2010) a policy document describes a business incubator as 'focussing a range of services on clients that are designed to help them launch a well - managed business". In this policy document it illustrates in figure 2 a very simple model for business incubators.



(Infodev, 2010)

Figure 2: Simple business incubator model

In general therefore business incubators were established in identified sectors to provide support to SMMEs that would accelerate their success as sustainable businesses. The support could range from taking up residence in the incubator premises to providing business and technical support services and network opportunities to SMMEs outside of the incubator premises. Incubation is a fairly costly SMME development instrument especially if it accommodates residents. The focus is therefore concentrated on SMME development where the probability for success is highest which should also be an important lesson for any newly established incubator.

The Department of Trade and Industry, South African (2014) describes Business incubators as "physical and/or virtual facilities that support the development of early-stage SMEs through a combination of business development services, funding and access to the physical space necessary to conduct business". They further define incubators as (1) supporting SMEs in the early stages of growth; (2) incubators offer services aimed at strengthening the capacity of SMEs to operate on their own; and (3) incubation is temporary therefore provide services to meet certain needs so that SMEs can grow independently once incubation ends. Importantly "early stage" is not a measure of time, but of how much a business has developed. Incubators, focus on entrepreneurs who wants to grow their businesses, not merely survive.

3.2 International Fashion Incubators

As described earlier, incubators play different roles in different environments and mean different things to different organisations. The emphasis in all the international examples found was on business support and networking. Incubators could be separated into two broad groups viz. residence based incubators or non-residence incubators. Another category of incubators also emerged post COVID and due to cost constraints which could be categorised as virtual incubators viz. providing on line advice and platforms.

Information was extracted from the fashion Incubator websites listed in table 1 below and courtesy email was sent to all the incubators (for further study) to verify data available on the websites. The author acknowledges responses from the following incubators viz. the DC Fashion Incubator in the USA, Philadelphia Fashion incubator and Textile Clothing and Footwear Resource Centre of Western Australia

Table 1: Fashion incubator

FASHION INCUBATOR/ ACCELERATOR	COUNTRY	URL
Amsterdam Science Park (interdisciplinary)	Netherlands	https://ace-incubator.nl/
Boston Fashion Incubator	USA	https://www.madeincboston.com/
Brooklyn Fashion Incubator	USA	https://www.thebrooklynfashionincubator.org/
Camera Moda Fashion Lab	ITALY	https://www.cameramoda.it/en/milano-moda-donna/fashion-hub-market/designer/

FASHION INCUBATOR/ ACCELERATOR	COUNTRY	URL
Centre for Fashion Enterprise/UAL: London College of Fashion	UK	https://www.arts.ac.uk/colleges/london-college-of-fashion/business-and-innovation/centre-for-fashion-enterprise
Chicago Fashion incubator	USA	https://www.chicagofashionincubator.org/
Council of Fashion Designers of America	USA	https://cfda.com/programs/designers#!
DC Fashion Incubator	USA	https://www.dcfashionfoundation.org/dcff-incubator/
European Fashion Accelerator	EU	https://www.eu-fa.eu/
Fashion for Good (platform /connector)	Netherlands	https://fashionforgood.com/
Fashion Tech Farm	Netherlands	https://fashiontechfarm.com/
Fashionomics Africa (platform)	Africa	https://fashionomicsafrica.org/
Foundry Lab Paris	France	https://www.foundryftlab.com/
La Caserne Paris	France	https://www.lacaserneparis.com/
Maisons de Mode	France	https://www.maisonsdemode.com/
Philadelphia Fashion Incubator	USA	https://philadelphiafashionincubator.com/
SA Creative Industries Incubator (interdisciplinary)		https://sa-creative-industries-incubator.co.za/
San Francisco Fashion Incubator	USA	https://fashionincubatorsf.org/
Textile Clothing and Footwear Resource Centre of Western Australia	Australia	https://tcfaustralia.com/
Toronto Fashion Incubator	Canada	https://fashionincubator.com/

The services provided by the fashion incubators listed covers the following general support, some to a greater or lesser degree. This is a general compilation of the information and not specific to a particular incubator.

For residential and non-residential incubators:

General and business seminars : Seminars/workshops in range of areas i.e. business plan writing, basic accounting, finance, product costing, pricing, branding marketing, social media marketing, retail management, range presentations/ visual merchandising, cash-flow strategic programs, production and manufacturing, Importing/Exporting, human resources, etc.

Technical Workshops: Courses range from sewing, design, pattern making, product development, draping, styling and textiles.

Marketing: Showcase, Fashion shows, pop up boutiques (temporary retail space, normally in warehouse type environments), Media exposure

Other: Negotiated discounts, fashion trend websites, shipping costs, Networking opportunities, fabric suppliers, between designers, funding support, Advocacy, Mentorship, consultation

3.3 Residential Incubators

This is where the fashion designer physically takes up residence on the premises of the incubator as compared to just making use of the services of the incubator.

As listed for non-residence

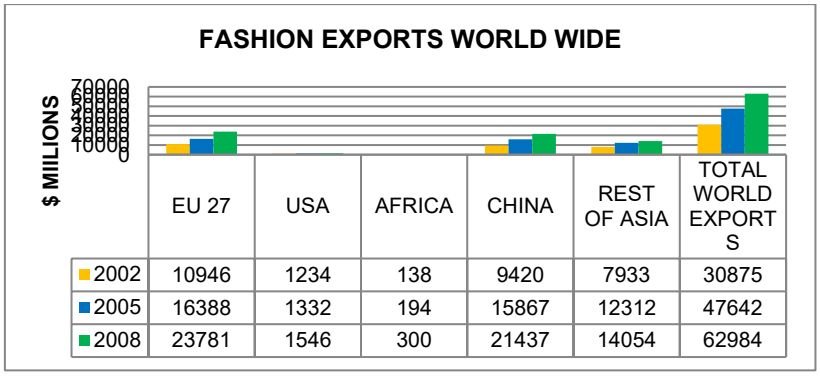
- Residence for a limited period (normally 1 year) on application, phased approach
- Shared administration, office space and show rooms
- Subsidised rental
- Strict criteria with emphasis on potential for success.

- Some have build-in partnership with retail outlets.

Fees charged

Courses fees range from free to between $500 and $1500 for technical courses. Membership fees ranges from $150 to $250 per month for non-residence and $ 275 to $ 550 for residence. Cost would be lesser for shared work space increasing substantially for a private studio. South Africa and particular Africa is lagging behind in fashion exports. The data extracted from the 2010 Creative Economy report illustrates (table 2) this point clearly (UNCTAD, 2010). It is important to note that Europe still commands a significant share of exports even though its manufacturing base has been eroded. This illustrates that Europe's strength is in fashion brand and design as opposed to manufacturing.

Table 2: Fashion exports worldwide (UNCTAD, 2010)



	EU 27	USA	AFRICA	CHINA	REST OF ASIA	TOTAL WORLD EXPORTS
2002	10946	1234	138	9420	7933	30875
2005	16388	1332	194	15867	12312	47642
2008	23781	1546	300	21437	14054	62984

3.4 South African Incubation Support

An agency of the Department of Small Business DSBviz. the Small Enterprise Development Agency (Small Enterprise Development Agency, n.d.) through its Technology Programmes supports incubators. The SEDA Technology Programme has 24 incubators across the country based on 3 different models of technology business centres (SEDA, 2012) i.e.

- Technology Demonstration Centres (TDCs) for demonstration of value adding technology,
- Technology Incubators (TIS), sheltered environment for technology based start-ups.
- Hybrid Centres combination of the two. These centres cover a wide range of sectors viz. ICT, manufacturing, biotechnology, small scale mining, construction, bio-fuels, Chemicals Floriculture Automotive, Agriculture, Essential Oils, Aluminium Stainless Steel and Furniture. However no known incubator supports the fashion sector in South Africa.

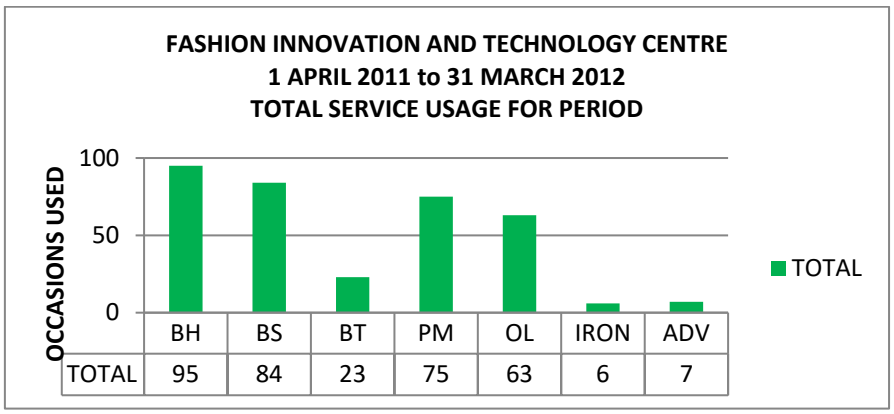
3.5 Support For The Smme Fashion Sector In Cape Town

The Technology Station:Clothing and Textiles(TSCT), based at the Cape Peninsula University of Technology, to provide technology support to the clothing and textile sector especially SMMEs as part of its community engagement programme. The unit is supported by the Technology Innovation Agency TIA to assist SMMEs to prototype their innovations. The TSCT partnered with the Cape Town Fashion Council and set up a satellite Station on the Cape Town Fashion Council premises known as the Fashion Technology and Innovation Centre (FTIC). The pilot project provided 3 specialised machines and 2 basic machine viz. a plain machine and an overlocker as well as an iron supported by a full time technician.

The following data (tables 3, 4 and 5) was extracted from the Annual report of the TSCT recorded on a quarterly basis for a period of one year, viz. 1 April 2011 to the 30 March 2012 (Isaacs, 2012).

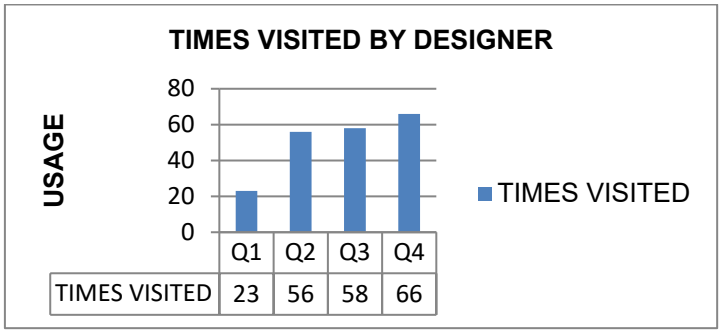
To be able to analyse the data in graphs the various machines and services were first coded (table 3).

Table 3: The most popular machines and services used for the period.



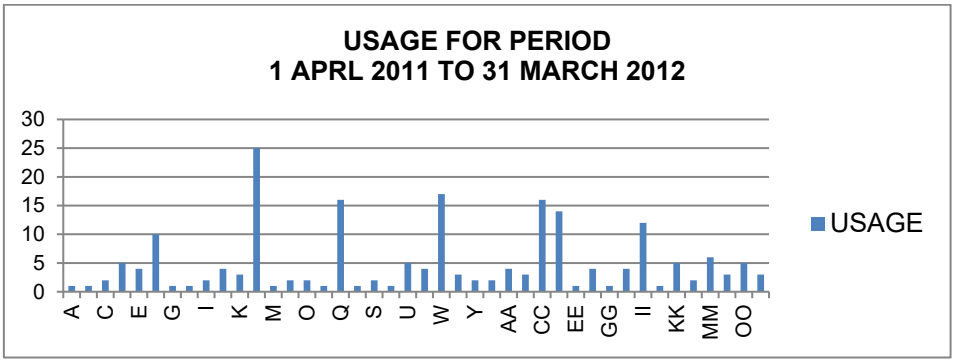
In a period of one year the growth in usage has been steadily increasing (table 6) from 23 users in the first quarter to 66 users in the fourth quarter. It is noted in table 5 that a number of designers are repeat users of the facility. This information would be used to develop the model for an incubator.

Table 4: The number of times visited by designers



In table 6 below it shows in coded form the frequency of the 42 designers who visited the FTIC during the period measured. Each letter represents a designer and how often they made use of the services. There are designers vi. L, Q, W, CC, DD that are candidates for a more permanent arrangement as noted in the international fashion incubators residential programme.

Table 5: The frequency of use by various designers



The data collected for the period measured show a linear growth in usage of the services of the FTIC as designers become familiar with the support offered. The designers that use the service work at their own premises and use the FTIC for completing their products. Various designers especially those from disadvantaged backgrounds have informally indicated a need for residence space to help them grow their business.

3.6 A Fashion Incubator Scenario for Cape Town

A centre would be available to fashion entrepreneurs against a set criteria viz.

- Graduate of an accredited tertiary education institution in Fashion, Clothing or Textiles.
- Registered business with a Business plan
- Payment of subsidised service fee.

STAGE 1

- Access to specialised technology to complete prototypes i.e.
- Various specialised sewing machines
- Sample embroidery machine and design facility
- Linkages to subcontractors also known as CMT(Cut Make and Trim) factories
- Technical advise

STAGE 2

- Provide up to date information on future fashion trends through access to trend reports magazines journals web information.
- CAD facilities
- CAD pattern making and grading
- Monthly network meetings
- Mentoring for presentation to buyers
- Show rooms
- Business and accounting support.
- Promote sustainable design

LONG TERM OBJECTIVES

- Sustainable centre through membership fees and sponsors.
- Organise group tour packages for young designers to attend international shows/exhibitions (access to DTI&CExport funds)
- Develop the South African fashion tourist market
- Retail outlets at strategic venues (e.g. Waterfront)
- Link to trade house for export
- Exhibition/ Fashion show
- Sustainable Fashion awards

4. Conclusion

The proposed fashion incubator in Cape Town aims to rejuvenate South Africa's clothing industry, addressing challenges from low-cost imports and a historical lack of design focus. Drawing on successful international models, this incubator would support emerging designers, helping them navigate industry complexities, boost creativity, and build sustainable businesses. Fashion incubators are proven to foster entrepreneurship and innovation, offering access to specialized equipment, technical advice, and industry networks. This support helps designers transition from purely creative roles to entrepreneurial ones, essential for developing a competitive fashion sector. Successful examples like the Fashion Incubator San Francisco and the British Fashion Council's Designer Fashion Fund highlight the positive impact on job creation and economic growth.

The Cape Town Fashion Incubator would provide similar support, including technical assistance, business mentorship, and networking opportunities. It would cater to the needs of fashion SMMEs, offering access to specialized sewing machines, CAD facilities, and current fashion trends. By supporting designers from disadvantaged backgrounds with subsidized services, the incubator aims to democratize industry resources, fostering a more inclusive and diverse fashion industry in South Africa.

Moreover, the incubator would promote sustainable practices, encouraging the use of eco-friendly materials and processes. This aligns with global sustainability trends and positions South African designers as leaders in ethical fashion. Long-term goals include organizing international tours, developing the fashion tourist market, and establishing retail outlets to integrate South African fashion into the global market. In summary, establishing a fashion incubator in Cape Town offers a strategic opportunity to rejuvenate the South African clothing sector. By addressing both the creative and business needs of emerging designers, the incubator would foster a new generation of fashion entrepreneurs, supporting economic development, job creation, and promoting sustainable and inclusive growth within the industry.

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Unlocking Tourism Diversity in Winter: Clusters of Tourists in Lisbon Based on Motivations, Profiles, and Behaviour

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Abstract: Recent trends in Lisbon's winter tourism indicate a shift towards off-peak travel, attracting diverse visitors with its rich cultural heritage, sustainable initiatives, and extended stay options for digital nomads. The city's culinary scene, arts, wellness activities, and tech-driven tourism options enhance its appeal. Aligned with these recent trends, tourism in Lisbon's region during the winter season presents a unique and dynamic landscape influenced by a wide range of motivations, tourist profiles, and travel behaviours. This study aims to define distinctive clusters of winter tourists in Lisbon by analysing these key variables, providing valuable insights specific to the winter travel context. Based on a compiled dataset from the winter season in Lisbon, this study delves into examining the factors driving tourist visits, encompassing socio-economic backgrounds, travel frequency, and age demographics. We aim to reveal the distinctive subgroups that define Lisbon's winter tourist population, employing data analysis techniques such as cluster analysis. From an academic perspective, this study offers a novel tourist segmentation model based on motivations, profiles, and behaviour. This model enriches the existing body of knowledge in tourism studies, providing a valuable reference for future research. For tourism agents in Lisbon, this study provides actionable insights to enhance strategic decision-making. By segmenting winter tourists, they can tailor marketing strategies and product development to cater to diverse tourist segments. Moreover, this approach can lead to economic benefits, optimising resource allocation, and revenue generation.

Keywords: Travel motivations, Push factors, Segmentation, Urban tourism, Winter tourism

1. Introduction

Winter tourism in urban settings has increasingly become a focal point for research, driven by the realisation that cities offer a unique blend of attractions and activities during the off-peak seasons that attract a diverse array of visitors (Ashworth and Page, 2011; Koens and Milano, 2023; Richards, 2018). Lisbon's rich cultural heritage and vibrant arts scene provide a compelling case study for examining these dynamics. Despite the growing interest, there remains a significant gap in the academic literature specifically addressing winter tourism in Lisbon, especially from a segmentation approach that considers the distinct profiles of tourists during this less typical tourism season.

Recent studies have argued for the importance of understanding the distinct seasonal patterns of tourist activities and how they contribute to the economic sustainability of urban destinations (McKercher et al., 2023; Vergori, 2017). Furthermore, literature on tourist segmentation highlights the need for city destinations to tailor their marketing strategies to different tourist segments to enhance destination appeal and competitiveness. The burgeoning interest in niche tourism markets, such as LGBTQ+ travel and digital nomadism, further emphasises the need for such targeted approaches (Dolnicar, 2020).

Based on data collected from tourists visiting Lisbon during the winter, three clusters were identified based on distinct travel motivations - push factors. This study advances tourism segmentation theory by identifying distinct clusters characterised by specific travel motivations and nuanced travel behavioural and sociodemographic aspects. Additionally, the findings help city planners and tourism marketers tailor strategies to meet the particular needs of different tourist segments, enhancing Lisbon's appeal as a winter destination.

2. Literature Review

2.1 Travel Motivations

Motivation is extensively recognised as fundamental in understanding human behaviour across various academic disciplines, including psychology, sociopsychology, and marketing. It has a critical role in shaping consumer decision-making, a topic scholars have rigorously explored over the years (Fodness, 1994; Gillison et al., 2019).

Motivation significantly influences tourist behaviour in the tourism industry, guiding everything from destination choice to activity selection during travel. Rooted in tourists' internal desires and values, these motivations often subconsciously shape decision-making processes and ultimately determine the travel experience (Pereira et al., 2019; Yoo et al., 2018).

In recent decades, the study of travel motivations has garnered extensive attention in tourism research, underscoring a direct link between motivational factors and travel intentions and behaviours. This body of research suggests that a deep understanding of travel motivations is essential for effectively meeting the needs and preferences of tourists, ultimately influencing their overall travel experiences (Lin and Nawijn, 2020; Wong et al., 2018).

The push and pull theory of motivations (Dann, 1977) is a widely accepted theoretical framework in tourism research. It postulates that the push and pull effect determines tourists' decision to travel: people travel because they are pushed by internally driven socio-psychological motives and pulled by externally driven destination-related motives (Crompton, 1979). Hence, push factors correspond to the internal aspects of the individual, to their psychosocial motivations for travel (Prayag and Hosany, 2014), while pull factors relate to aspects external to the individual, including the set of attributes and characteristics of tourist products (Yoon and Uysal, 2005).

The push-pull model has been applied across various tourism contexts to explore tourist motivation (Dancausa et al., 2023; Liu, 2023), including food tourism (Su et al., 2018), culture and heritage tourism (Chen and Mo, 2014; Yousefi et al., 2015), adventure tourism (Giddy, 2018.), and cruise tourism (Whyte, 2017). These studies reveal that both internal and external factors play a role in influencing tourist motivation. Anyway, the relative importance of these factors may vary depending on the specific context.

As a result, a considerable number of travel motivations have been identified, such as escape, prestige, challenge, adventure, excitement, relaxation, self-discovery, ego-enhancement, social circles, gaining knowledge, spiritual needs, and family togetherness (*e.g.,* Baniya and Paudel, 2016; Rita et al., 2019).

2.2 Urban Winter Tourism

Tourism seasonality represents a significant challenge in the tourism industry, affecting destination management and economic stability (Baños-Pino et al., 2023; Böcker et al., 2013; Coromina and Camprubí, 2016). Urban winter tourism refers to the phenomenon of tourists visiting urban destinations during the winter season, attracted by the city's cultural and urban experiences rather than traditional snow-centric activities. This form of tourism leverages the unique attributes of cities to offer diverse attractions and activities even in colder weather (Connell et al. 2015; Duro 2018).

Urban winter tourism moves away from traditional activities like skiing and snowboarding, focusing instead on cultural events, festivals, markets, and outdoor activities suitable for cold weather. This shift from snow-centric to cultural and urban experiences highlights the versatility and appeal of cities as winter destinations. Cities leverage their cultural assets to host diverse winter events and activities that capitalize on the unique features of urban settings. This strategy enhances traditional tourist offerings, reduces dependency on specific weather conditions, and attracts visitors during the off-peak season, leading to significant economic benefits (Bausch & Unseld 2018; Bichler & Pikkemaat 2021).

Tourists, especially those from snow-deprived regions, are drawn to urban destinations seeking novelty in winter landscapes and are further motivated by the festive ambience of holiday celebrations like New Year's Eve, for

instance, fostering socialising and exploration. Overall, this blend of seeking novelty and participating in seasonal festivities significantly motivates tourists to choose urban destinations during winter (Cocolas et al., 2016).

Winter tourism in Lisbon offers a unique chance to experience the city's notable features during the cooler months, influenced by several push factors that draw visitors. The city's mild climate, vibrant cultural events, affordable travel options, and unique culinary offerings are significant attractions. These elements and tourists' internal motivations - such as comfort, cultural engagement, value, and culinary curiosity, fundamentally influence their decision to visit. Understanding these pull and push factors provides deeper insights into why Lisbon continues to captivate diverse visitors during winter, highlighting the complex interplay between destination attributes and personal travel motivations (Loureiro and Sarmento, 2019; Machete et al., 2014).

2.3 Tourist Segmentation Based on Push Factors

Segmenting tourists according to their push factors is vital in the tourism sector, shaping marketing approaches, resource allocation, and sustainable development. By understanding tourists' internal motivations, destinations can customise marketing strategies to cater to diverse needs effectively, thereby boosting promotional efficacy and overall destination attractiveness.

Identifying specific segments such as escape, novelty, or passive seekers enables destination managers to craft targeted marketing strategies that resonate with each group's unique motivations, as highlighted by Tsegaw (2023). This strategic approach not only improves marketing outcomes but also optimises the use of resources, particularly in digital and social media platforms, where content can be specifically configured to attract tourists based on their motivational factors (Katsikari et al., 2020).

Furthermore, understanding tourist push factors aids in strategically allocating resources, ensuring that services are tailored to meet the expectations of distinct tourist groups. This not only enhances the tourist experience, potentially increasing destination loyalty, but also aligns with sustainable tourism practices by addressing the specific needs of tourists in a manner that promotes resource efficiency (Mesić et al., 2022).

3. Method

3.1 Data Collection and Instruments

A self-administered questionnaire was used to collect data from a convenience sample of Lisbon region tourists. The respondents answer the questionnaire autonomously at their own pace, without interference from the interviewer. This process assures the respondent a sense of anonymity and security, promoting honesty in responses and reducing social desirability bias. Thirteen sampling points were identified to cover the region as best as possible, and the data was collected between January and February 2024. The winter season in Lisbon was defined based on climatic and tourism industry standards. In the Lisbon region, winter spans from December to February and is characterised by cooler temperatures and a distinct shift in tourist activities and motivations. The tourism industry in Lisbon aligns its marketing and operational strategies with this seasonal framework, promoting winter-specific attractions and events. Our study excluded December due to the particular characteristics of the holiday season events that could affect travel motivations and tourists' decisions.

The list of sources of tourism information that people usually consider when organising tourism travels (rated by respondents from 1- Not at all Important to 7- Extremely Important) was adapted from the literature (Coromina and Camprubí, 2016; No and Kim, 2015), as well as the list of reasons to take the trip (1- Totally Disagree; 7- Totally Agree) (Rita et al., 2019; Sangpikul, 2008, Yung-Kun et al., 2015); other variables included in the questionnaire intended to describe the participants' demographic profile and travelling behaviour.

3.2 Sample Profile

The convenience sample comprises 306 observations. The age distribution reflects a broad spectrum, with a greater percentage falling within the 26 to 35 years bracket (38%). The 18 to 25 years group (20%), the 36 to 45 years group, and the 46 to 55 years group (15% each) are also noteworthy. The gender distribution reveals a slight predominance of women, constituting 55% of the sample. 77% of respondents indicated possessing 'Tertiary education', and 21% hold secondary education. Among the respondents, 60% are employed full-time, and 13% are students. Entrepreneurs constitute 12%; the remaining sample was formed by retirees, part-time employees, and unemployed participants. 45% of the participants reported an annual gross income below 20,000 euros, while 42% reported between 20,000 and 40,000 euros. The rest of the sample reported more than 40 000 euros. Respondents originate from a diverse range of 31 countries, but the majority comes from European countries (76%), with Spain (17%), Italy (15%), and France (12%) emerging as the most represented.

Related to travel behaviour, 71% of the tourists were visiting the Lisbon region for the first time. The other participants have visited the area one to three times before. 69% consider their travel arrangements independent, and 30% purchased the service from a travel agency or tour operator. 31% visited the region with family, 30% with friends, 26% with a spouse or partner, 11% were solo travellers, and 1% with colleagues or co-workers. The main reasons for the trip were cultural exploration and experience (58%), leisure (56%), and adventure and exploration (22%).

3.3 Data Analysis

A K-means algorithm analysis was performed for two, three, four, and five clusters. The solution of three segments was confirmed as the best option statistically. The discriminant analysis revealed that 98% of the cases were correctly classified. The Wilks statistic for the two discriminant functions was 0,081 (<0,01), confirming significant differences between the three groups. The canonical correlations were 0,861 and 0,829 for functions 1 and 2, respectively. Figure 1 shows the position of the clusters according to the two discriminant functions. ANOVA tests confirm the differences between the motivation variables among the three groups, except for 'I wish to relax' and 'I wish to see the beauty of the place'. Segment characterisation was done through descriptive statistics, and differences were tested using Qui-square and ANOVA /Kruskal-Wallis tests.

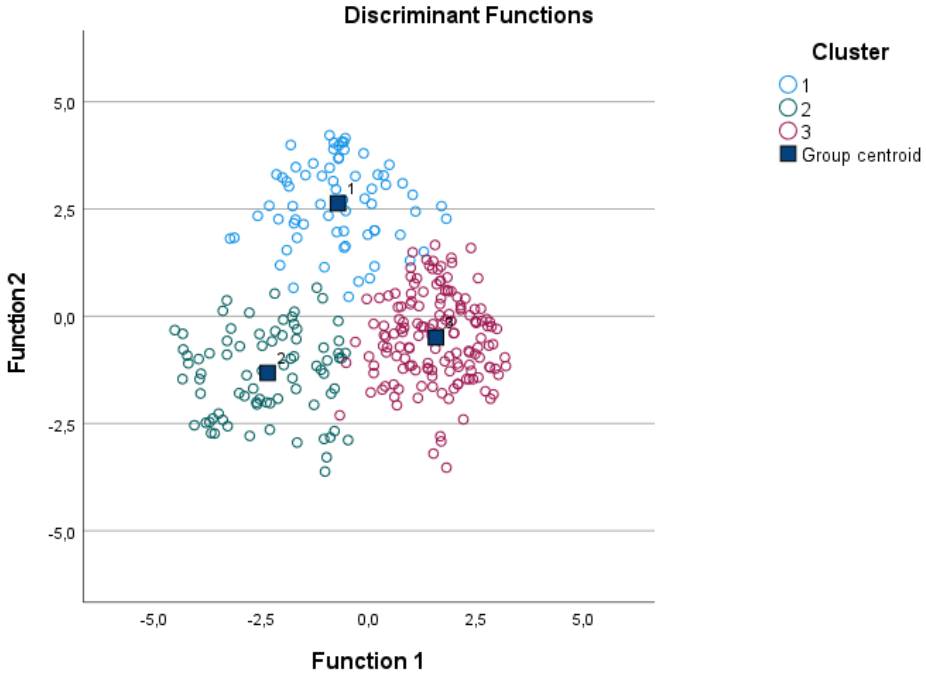


Figure 1: Clusters position supported by travel motivation

4. Results

We begin by describing the traits that are shared across all segments. Then, the characterisation of each cluster is presented, considering travel profile, motivations, sources of tourism information, and sociodemographic characteristics.

Regarding travel profile, there was no significant difference between tourists visiting the region for the first time across the three segments (between 65% and 77%). 'Cultural exploration and experience' is the primary reason for travelling, cited by 50% to 60% of respondents across all segments, although nearly 80% of those in cluster 2 also travelled for 'leisure' purposes. Adventure and exploration are other common travel reasons, with 19% to 24% of responses in each segment. Motives such as 'family reunions', 'work-related travel', 'honeymoons', and 'educational' pursuits received minimal responses, ranging from 0% to 6%, with "work and business" travel slightly more prevalent in cluster 3.

Regarding travel motivations, 'I wish to relax' and 'I wish to see the beauty of the place' are consensual across all three segments. Regarding the motivation, 'I wish to relax,' Cluster 1 had a 79.7% total agreement, cluster 2 had 77.5%, and Cluster 3 had a 73.2% total agreement. Concerning 'I wish to see the beauty of the place', cluster 1 had 98.6%, cluster 2 had 91.3%, and cluster 3 had 90.8%

Concerning sources of tourism information, all segments similarly valued 'official websites (e.g., websites of locals, attractions, tourism organisations)' and 'search engines (*e.g.,* Google)'.

As for the sociodemographic profile, there were no significant differences among the three segments regarding the 'Current professional situation' of participants, with 59% to 65% being 'Employed full-time'.

4.1 Cluster 1: Cultural Explorers

Travel profile - Regarding travel arrangements, 49% of the respondents from this segment opted for independent travel arrangements, while the remaining (44%) preferred services purchased through a travel agency. Most travellers prefer to go with 'family members' or a 'spouse/partner', making up nearly 90% of the segment, while fewer choose to travel with 'friends' or 'solo'. Trips of 1-7 days are most common, comprising over 70% of responses from this segment, but 1–2-week stays are also notable at 26%. The main motivation for travel is 'cultural exploration or experiences', which nearly 60% of participants cite, closely followed by 'leisure' at 49%.

Travel motivations- Tourists in this segment strongly disagree with the statement, 'I wish to have a break from everyday life'. Conversely, they show the highest level of agreement for 'Interactions with families' and 'I wish to interact with other people'. Additionally, there is a higher agreement, compared to other segments, with 'I wish to be in contact with nature' and 'I wish to observe animals that are not living in the country where I live'.

Tourism information sources - In this segment, the most influential sources of information, ranked by their degree of importance, are 'Search engines (e.g., Google)', at 81.2%, 'Official websites (e.g., websites of locals, attractions, tourism organisations)', at 66.7%, 'Friends and relatives' recommendation', at 59.4%, and 'Sites of reviews (e.g., TripAdvisor, Booking, Trivago)' at 55.1%. For 'Travel agencies', 40.6% of respondents consider it extremely important, while 24.6% do not attribute any importance to it. 'Tourism brochures' also see an equal split at 24.6% between those who find them extremely important and those who don't find them important at all. Press, radio, and television are deemed important by 66.7% of respondents from this segment. 'Tourism blogs' exhibit a similar pattern, with 55.1% agreement. On the less favourable side, 'Tourism fairs' are considered "not at all important" by 38.2% of respondents, 'Social networks (Facebook, Instagram, YouTube, etc.)' by 44.9%, and 'Digital influencers' by 60.9%.

Sociodemographic profile – In this segment, most respondents are male (55%). There is nearly an equal split between individuals with 'Secondary/Professional education' and those with 'Tertiary-University' qualifications (47% versus 49%). This segment also comprises the highest percentage of 'Employed-full time' (65%) and 'Retired' (25%) individuals among the three segments. Furthermore, 59% of the respondents report an income bracket of €20,000 to €40,000.

4.2 Cluster 2: Leisure explorers

Travel profile - Regarding travel arrangements, 50% of respondents from this segment indicated independent travel arrangements, while the other 50% preferred services purchased through a travel agency. Regarding the travel party composition, this segment has the highest proportion (24%) of 'solo travellers'. However, there is a stronger preference for travelling with 'Family members' or a 'spouse or partner', which accounts for 73% of the total. Additionally, the data reveals a preference for stays lasting '4-7 days' and '1-2 weeks', representing 84% of responses. Regarding the reason for travel, 'Leisure' notably stands out in this segment, with a significantly higher percentage (79%) of affirmative responses, nearly twice as many as in the other segments.

Travel motivations - 'I wish to have fun' garners the highest level of agreement among the listed motivations in this segment, while 'I need to study or work' encounters complete disagreement. There is also a strong disagreement about 'I wish to interact with my friends'. Furthermore, 'I wish to do what most people think is necessary to do at least once in life' receives lower levels of agreement than the other two segments.

Tourism information sources - This segment distinguishes itself by placing greater importance on 'Tourism blogs', demonstrating less variability in this preference. It assigns the least significance to 'Friends and relatives' recommendations.

Sociodemographic profile - This segment exhibits a nearly equal distribution of male and female participants (50% versus 49%). It primarily comprises individuals aged 26 to 55, constituting approximately 80% of its demographic. Notably, 89% of respondents hold a 'Tertiary-University' degree, the highest proportion among all segments. Regarding their 'Current Professional Situation', it ranks second in the percentage of 'Employed-full time' respondents (61.3%), has the highest rate of 'Entrepreneurs' (19.8%), and uniquely includes 'Unemployed'

respondents at 4%. Income levels are relatively evenly distributed, with 48% earning less than €20,000 and 44% earning between €20,000 and €40,000.

4.3 Cluster 3: Social Explorers

Travel profile - This segment is distinguished in 'Travel arrangements' by a significant preference for independent travel arrangements, with 85.6% choosing this option compared to only 14.4% opting for the more traditional services purchased from a travel agency or tour operator. Concerning the 'Travel Party', this segment is notable for a high rate (56%) of 'travelling with friends' and a low rate (11,1%) of travelling with a 'spouse or partner'. It shows a preference (73,2%) for stays ranging from '4-7 days' (42,5%) to '1-2 weeks (28,8%)'. The primary reason to travel is 'Cultural exploration or Experience' (60%), followed by 'Leisure' (49%).

Travel Motivations - This segment exhibits the most disagreement and greatest variability concerning the desire 'to know different cultures'. Conversely, 'I wish to interact with my friends' receives the highest level of agreement. Both 'I wish to feel more independent' and 'When discussing with my friends on social media (such as Facebook) I raised the impression that I would do it' also show high levels of agreement. Additionally, this segment shows strong agreement for motivations such as 'I wish to have fun', 'I wish to see the beauty of the place', 'I wish to have a break from everyday life', 'I wish to know different cultures', and 'I wish to relax'. Motivations such as: 'I wish to feel more independent', 'I wish to interact with my friends', 'When discussing with my friends on social media (such as Facebook), I expressed the intention to do it', 'I wish to experience beautiful natural landscapes', 'I wish to be in contact with nature', 'I wish to do what most people think is necessary to do at least once in life', 'I wish to interact with other people', and 'I feel connected to the Lisbon region' also have relatively high levels of agreement. However, there is an important level of disagreement for motivations such as 'I wish to observe animals that are not native to my country', 'I wish to interact with my family (partner, children, mother, father, brothers, etc.)' and 'I need to study or work'.

Tourism information sources - The more traditional 'Travel agencies', 'Tourism brochures', and 'Press, radio, and television' are deemed least important by this segment, whereas 'Review sites' are highly valued and considered very important. Additionally, 'Digital influencers' and 'Social networks' are rated highly important and exhibit the least variability in this group.

Sociodemographic profile- In this segment, female participants constitute the majority (62%), with a significant portion (85%) aged 18 to 35 years and none over 65. Regarding education, 84% hold 'Tertiary-University' qualifications, with no respondents having only 'Primary' education. Regarding their 'Current Professional Situation', this segment includes the highest proportion of 'Students' (21%), the lowest level of 'Employed-full time' (58%), and nearly 11% are 'Entrepreneurs'. Financially, this group has the largest share (52%) in the lowest income (less than €20,000), reflecting the high number of students, and also holds the second-highest proportion (11.3%) within the €40,001 to €50,000 income range.

5. Discussion

This study provides a comprehensive insight into the dynamics of winter tourism in Lisbon, highlighting its evolution and the diverse tourist segments it attracts. Next, we present a breakdown of the theoretical and practical contributions. The theoretical insights help build a solid academic foundation on urban winter tourism dynamics. At the same time, the practical applications provide actionable strategies for enhancing Lisbon's appeal and economic benefits during the winter months. These contributions are vital for sustaining tourism growth and adapting to changing tourist behaviours in urban settings.

5.1 Theoretical Contribution

The research enriches the theoretical landscape. It contributes to urban tourism theory by illustrating how cities can leverage their inherent cultural and infrastructural advantages in less busy seasons. Moreover, the study enhances tourism segmentation theory by pinpointing distinct clusters grounded in travel motivations and profiling each based on nuanced behavioural and sociodemographic variables. It helps understand how different segments perceive and consume tourism differently, particularly in an urban winter context. Furthermore, integrating socio-economic factors like employment status, income levels, and educational backgrounds into the analysis provides a deeper theoretical understanding of how these elements influence travel preferences and behaviours, aligning with theories of consumer behaviour in tourism.

5.2 Practical Contribution

The study's findings offer valuable guidance for tourism marketers and city planners in Lisbon on tailoring their offerings to meet the distinct needs of various tourist segments during the winter. By understanding the primary travel motivations of each segment, tourism providers can diversify their products and services to better cater to these preferences. Additionally, insights from the study can aid in efficient resource allocation and policy formulation, helping to prioritise investments in tourism infrastructure such as enhancing cultural sites, improving public transportation, and developing winter-specific festivals and events. Understanding each segment's specific needs and preferences, including their length of stay and travel party composition, enables tourism operators to create more targeted and satisfying experiences that could lead to higher rates of repeat visitation and positive word-of-mouth.

5.3 Limitations and Further Research

The use of convenience sampling in the study on Lisbon's winter tourism poses a significant methodological limitation due to its susceptibility to selection bias, which may affect the sample's representativeness and limit the generalizability of the findings. Furthermore, the study's reliance on cluster analysis, which is heavily dependent on the chosen variables and data integrity, could be compromised by the limitations of the sampling method. Consequently, while the study offers valuable insights into the dynamics of winter tourism in Lisbon, these findings should be taken with caution, considering the potential biases and limitations of the study's design and methodology. Further research can be done by adding other research variables while keeping the questionnaire with a reasonable dimension.

Addressing these limitations in future research could involve expanding the scope of data collection across multiple seasons, including a broader geographical area, incorporating more granular demographic data, conducting longitudinal studies, and integrating more qualitative analyses to understand the cultural and social nuances affecting tourist behaviours.

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Greenwashing in the FinTech Sector: The Role of the EU Corporate Sustainability Reporting Directive (CSRD)

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Abstract: FinTech companies, along with other financial institutions, face increasing pressure to take the lead in promoting a more environmentally sustainable future. The EU lately incorporated Corporate Sustainability Reporting Directive (CSRD) which offers both possibilities and challenges. This study examines the most recent modifications to Environmental, Social, and Governance (ESG) standards, identifying potential shifts that could affect FinTech firms. The problem of "greenwashing," a tactic used by businesses to misrepresent themselves as environmentally conscious, is especially concerning. Through literature analysis, this study attempts to explain terms related to greenwashing. While greenwashing instances were revealed so far within the confines of traditional banking, this study ventures beyond, including FinTech firms. FinTech companies are the focus of analysis because they are expected to play a significant role in the increased regulatory scrutiny starting in 2024. The paper addresses the opportunities and challenges that financial technology companies may face as they navigate this complex field. Relevant stakeholders looking for deep insights into the relationship between financial technology and environmental responsibility will find great value in the research's conclusions. This paper adds to an ongoing conversation on sustainability and regulation, enhancing the discussion of ethical financial activities.

Keywords: Greenwashing, FinTech, EU corporate sustainability reporting directive, Environmental, Social, and governance (ESG) criteria, Regulatory implications

1. Introduction

The world is witnessing the pressing need to meet the 2030 Sustainable Development Goals (SDGs). SDGs are an example of a few international agreements, primary among them the Paris Agreement, which contains a promise to attain the net-zero aim (Lee et al., 2023). The financial sector noted the challenge and opportunity of contributing to sustainable innovation. All three pillars—economic, environmental, and social—are driven by the FinTech sustainability nexus, according to the literature (Abad-Segura et al., 2020; Goldstein et al., 2019).

Few studies have identified FinTech as a key player in energy transition and emissions reduction. Low-carbon FinTech is promoting sustainable development by facilitating green finance, lowering costs, and offering efficient, sustainable lifestyles (Sreelekshmi et al., 2023). The number of climate tech startups and scaleups is rising, with the thriving green technology sector emerging. The sector is expected to grow to $9.5 trillion by 2030. Only positive for the investors and for all the workers that the sector employs, but also for the planet. Green tech companies use innovation and new business models to reduce greenhouse gas emissions, replace unsustainable materials, and lower demand for non-renewable natural resources (Time, 2024). This new trend is only showing the speed and the need for more enablers to bring us closer to sustainability goals.

The current European Union (EU) regulatory scene helps businesses move towards greener practices.

With the implementation of the new European Union Directive (EU) 2022/2464 of the European Parliament and of the Council of December 14, 2022, the non-financial disclosures for large companies are now regulated. The Directive aims to increase transparency and comparability of Environmental, Social, and Governance (ESG) disclosures while also ensuring due diligence of the information presented. Previously, the audit of non-financial statements was not secured, leading to irresponsible practices by some companies and financial institutions. This practice was coined in literature as "greenwashing," a tactic described by companies that misleads stakeholders about their environmental practices and approaches.

There are a handful of previous studies, published just over the last year and currently, that investigated the effects of the new CSRD directive on the FinTech sector. Zhou & Wang (2024) examined FinTech's role in sustainable finance and discovered that, in the end, it promotes sustainable finance by helping to expose greenwashing by making financial services more accessible to environmentally conscious businesses. Xie et al. (2023) focused on the topic of how FinTech inhibits corporate greenwashing. The impact of bank FinTech on ESG greenwashing was studied by Liu & Li (2024). The findings included that FinTech reduces greenwashing by minimizing financial constraints and information asymmetry, particularly in high-polluting industries. While some studies examined the implications of recent regulations on the FinTech sector, including CSRD, there is a notable gap in research specifically focusing on how the FinTech sector adapts to new regulatory regimes, particularly in combating greenwashing. FinTech, as an emerging sector, is not known as well as traditional banks

for adhering to ESG practices or guidelines. Given the limited studies in this specific area, this study aims to address this gap by investigating existing literature on greenwashing in FinTech and studying the implications of the new CSRD directive on the regulatory landscape of FinTech.

Although most cases of greenwashing reported so far concerned traditional banking institutions that disclosed non-financial information on a voluntary basis, this study expands the discussion to include FinTech companies. This paper contributes to a more nuanced understanding of greenwashing within the evolving regulatory framework (CSRD) by focusing specifically on the FinTech industry. It also contributes to the growing body of literature on the implementation of the CSRD directive, with a particular focus on assisting FinTech firms to detect and combat greenwashing.

This study is guided by the following research questions:

Q1: What conclusions can be drawn from the literature on greenwashing that are particularly relevant to the FinTech sector's adaptation to new regulatory regimes?

Q2: What role can FinTech play in mitigating greenwashing?

The implementation of the directive shall be considered a legal factor, however, if it is deemed to affect the entire business environment of the companies. The implementation and its effects are therefore multi-related and connected to other elements. This study, exploratory in nature, aims to show the effect of these potential elements by reviewing the existing literature (desk research). To address the research questions, the study will employ a combination of inductive, deductive, and synthetic approaches. The methodology applied in the study adapts the SLEPT (Social, Legal, Economic, Political, and Technological) framework. Although the analysis does not strictly follow the traditional SLEPT framework categories, it does modify these elements in order to fully analyze the directive's complex effects. SLEPT adaptation aids in structuring the study's deductive nature.

The article is organized as follows for the remainder of it: The second section provides a synthesis of recent regulations such as the Corporate Sustainability Reporting Directive (CSRD) that aim to encourage FinTech companies (and not only) to integrate environmental sustainability into their operations. The third section gathers and explains the main terminology relevant to the study: greenwashing and FinTech. The explanation of the terms is based on the Scopus database searches of these two terms relevant to the study. The fourth section, titled "CSRD contribution to FinTech's business landscape," presents arguments for the research questions. In the "Conclusions" section, the findings, recommendations, and contributions are presented.

2. Regulations as a Driver for FinTech's Environmental Sustainability

Environmental sustainability is an important topic that has gained attention through the implementation of CSRD. Regulations acknowledge the significance of sustainability. New regulatory frameworks encourage FinTech companies to incorporate environmental sustainability into their operations (Vergara & Agudo, 2021).

By requiring businesses to integrate sustainability into their activities, the Corporate Sustainability Reporting Directive (CSRD) contributes to the advancement of green technology. A systematic framework that requires thorough reporting on environmental, social, and governance (ESG) factors is made available by the implementation of the CSRD. The directive itself orders the companies, and FinTech's among them, to include sustainability aims, such as absolute greenhouse gas emission reduction targets for 2030 and 2050. CSRD also mandates to include a description of the company's progress towards attaining its aims, as well as a declaration on whether its environmental targets rely on conclusive scientific evidence (European Union, 2022, Article 19a, 2b).

FinTech, also being in the scope of this regulation, will be required to present a plan, including how it will carry out actions and make related financial and investment plans to make sure that its business model and strategy are in line with the shift to a sustainable economy. The goal is limiting global warming to 1.5°C under the terms of the Paris Agreement, adopted on December 12, 2015, by the United Nations Framework Convention on Climate Change, and achieving climate neutrality by 2050 as set forth in Regulation (EU) 2021/1119 of the European Parliament and of the Council (European Union, 2022, Article 19a).

The directive encourages environmental practices by establishing criteria for environmentally sustainable economic activities, which "may encourage economic operators not covered by this Regulation, on a voluntary basis, to publish and disclose information on their websites regarding the environmentally sustainable economic activities they carry out (European Union, 2022, Recital 15).

3. Definitions of FinTech and Greenwashing

Two concepts relevant to this study are financial technology (FinTech) and "greenwashing." There does not appear to be a single, accepted definition of FinTech. Admittedly, there is a conceptual diversity of the term in the academic literature (Milian et al., 2019). According to Zhou et al. (2022), the Financial Stability Board (FCB) characterizes FinTech as financial innovation propelled by technology that presents innovative applications, procedures, and goods that have a noteworthy influence on financial markets, establishments, and offerings. Another definition describes the FinTech phenomenon as an innovation aimed at providing alternative financial services, followed by practical examples of FinTech: peer-to-peer lending, digital-only banks, mobile money, cryptocurrency, and regulatory technology (RegTech). Mobile money is a prominent example of a widely adopted FinTech innovation (Senyo et al., 2022). However, the Goldstein et al. 2019 study describes FinTech as focusing on integrating recent technology into established financial operations while downplaying the importance of the Internet. This latter FinTech definition is unique in that it places FinTech in the context of its contributions to current financial systems, highlighting the aspect of incorporating new technological advancements into already existing financial systems and procedures.

The intricacy of recognizing and comprehending greenwashing—a practice in which businesses may mislead stakeholders about their environmental efforts or effects—is within the scope of this study. Because greenwashing takes many different forms—from deceptive environmental labels on products to inflated sustainability claims in corporate reports—even to the most knowledgeable, it is challenging to identify it.

There are a range of terms that are used to describe greenwashing. These include corporate social responsibility decoupling, greenwashing, pinkwashing, bluewashing, CSR washing, or recently, social washing. These terms are interchangeable. Although greenwashing is used broadly, it will be consistently applied throughout the whole study.

Existing scientific publications on the subject of greenwashing feature methodical literature reviews. This study will rely on the outcomes of the analysis made by De Freitas Netto et al. (2020) to structure and systematize the terminology. However, the definitions gathered in Table 1 covered up to and until 2020, leaving a gap of four years of academic literature that evolved and equilibrated the terminology. To fill this gap, a more extensive search was conducted, which enhanced and completed the list of definitions of greenwashing found in scholarly publications after 2020. Aiming to refine a variety of existing definitions of greenwashing, a narrow search of the existing academic literature focused on the issue of greenwashing in the context of FinTech was done. The search was conducted using the Scopus database. Search terms that matched the definitions used in the study were included in the search string: (TITLE-ABS-KEY (greenwashing) AND TITLE-ABS-KEY (FinTech))).The search result returned seven papers, with no time bounds. It is important to note, however, that most papers were published recently in 2024 and 2023.

Table 1: Selected definitions of term greenwashing

Year	Author	Definition
1976	Weick	Decoupling among authorities in educational institutions.
1977	Meyer and Rowan	Decoupling as action of upholding formal, standardized structures while adjusting their operations to suit real-world needs.
2010	Jamali, Egels-Zandén, et al.	Separation of CSR policies from daily operations.
2012	Walker and Wan	CSR Decoupling as symbolic CSR initiatives that seek to improve society and the environment without requiring the company to materially adjust its actual business processes. Companies that have a negative CSR performance which at the same time apply a positive communication about their CSR performance.
2016	Pope and Wereas	"CSR-washing," referring to separation of CSR action from communication and a business's ability to compete.
2016	Haack et.al	Improvements to the environment and society, symbolic in nature.
2019	Sauerwald, S. and Su, W	The gap between how firms communicate CSR and what firms do in terms of CSR.
2020	Glozer and Mori	CSR decoupling as hypocritical presentation of themselves, which deviates from their true selves.

Year	Author	Definition
2020	Du, 2015; Akituran, 2018; Huang et al., 2020; Torelli et al.	Greenwashing as a type of CSR decoupling in which businesses signal their environmental responsibility publicly through environmental certification or other means, frequently without making significant changes to their actual environmental practices.
2022	Minh and Quang	Misleading information or false impressions about company's products are environmentally friendly. Businesses will use "strategic" environmental speculation.
2023	Xie et al.	Presenting false information or misleading impressions about how environmentally friendly a company's products are.

Source: Own elaboration based on De Freitas Netto et al. (2020), Minh and Quang, (2022), Xie et al., (2023).

In the academic literature, both terms "green finance" and "FinTech" are relatively new and largely unexplored, so their nexus research is even more relevant. Green FinTech gained entrepreneurial attention as evidenced by their growth in terms of number, areas under operation, regions of operation, number of employees, and recognition from funding agencies (Wan et al., 2023) According to the StartUs Insights Report, there are currently 863 green finance companies globally. Among these, green FinTech stands out for their innovative solutions in green financing, including areas like green funds, traceable investments, and ESG financing. These startups operate in hubs such as London, New York City, San Francisco, Singapore, and Berlin (StartUs Insights, 2024).

The academic literature mentions that some scholars consider only environmental issues when defining greenwashing, distinguishing it from the term bluewashing, which stands for social issues. Other researchers do not make this distinction and consider greenwashing to have a social and environmental focus. Greenwashing can be perceived from several different angles, from product-level claims with environmental labeling to firm-level elements being a part of sustainability reports. This multifaceted way of greenwashing offers consumers difficulty in identifying and addressing this phenomenon (De Freitas Netto et al., 2020).

Over the course of decades, several academics and researchers have contributed to our understanding of the concept of "greenwashing." Although the concept has evolved over time, it still presents a persistent challenge to ensuring corporate actions match their stated intentions.

3.1 FinTech Greenwashing in Scientific Research

The searches for definitions of FinTech and greenwashing in the academic database of Scopus sought to highlight so far carried out research that would center around the problem in a specific FinTech environment. Zhou and Wang (2024) state that their research examines how FinTech can help historically non-environmentally conscious companies (referred to as "brown firms") recognize and minimize their greenwashing practices, with an emphasis on the convergence of sustainable finance and FinTech. The study claims that many brown businesses may falsify their environmental friendliness to obtain sustainable financing, therefore finding themselves participating in greenwashing. According to the study, financial institutions can now choose companies that genuinely qualify for sustainable finance based on their environmental contributions, thanks to this technological capability. The study highlights the pivotal function of FinTech in augmenting the effectiveness of sustainable finance. This is achieved by providing the necessary instruments to counteract greenwashing, thereby guaranteeing that financial support is allotted to authentically sustainable endeavors instead of those preventing them. A similar outcome is included in the study by Xie et al. (2023. The research highlights that corporate greenwashing behavior is inhibited by financial technology and that this inhibitory effect is positively reinforced by financial constraints. The article illustrates that FinTech is perceived as a powerful tool to help achieve transparency when identifying greenwashing. It also underscores the importance of financial constraints reinforcing this effect, which will contribute to more sincere and sustainable corporate practices. The most recent study by Liu and Li (2024) shows that by removing financial barriers and reducing information asymmetry, FinTech successfully lowers ESG greenwashing.

Although the academic literature seems to be limited, the studies agree that FinTech contributes to diminishing greenwashing by improving straightforwardness and transparency, monitoring, and guaranteeing the genuineness of environmental claims. The integration of advanced technologies used by FinTech creates an environment where honest and genuine sustainable practices are stimulated and the opposite is discouraged.

4. The CSRD Contribution to FinTech's Business Landscape

This study draws on the SLEPT framework to investigate the broader environmental factors influencing FinTech's under new regulations. While not strictly adhering to the conventional categories of SLEPT framework, the analysis adapts these elements to thoroughly analyse the directive's multifaceted influences. Adapting SLEPT helps to structure the deductive character of this study.

4.1 CSRD Implementation

The Corporate Sustainability Reporting Directive (DIRECTIVE (EU) 2022/2464) went into effect on January 5, 2023. The implementation of CSRD is linked to the European Green Deal that envisions the EU as a contemporary, resource-efficient, and competitive economy.

CRSD introduced the requirement to report on sustainability by large companies (with an average number of employees exceeding 500) and publicly traded corporations. Parent undertakings being a part of a large group (with an average number of employees exceeding 500 on a consolidated basis) are also in scope. In the case of non-European-based companies with an annual turnover exceeding EUR 150 million on the EU market or companies with securities traded on EU-regulated markets, these companies will also be required to issue sustainability reports. Additionally, all subsidiary undertakings are exempt from reporting non-financial information under Directive 2013/34/EU's Articles 19a(3) and 29a(3), provided that both the parent undertaking and its subsidiary undertakings are included in the consolidated management report, and the report also includes non-financial information reported in compliance with that Directive (European Union, 2022, Recital 25). This could be seen as a regulator's latitude to ease the load on certain companies. Regardless of the industry, businesses covered by the CSRD are subject to these standards. They complement and add to global standardization efforts while being adapted by EU policies. One of the major differences of the recently launched directive is that the non-financial reports are called "sustainability reports" (Directive 2022/2464, EN-CCSRD Directive, EUR-LEX). The information that undertakings should disclose regarding the business-relevant principles of ESG in sustainability reporting standards is collected in Table 2.

Table 2: Reporting requirements per ESG factor based on CSRD

ESG Factor	Reporting topic	Disclosure information
Ecological	Climate	Risks and resilience related to climate scenarios, including adaptation plans for achieving climate neutrality by 2050
Ecological	Climate	GHG emissions and removals, usage of offsets and their sources
Ecological	Energy	Reducing energy use and increasing energy efficiency
Ecological	Climate	Climate, air, land, water and biodiversity
Social	Human rights	Forced and child labour
Social	Forced labour	Import of goods produced through human rights abuses
Social	Employment	Risks, trends, conditions of employment
Social	Inclusion	Equal opportunities and workplace conditions
Social	Gender equality and equal pay	Gender and pay gap
Social	Disability	Accessibility measures
Social	Training and skills development	Access to training
Social	Collective bargaining	Policies and strategies related to collective bargaining
Social	Participation of workers	Participation in administrative and supervisory boards
Social	Diversity	Gender diversity in leadership and board representation
Governance	Sustainability oversight	The expertise and skills needed to fulfil roles of board members
Governance	Risk management	Risk and control systems related to sustainability
Governance	Corporate ethics	Anti-corruption and anti-bribery
Governance	Suppliers	Payment practices, terms, interest, recovery costs

Source: European Union, 2022, Recital 14,49

Enhancing the comparability and transparency of ESG disclosures made by companies is the directive's main goal. The regulator wants to encourage uniform and consistent ESG information disclosure. It mandates that information on policies, key risks, and results pertaining to environmental matters, social and employee factors, human rights, anti-corruption issues, and diversity on the board of directors be included in annual sustainability reports. Firms in the scope of the directive will now be required to use EFRAG (European Financial Reporting Supervisory Group), which is a private association established in 2001 with the encouragement of the European Commission to serve the public interest (EFRAG Today, EFRAG). These unified standards replace GRI (Global Reporting Directive), SASB (Sustainability Accounting Standards Board), or the Task Force on Climate-Related Financial Disclosure (EFRAG, n.d.).

4.1.1 S for social contributions of CSRD

Except for the impact on the engagement of stakeholders, investors, consumers, and civil society the new directive will have, the regulation supports the system of classification for environmentally sustainable economic activities with the aim of scaling up sustainable investments and combating greenwashing of financial products that unduly claim to be sustainable (European Union, 2022, Recital 2). This measure aims to mitigate the risk of greenwashing by guaranteeing transparency, consistency, and accountability in the promotion of environmentally sustainable investments. All are particularly important for sustaining social trust in FinTech companies and their practices.

CSRD emphasizes how crucial sustainability reporting is to preserve public confidence and business reputation. The absence of trustworthy sustainability data may cause a deficiency in accountability, which in turn may diminish public confidence in companies and impede the smooth operation of the social market economy. In addition, the inability of investors to allocate capital to initiatives that mitigate social and environmental problems undermines the goals of the Green Deal, the Action Plan on Financing Sustainable Growth, and the Paris Agreement. Organizations lack the ability to hold companies accountable for their effects on people and the environment when sustainability reporting is weak. The public's trust in businesses may be damaged by this lack of accountability, which would reduce the efficiency of the social market economy (European Union, 2022, Recital 14).

The directive contributes to addressing social responsibility issues by specifying disclosures on social factors such as working conditions, social partner involvement, collective bargaining, equality, non-discrimination, diversity, and inclusion, as well as human rights. Such data should help to address how this will affect people, employees, and people's health and wellbeing. The details that undertakings reveal regarding human rights should, where appropriate, incorporate information regarding child labour and forced labour into their value chains. The implementation of sustainability reporting requirements pertaining to forced labour should not prevent public authorities from fulfilling their obligation to confront the import of goods resulting from human rights violations, including forced labour, through trade policy and diplomatic channels. Businesses should also be able to report on potential hazards and changes in employment and income trends, the inclusion of people with disabilities, and accessibility measures taken by undertakings. The reporting standards assume the reporting obligation to disclose information on available workers' training and skill development. Bargaining should include information about work councils, collective agreements, and the proportion of workers covered by them. Sustainability reporting standards should include disclosures on worker participation in administrative and supervisory boards. Gender diversity at top management and the representation of underrepresented groups on boards are integral parts of the directive (European Union, 2022, Recital49).

In summary, enhancing the social responsibility of the undertakings is the goal of the CSRD Directive, which requires a comprehensive and transparent way of reporting. This should be an enabler to promote public trust in companies through their actions and policies. All these factors support the effective operation of the social market economy.

4.1.2 L for legal contributions of CSRD

The sustainability reports should be published with an assurance opinion expressed by a person or firm authorized to give an opinion on the assurance of sustainability reporting, either under the national law of the third country undertaking or of a Member State, in order to ensure the quality and reliability of the reporting. The subsidiary undertaking or branch of the third-country undertaking should make a statement in case such an assurance opinion is not provided. The public should have free access to the sustainability report via the central, commercial, or company registers of the Member States or via the subsidiary undertaking's website (European Union, 2022, Recital 20). Furthermore, the European Union (2022) permits annual reports from Member States

to the Commission on subsidiary or third-country undertakings, including those where the subsidiary or branch claimed inability to obtain relevant data (European Union, 2022, Recital 60).

The regulations governing the actions and sanctions that apply to any violations must be established by the Member States. Member States establish effective investigation and sanction systems to detect, correct, and prevent poor statutory auditing and sustainability reporting. Additionally, the directive suggests that the Member States must impose effective, proportionate, and dissuasive sanctions on statutory auditors and audit firms that fail to comply with the directive. Member States may choose not to establish administrative sanctions for infringements already covered by national criminal law. In this case, they must notify the Commission of any relevant criminal law provisions (European Union, 2022, Article 2, Recital 30).

Summarizing, the directive imposes legal obligations on companies in scope to issue sustainability reports, not leaving FinTech companies alone. It is anticipated that this change will have a significant impact on how FinTech businesses function within the EU, encouraging them to apply their technology and novel nature to the approach towards sustainable reporting. However, the anticipated challenge for FinTech businesses may come from their unregulated nature, and more scrutiny is being applied to the consequences of noncompliance.

4.1.3 E for economic contributions of CSRD

The European Union has standardized regulations to address the gap between user needs and current corporate sustainability data, warning against the potential for disparate national standards, higher compliance costs, and eroded capital market coherence (European Union, 2022, Recitals 15, 16).

Investors may struggle to assess risks in the absence of sustainability information, which could result in systemic financial hazards. Acknowledged by organizations like the European Central Bank and the Financial Stability Board, especially regarding climate change, this shortcoming inhibits investors from funding initiatives that support social and environmental advancement objectives like the Green Deal and Paris Agreement. In addition, the lack of uniform standards for evaluating sustainability impedes the endeavours of labour unions and civic society, to proficiently deliberate on sustainability practices with corporations (European Union, 2022, Recital 14).

In conclusion, the directive indicates that there will be financial savings and benefits that the businesses will experience in the medium- to long-term when it comes to a decline in reporting expenses. However, there is no mention of the extra expenses businesses will incur as a result of hiring experts in the field of sustainability or using the right software to facilitate reporting. ESG is the third area that CFOs will be looking to outside experts for assistance with because it will be challenging to automate, according to the most recent State of European FinTech 2023 report. Not to mention the mandatory audits that FinTech companies must follow, these will generate expenses.

4.1.4 P for political contributions of CSRD

In the Green Deal, the Commission committed itself to supporting businesses and other stakeholders in developing standardized natural capital accounting practices within the Union. Internationally, with the aim of ensuring appropriate management of environmental risks and mitigation opportunities and reducing related transaction costs (The European Green Deal, 2021). This European Union agenda is a key step in the European political arena towards a more sustainable future.

By implementing CSRD, the consistent way of reporting, data capture, and comparison is standardized, which is a major enabler of cooperation between member states. Such harmonization of reporting will position Europe as a pioneer in collectively achieving the goals of the European Green Deal. European FinTech will have a chance to demonstrate that they can lead the way with their access to technology and expertise to carry out ESG matters.

4.1.5 T for technological contributions of CSRD

The EU Commission hopes to enhance the comprehensiveness, comparability, completeness, and reliability of non-financial reporting (European Union, 2022, Recital 39). The so-far gap exists in a lack of common steer with regards to approaching ESG-related topics, also by FinTech businesses. With the implementation of the new CSRD, these gaps are filled. As a result, both the reporting regime's application and reports' contents are expanded; this applies to FinTech as well. However, European FinTech shall prepare to comply with such a development, which may require additional resources in terms of technology, experts, or internal advice. Although some elements of the directive might still be ambiguous and need more extended exemplification, the

directive can be considered a major step in progressing with businesses on ESG-related matters. The intense time constraints that are placed on businesses, in addition to the uncertainty they experience regarding the contents of both the CSRD's final draft and the European Sustainability Reporting Standards (EFRAG), play a role (Baumüller & Grbenic, 2021).

It is expected that the practices of sustainability reporting standards will be harmonised and standardized. There is a likelihood that third-party data providers will improve and that expertise will grow in this area, with the potential for job creation. This is a great challenge for FinTech businesses but also an opportunity for new product propositions to be offered to the market.

5. Conclusion

This paper aimed to address the latest alterations in Environmental, Social, and Governance (ESG) criteria regulations, pinpointing anticipated changes that may impact FinTech companies. Through the literature review and analysis of the CSRD directive, this paper aims to consolidate the diverse terminology surrounding greenwashing as well as focus on FinTech advancements and market trends with utilizing the technology to progress on the implementation of SDGs.

Regarding the FinTech industry's ability to adjust to new regulatory frameworks and its function in reducing greenwashing, this study aimed to address two important research questions: What conclusions can be drawn from the literature on greenwashing that are particularly relevant to the FinTech sector's adaptation to new regulatory regimes? Analysis shows that the literature on greenwashing places a strong emphasis on the necessity of accountability and transparency in business sustainability initiatives. This is especially important for FinTech companies getting ready to support and comply with the EU's Corporate Sustainability Reporting Directive (CSRD), which requires consistent disclosures about sustainability. The CSRD minimizes the risk of greenwashing by ensuring that sustainability claims are true and verifiable, which helps to reduce information asymmetry and increase investor trust. The following was the second research question: "What role can FinTech play in mitigating greenwashing? According to the analysis, FinTech, also through the recent emergence of companies active in the green technology sector (green tech), can make a big difference by utilizing its technologies to track business behavior, enable compliance, forecast sustainability trends, and identify possible instances of greenwashing. FinTech businesses can also create thorough sustainability reporting systems that compile information from multiple sources to enable truthful disclosures and adherence to legal requirements.

The study had limitations. Due to the CSRD Directive that applies to companies for the reporting period of 2024, with first reports expected to be published only in 2025, the analysis is not yet supported by the application of the directive and empirical evidence. However, this presents an opportunity for further research in the identified area of this study. Empirical data and its analysis will serve as confirmation of the direction FinTech companies take towards the application of ESG factors into their business models. Gaining more insights will enhance understanding the advancements and contributions to achieving net zero targets.

In summary, the recently launched CSRD directive can help FinTech companies normalize standards and utilize technology, big data, data mining, and AI to advance their product offerings. Recently noticeable trends of FinTech companies that become active around green technology are a sign that only advancing on the scope of activity is the scenario and the direction for these businesses moving forward. FinTech companies, in contrast to traditional banking institutions, regularly perform market research and instantly respond to the needs of the market or consumers. Compliance with recently launched regulations or FinTech's ability to serve other businesses to prevent greenwashing is one of the examples of FinTech leading the way to a more sustainable future.

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