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ECKM Preface

Knowledge Management (ECKM 2023), hosted by Iscte – Instituto Universitário de Lisboa, Portugal on 7-8 September 2023. The Conference Chair is Prof Florinda Matos, and the Programme Chair is Prof Álvaro Rosa, both from Iscte Business School, Iscte – Instituto Universitário de Lisboa, Portugal.

ECKM is now a well-established event on the academic research calendar and now in its 24th year the key aim remains the opportunity for participants to share ideas and meet the people who hold them. The scope of papers will ensure an interesting two days. The subjects covered illustrate the wide range of topics that fall into this important and ever-growing area of research.

The opening keynote presentation is given by Professor Leif Edvinsson, on the topic of *Intellectual Capital as a Missed Value.* The second day of the conference will open with an address by Professor Noboru Konno from Tama Graduate School and Keio University, Japan who will talk about *Society 5.0, Knowledge and Conceptual Capability*, and Professor Jay Liebowitz, who will talk about *Digital Transformation for the University of the Future*.

With an initial submission of 350 abstracts, after the double blind, peer review process there are 184 Academic research papers, 11 PhD research papers, 1 Masters Research paper, 4 Non-Academic papers and 11 work-in-progress papers published in these Conference Proceedings. These papers represent research from Australia, Austria, Brazil, Bulgaria, Canada, Chile, China, Colombia, Cyprus, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Iran, Iraq, Ireland, Israel, Italy, Japan, Jordan, Kazakhstan, Kuwait, Latvia, Lithuania, Malaysia, México, Morocco, Netherlands, Norway, Palestine, Peru, Philippines, Poland, Portugal, Romania, South Africa, Spain, Sweden, Switzerland, Taiwan, Thailand, Tunisia, UK, United Arab Emirates and the USA.

We hope you enjoy the conference.

Prof Florinda Matos
Iscte – Instituto Universitário de Lisboa
Portugal
September 2023

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BIOGRAPHIES

Conference and Programme Chairs



Florinda Matos is a Professor at ISCTE - University Institute of Lisbon. She is the founder and president of the Intellectual Capital Association (ICAA), whose mission is to help transform intellectual capital into added value by contributing to Sustainable Development. She is also a member of the New Club of Paris, an international organisation whose main objective is to create awareness about the Knowledge Economy. As a Knowledge Management and Intellectual Capital expert, she works with several international organisations to promote the management of the intangibles as accelerators of Innovation, Competitiveness and Sustainability in the Digital Economy.



Prof Álvaro Rosa is associate professor (with Habilitation) at ISCTE Business School. Currently is the director of the Master of International Management at Iscte - Instituto Universitário de Lisboa and member of Scientific Committee of Iscte Doctoral Programme on Applied Management. His research interests are strategy, qaulity and cross-cultural management. He is a regular visiting scholar in faculties in China, Brazil, UK, and Slovenia.

Keynote Speakers



Leif Edvinsson is a key pioneering contributor to the theory and practice of Intellectual Capital (IC). He is the world's first Director of IC in 1991. He was prototyping in 1996 the Skandia Future Center as Lab for Organisational design. In 1998, he was awarded by Brain Trust "Brain of the Year" award, UK; listed in Who's Who in the world; earlier associate member of the Club of Rome; and Co-founder and Founding Chairman of the New Club of Paris. In 2013, he was awarded the Thought Leader Award by the European Commission, Intel and Peter Drucker Association. In 2015, he was appointed Advisory Board to JIN—the Japan Innovation Network. He was appointed in 2016 to the Advisory Board of Norway Open Innovation Forum. Together with the UN he was awarded the KM Award 2017, in Geneva Palais des Nations, by km-a.net.



Dr. Jay Liebowitz is the Executive-in-Residence for Public Service at Columbia University's Data Science Institute. He was previously a Visiting Professor in the Stillman School of Business and the MS-Business Analytics Capstone & Co-Program Director (External Relations) at Seton Hall University. He was ranked one of the top 10 knowledge management researchers/practitioners out of 11,000 worldwide, and was ranked #2 in KM Strategy worldwide according to the January 2010 Journal of Knowledge Management. At Johns Hopkins University, he was the founding Program Director for the Graduate Certificate in Competitive Intelligence and the Capstone Director of the MS-Information and Telecommunications Systems for Business Program, where he engaged over 30 organizations in industry, government, and not-for-profits in capstone projects. Prior to joining Hopkins, Dr. Liebowitz was the first Knowledge Management Officer at NASA Goddard Space Flight Center. Dr. Liebowitz is the Founding Editor-in-Chief of Expert Systems With Applications: An International Journal (published by Elsevier; ranked as a top-tier journal; Thomson Impact Factor from June 2021 is 8.665). He is a Fulbright Scholar, IEEE-USA Federal Communications Commission Executive Fellow, and Computer Educator of the Year (International Association for Computer Information Systems). He has published over 45 books and a myriad of journal articles on knowledge management, analytics, financial literacy, intelligent systems, and IT management. He has lectured and consulted worldwide.



Professor Noboru Konno is an eminent pioneer in "knowledge ecology," with a distinguished career encompassing extensive research on knowledge creation and its application in fostering innovation through the concept of "ba" or place. He has contributed to diverse consulting projects, ranging from knowledge management and design strategy initiatives to change management for design organizations and the development of innovative workplaces. Currently holding positions as a professor at both Tama Graduate School and Keio University, Konno is widely recognized for his practical roles as the President of Japan Innovation Network (JIN) . Among his achievements, Konno's book titled "Intellectualizing Capability" stands out, earning him the Financial Times Global Best Business Book Award. In addition, he has authored other influential works such as “Methodology of Conceptualizing Capability," "The Principles of Knowledge Creation Management," and "Purpose Engineering.”

Mini Track Chairs



D.Sc. Sladjana Cabrilo is a Professor at I-Shou University in Taiwan. She holds a PhD degree in Industrial Engineering and Engineering Management from the University of Novi Sad, Serbia. Sladjana’s research focuses on intellectual capital, knowledge management, innovation, business performance, and digital transformation. Her experience includes participation in scientific and industry-related projects, publishing more than 80 academic articles & serving on editorial boards.



Francisca Castilla-Polo (PhD): Lecturer specialized in Reputation, Corporate Social Responsibility and Non-Financial Indicators. She is an Associate Professor within the Financial Economy and Accounting Department at the University of Jaén (Spain). Her research interests are focused on the measurement and disclosure of non-compulsory accounting information and its effects on corporate reputation together with other intangible assets such as human capital, social capital and relational capital. She has published in first position top-journals indexed within Web of Knowledge Science (WOS) and she has taken part in numerous research projects related to her areas of interest.



Andrew Herd is a knowledge management and lessons learned senior expert and practitioner. He has worked at the European Space Agency for 20 years and for the last 7 years been dedicated to the area of knowledge management at ESA including being the lead for corporate lessons learned since its conception at the Agency. Andrew has been part of internal activities for KM as well as knowledge sharing on KM and LL processes outside of the Agency: with industry, academia and also other non-profit organisations. Whilst working as a thought leader in this area, he is actively open to new ideas and adopting or adapting these within the specific organisational context of the Agency.



Prof Ali Hessami was the Chair and Technical Editor of IEEE’s first global standard “Model Process for addressing Ethical Concerns in System Design”, referred to as P7000. This generic process standard that’s been published as IEEE 7000 in September 2021 is aimed at identification, evaluation and protection of ethical human values in products, services and systems. Ali is also VC of IEEE Ethics Certification Programme for Autonomous and Intelligent Systems (ECPAIS)



D.Sc. Aino Kianto is a Full Professor in Knowledge Management at the LUT School of Business and Management, LUT University, Finland. Her research focuses on knowledge management, intellectual capital, creativity, innovation and organizational renewal. Prof. Kianto has delivered keynote speeches and acted as a track chair in many international conferences and serves in the editorial board of five academic journals.



Anna Maria Melina is a research fellow at University of Catanzaro. She is adjunct professor in Organizational Theory and Organizational Behavior. Her research focuses on Knowledge Management, Family Business, Small & Medium Business, Generational Change and Healthcare System. She is a speaker in national and international conferences. She is the author and/or co-author of several publications, including books, articles, research reports and working papers.



Paulo Gonçalves Pinheiro is a Professor of Beira Interior University (UBI), Business & Economics Department, and a researcher at the NECE, Research Center in Business Sciences (UBI). His teaching activities are mainly on knowledge management and comprehend undergraduate, master, and doctoral students. He is a Ph.D. in management and author of several publications. His main research areas are information management, organizational spirituality, organizational practical wisdom, and knowledge management. https://orcid.org/0000-0003-2397-6463



Raquel Puentes Poyatos is a Professor of Organization theory and Human Resource Management at the University of Jaen (Spain), where she received her Ph.D. Currently, her research is focused on the fields of HRM, Corporate Social Responsibility and knowledge management. She publications appeared in academic journals.



Raysa Rocha teaches at the University of Beira Interior (UBI). She is project manager in the ENTRANCE, RE-START and ENTER_EdTech projects (Erasmus+). Raysa received her PhD with distinction from UBI. She is part of international networks, i.e., Academy of Management - AOM, International Association for Knowledge Management, and the Social Responsibility Research Network. During her PhD, Raysa received international awards for her thesis project, including the MSR 2021 Promising Dissertation Award given by the MSR-AOM. She is interested in studying organizational practices that lead to a humanized strategy. Raysa's has published in journals of great distinction, i.e., Journal of Business Ethics and the Social Responsibility Journal. https://orcid.org/0000-0002-6542-1397



M. Isabel Sánchez-Hernández (PhD): Lecturer specialized in Corporate Social Responsibility, Human Resources and Sustainable Entrepreneurship for Regional Development. Professor within the Business Management and Sociology Department at the University of Extremadura (Spain). Her research interests range across several key areas within the Business Organization and Sustainability Management.



Assoc. Prof. Dr hab. Eng. Sebastian Saniuk is employed as a professor at the University of Zielona Góra (Poland). Since 2015 he is a member of the Committee of Production Engineering of the Polish Academy of Sciences. His research interests include issues related to production management, industrial engineering and logistics, employees' knowledge and skills, sustainable development, corporate social responsibility, particularly planning and control of production flow and modelling of production networks of SME's, rapid prototyping, CSR in SME's. The results of his research have been presented in over 270 national and international scientific publications including journals, monographs and conference proceedings of national and international conferences indexed in Web of Science and Scopus database (in countries including: China, Turkey, Slovakia, Czech Republic, Croatia and Germany). During his career, he has conducted research under several grants awarded and funded by the Polish Ministry of Science and Higher Education, The National Centre for Research and Development and the European Union. H-index=14 (WoS), h-Index=15 (Scopus).



Dr. Changiz Valmohammadi is Associate Professor at, Islamic Azad University, South Tehran Branch. His areas of interest are quality management, knowledge management, operations management, strategic management, and application of IT in business operations. For more than 25 years he has taught and supervised undergraduate, graduate students at both national and international universities, such as Taylor's university and Universidad de las Américas Puebla (UDLAP) and offered consulting services to the Iranian public and private organizations. He has published research papers in journals such as Information & Management, International Journal of Production Economics, The TQM Journal, International Journal of Productivity and Performance, Resources Policy, Total Quality Management & Business Excellence and Journal of Enterprise Information Management. He sits on editorial board of Journals such as Management Decision, Industrial and Commercial Training, JUST to name a few.



Marzia Ventura, Ph.D., is a researcher and Professor at Magna Graecia University of Catanzaro and she is member of Research Center "Economics and Management of Services". The main topic of research is on human resource management, intellectual capital, corporate social responsibility, knowledge sharing in organizations.



Walter Vesperi is Ph.D. in Management and Economics in University of Messina actually is Research and Professor at Magna Graecia University of Catanzaro. His research in terests are knowledge management that influence organizational development and change in dynamically evolving environments. His publications appeared in academic journals and he attended at several international conferences.



Yong Wang is Professor in Family Business & Entrepreneurship at Wolverhampton Business School and Fellow of the International Family Enterprise Research Academy (IFERA). Prof. Wang's research focus on family business and entrepreneurship. His publications have appeared in the Journal of Small Business Management, Journal of Strategic Information System, Journal of Family Business Strategy, International Journal of Entrepreneurial Behaviour and Research, as well as others.

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Lawrence Abiwu, is an adjunct lecturer at the School of Management, Information Technology and Governance at the University of KwaZulu-Natal. He holds a PhD in Human Resource Management and his research interests are talent management, human capital formation and development, industrial action, organisational sustainability, employer branding, workplace discipline and employee dismissals.

Ricardo Abreu obtained a bachelor's degree in consumption sciences by the Portuguese Institute of Marketing Administration (IPAM). He holds a master's degree in sociology, innovation and society, and a PhD in innovation public policy, obtained at ISCTE-IUL. He is a professor and researcher at ISCTE-IUL and IPAM, focusing on innovation, technology, consumer and market behavior.

Roziya Abu is an associate professor at MARA University of Technology (UiTM) Malaysia. She received her PhD in social science and psychology from Victoria University, Melbourne, Australia, in 2014. Her study focuses on small/rural libraries and community development, data analytics and information management.

Aderonke Adesina is an employability project officer at Nottingham Trent University, UK. She received her PhD in information science from the University of Zululand in 2022. She has ten academic publications. Her main research areas include knowledge management, information systems, and enhancing the employability of individuals.

Pia Adibe. As a Doctoral Researcher, my research focus is on collaboration and organizing, and I am drawn to research that aims to bring individual narrative knowing and dialogic methods to the core of learning and development of sustainable systems and digital solutions. I hold a master's degree in knowledge management and have several positions of trust.

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The Importance of Digital and Soft Skills in the Digital Age

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Abstract: In our digital age, the effects of digital transformation, the scope and speed of current changes, and the emergence of digital technologies have led to a radical transformation of workplaces, resulting in a reduction of demand for employees carrying out routine, manual tasks, while evokes a need for digitally-skilled employees emphasising the importance of digital and soft skills for business growth. Organisations need to equip their employees with different types of skills to achieve organisational goals in order to benefit from investments in digital technologies. While practitioners and academics are increasingly focusing on the importance of the human factor of digital transformation processes, there is limited knowledge about the impacts of digital transformation on the digital skills of the employee and how organisations can guide employees through the digital transformation journey, yet. This study provides an important insight into a specific country's context, which has not been sufficiently examined. This paper aims 1) to investigate how the digital transformation has changed the demand for human workforce (Q1a) and the challenge in the lack of digital skills (Q1b) and 2) to examine the importance of soft skills as an impact of digital transformation (Q2). The target group of the research is the managers and white collar workers of Hungarian manufacturing companies. The data collection was in spring 2021. Descriptive statistics and relationship analyses (Cramer's V and Kendall's Tau) were used to analyse the collected data (n=489). The research investigates an important social-digital phenomena determining how digital transformation arises significant demands on digital and soft skills. Results indicate that digital and soft skills such as critical thinking, complex problem solving, adaptability, resilience and creativity are essential to successfully exploit the digital transformation. The result can add value and stimulate new research on digital and soft skills and provide a useful benchmark for other countries.

Keywords: Digital transformation, Digital skill, Soft skill, Manufacturing, Hungary

1. Introduction

By digitising industrial processes, organisations are able to easily enhance their performance, but are facing significant challenges with regard to the management of human resources. The use of digital technologies can be viewed from a technical preparation and knowledge standpoint (digital competence) or an equipment usage-related behaviour standpoint (digital attitude). Difficulties concerning the digital competences of employees include the use of digital technologies, the understanding of the opportunities and hazards of the Internet and communication via electronic media. Individuals must be able to use digital technologies for a given purpose in a conscious, productive manner. Digital attitude refers to employees' behaviour and mindset with regard to the responsible use of available information and digital technology and collaboration with smart technologies. The challenge, however, is that in the absence of information and digital competence, employees become fearful of losing their jobs to digitalisation. Although digital technologies are able to replace human labour, this is not true in every situation. Training and continuous education will play a significant role, as people now performing tasks subject to automation will be moved to new areas, where they can produce more added value, which, however, will require employees to have the appropriate mindset. Numerous academic studies have highlighted that the biggest challenge of digital transformation for many organisations is to find ways to develop their employees' digital skills and competence (Kane et al, 2019; Dery et al, 2017). Human labours need to be up-skilled to use digital technologies autonomously, to perform value-adding tasks in production and to collaborate with an autonomous employee (Longo, 2020). At the same time, digital skills and competence alone are not enough, other soft skills will also be needed. Research by leading consultation companies, like World Economic Forum (2020) indicates that most organisations require skills such as critical thinking, complex problem solving, adaptability and resilience (Trenerry et al. 2021). The era of digital transformation is therefore creating a demand for a digitally-skilled employee, emphasising the importance of digital and soft skills (Scuotto et al, 2021).

Our research complements existing research in several ways. The paper contributes to the emerging but still limited literature investigating the human workforce needs related to the digital transformation of Hungarian companies. Second, this study aims to analyse the importance of soft skills for digital transformation.

This paper thus contributes to the debate by exploring the relationship between digital and soft skills that together can shape the organisational success of digital transformation. Finally, our findings have policy implications. The paper describes the key soft skills that universities need to focus when designing study programmes and student learning objectives. Universities need to prepare their students to be future-ready for the challenges posed by digital transformation.

The rest of this paper is organised as follows. Chapter 2 provides an overview of digital transformation, digital skills and soft skills. Chapter 3 describes the research methodology. This is followed by the section on the results of the research (Chapter 4). Finally, in Chapter 5, we discuss the implications of our results for practitioners and highlight the limitations of our study.

2. Theoretical Background

2.1 Digital Tansformation

The industrial revolutions of the last three centuries have had a major impact on the social characteristics of today. New technologies and new ways of perceiving the world have triggered profound changes in economic systems and social structures (Schwab, 2016). From the steam engine of the 1760s onwards, technology has evolved exponentially, constantly improving itself and acting as a kind of recursion, where new technologies have been created based on the old ones. Schumpeter explained this phenomenon in terms of innovation waves (Figure 1), explaining that each innovation wave does not last in the same way and is shortened due to the rapid development of new technologies (Jovanović et al., 2018).

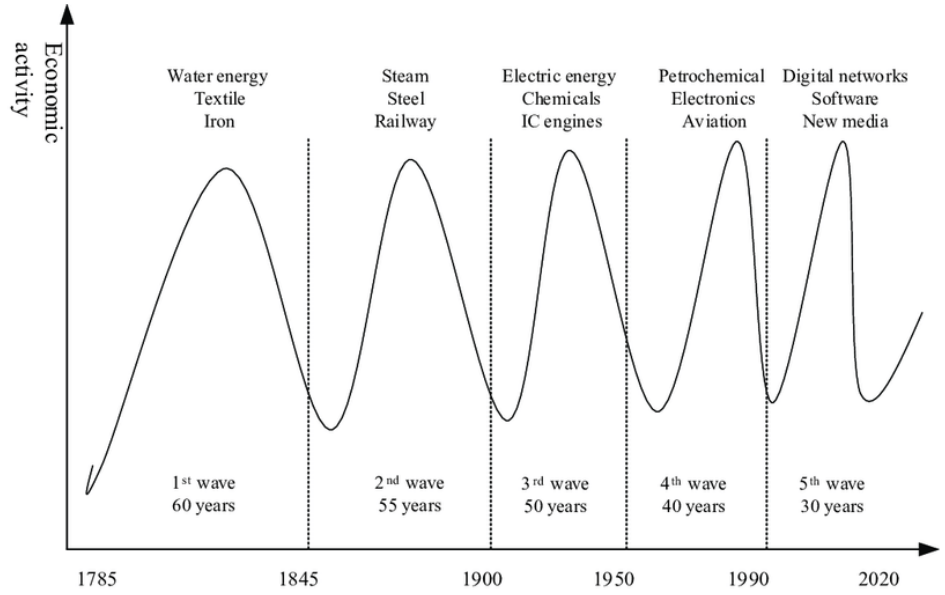


Figure 1: Schumpeter's Long Waves of Innovation. Source: Jovanović et.al, 2018

We are now in the 5th wave of innovation, where digital technologies are becoming the driving force for change. One of the most important revolutions in modern business is the shift from traditional to digital business models, i.e. digital transformation to achieve higher levels of competitiveness.

Digital transformation is ‘‘*a fundamental change process, enabled by the innovative use of digital technologies accompanied by the strategic leverage of key resources and capabilities, aiming to radically improve an entity (…) and redefine its value proposition for its stakeholders”* (Gong and Ribiere, 2021).

In this fifth wave of innovation, three eras of digital transformation can be distinguished.

- Digitisation: involves the migration of processes and systems (e.g. paper-based) to a digital platform. Digitisation is the process of converting data previously captured on analogue media into a form that can be interpreted by computer systems using a digitisation tool.
- Digitalisation: refers to the further integration and optimisation of digital technologies and IT capabilities to improve processes and services. In the case of digitalisation, automation through digital technologies (e.g. robotics or artificial intelligence) enables higher levels of productivity, more

efficient, safer and more convenient operations (Company and Manyika, 2017), and transforms the world of work, creating new types of digital/virtual work (Valenduc and Vendramin, 2017).
- Digital transformation: refers to the systemic and extensive use of digital technologies (Verhoef et al., 2019).

The impact of digital transformation have led to a significant change of working environments, a decreasing need for employees performing manual tasks (Bertani et al., 2020; Szabó-Szentgróti et al. 2021), while the need for digitally trained employees is steadily increasing (Kozanoglu and Abedin, 2020).

2.2 Digital Skills

Digital competence is about the ability to apply digital skills (knowledge and attitude). "*It involves the confident, critical and responsible use of, and engagement with digital technologies for learning, at work, and for participation in society. It includes information and data literacy, communication and collaboration, media literacy, digital content creation (including programming), safety (including digital well-being and competences related to cybersecurity), intellectual property related questions, problem solving and critical thinking"* (European Commission, 2019).

Sufficient proficiency in the use of digital technologies is a key competence not only for those in the IT sector, but for all citizens. There are multiple methods available to determine the level of digital competence (Morrison and Rooney, 2017; Gekara et al., 2019). The first edition of the European Digital Competence Framework for Citizens (Ferrari, 2013) was published in 2013, and has since been revised twice. The reference material, which describes the areas and levels of digital competence, outlines eight incremental levels in the development of digital competence (Carretero, et al., 2017). Hiring, finding and developing an employee with digital competence often pose major challenge (Karacay, 2018) and the issue is of the highest priority to the European Union. In 2022, only 54% of Europeans possessed basic digital skills, and less than one-third (26%) advanced digital skills, which means that the majority of the EU population still do not possess an adequate level of digital competence, even though most companies and vacant positions do specifically require such competence. The DESI 2022 index, used to assess the development of the digital economy and society, places Hungary at the 22nd place. Less than half (49%) of the Hungarian population have at least basic digital skills.[1]

2.3 Soft Skills

Digital transformation requires not only digital skills and competence, but also other key individual traits from employees (Dremel et al., 2017). Specific expertise is losing significance, while the value of adaptive employees with a diverse range of skills and expertise is growing (Kergroach, 2017). The World Economic Forum (2020) considers the following to be the most desirable competencies in the era of Industry 4.0: complex problem solving, critical thinking, creativity, human resources management, coordination, emotional intelligence, judgement and decision-making, service-orientation, negotiation and cognitive flexibility. Organisations are also facing challenges in the retraining and further education of employees, as these require existing skills such as critical thinking, complex problem solving, adaptability and resilience (Trenerry et al. 2021). In this technology-driven environment, "soft" skills, such as problem solving and creativity, are becoming increasingly important (Grundke et al., 2018). In their study, Chuang and Graham (2018) have emphasised that in addition to the increasing need for specific skills, certain fundamental soft skills of employees, such as problem solving ability and critical thinking, are being highlighted. In the course of our research, we examined the following soft skills:

- Complex problem solving: problem solving skill is a combination of cognitive and motivational processes applied in various situations and tasks; as an ability, it allows an individual to accomplish goals that could not be achieved through simple, well-known routine or algorithms (Dossey, et al, 2000).
- Critical thinking: a set of situation-dependent general cognitive skills; a process of purposeful, self-regulatory judgment and evaluation, in the course of which the individual employs cognitive capabilities and strategies to increase the probability of a desired outcome, decision (Facione, 1990).
- Adaptability: includes the ability to adapt to change, i.e. to various roles and workplace duties, and the ability to perform effective work under shifting priorities (Binkley et al., 2012).

[1] https://ec.europa.eu/newsroom/dae/redirection/document/88704

- Creativity: the skill/ability to create; it is a unique alignment of personal attributes, mental and practical skills and includes all temperaments and factors of the personality that allow for creation. It is also apparent in behaviour and conduct (Binkley et al., 2012).
- Resilience: the ability to remain flexible and composed in case of shock, which ensures functional survival (Block - Block, 1980).

3. Research Methodology

This paper aims 1) to investigate how the digital transformation has changed the demand for human labour (Q1a) and the challenge in the lack of digital skills (Q1b) and 2) to examine the importance of soft skills as an impact of digital transformation (Q2).

In the course of our research, we aimed to find answers to the following questions:

- Q1**.** How has digital transformation changed
- *Q1a***.** the demand for human workforce and
- *Q1b***.** the challenges posed by the lack of digital skills of the employees?
- Q2**.** What has been the impact of digital transformation on the importance of soft skills?

Based on the literature and existing research, we have made the following hypotheses:

H1a. Digital transformation has reduced the demand for human workforce.

H1b. Digital transformation has intensified the challenge posed by a lack of digital skills of the employees.

H2. A list of soft skills can be determined, which are important factors as an impact of the digital transformation.

3.1 Data Collection

The data used in the analysis are from primary sources, from an online questionnaire survey conducted in the spring of 2021 (Obermayer et al., 2022). Questionnaires have been completed by managers and white-collar employees of Hungarian organisations. We have invited more than 50 000 companies to complete our questionnaire; we have queried their e-mail addresses from the database of Bureau van Dijk Orbis[2]. We have selected the target group based on two criteria: firstly they must be Hungarian enterprises, secondly they must be manufacturers. The questionnaire has contained the following parts:

- Introduction, experiencing/perceiving digitalisation (24 questions)
- Digital toolbox / Industry 4.0 and its applications (26 questions)
- Human-machine interface (trust and fear) (19 questions)
- The supporting role of leadership (9 question)
- Organisational culture - learning organisation (9 question)
- General questions (5 questions)

Table 1: Relevant Questions of the Part I. and II. of the Questionnaire

Category	Variables	Questions	Answers and associated codes
I		***How has digital transformation changed the following factors in the organisation?***	
	1	*Demand for human workforce*	1: significant reduction
			2: moderate reduction
			3: moderate increase
			4: significant increase

[2] https://www.bvdinfo.com/en-gb

Category	Variables	Questions	Answers and associated codes
	2	*The challenge presented by a lack of digital skills of the employee*	1: did not increase at all
			2: minor increase
			3: significant increase
			4: total increase
II		***What has been the impact of digital transformation on the importance of the following soft skills?***	
	3	*Adaptability*	1: not important at all
	4	*Creativity*	2: more likely to be unimportant
	5	*Critical thinking*	3: more likely to be important
	6	*Complex problem solving*	4: very important
	7	*Resilience*	

3.2 Sample

There were 489 evaluable responses in the sample (n = 489). 11% of respondents were white-collar employees, 89% were management (72% senior management). We have determined the size of the organisations based on the number of their employees (Figure 2): half (53%) of respondents were small organisations with 11-50 employees, 20% were medium-sized organisations with 51-250 employees, 17% were micro-organisations with no more than 10 employees, and 10% were large organisations with more than 250 employees.

Due to the predominance of micro, small and medium-sized organisations (SME), the sample was representative of the Hungarian corporate sector as a whole.

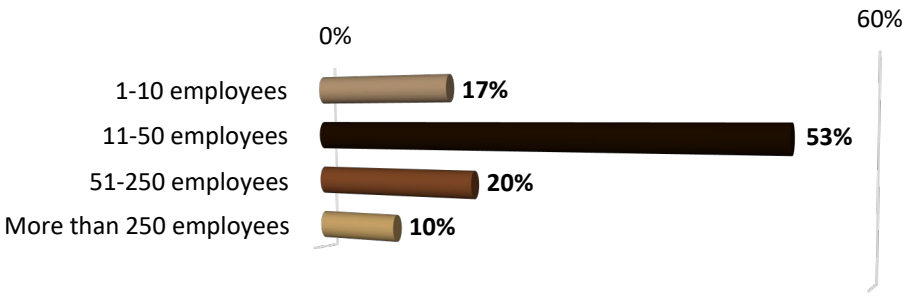


Figure 2: Distribution of Employee Numbers (%)

3.3 Analysis

Kendall's Tau coefficient (τ) is suitable for investigating our correlations; it may assume values in the interval [-1, 1] interval. Results are provided at the 5% significance level. If the p value of V or τ is less than 0.05, the correlation between the two variables shall be considered significant. The absolute value of significant results describes the strength of the correlation (Sajtos and Mitev, 2007): 0: no correlation; [0, 0.2]: weak correlation; [0.2, 0.7]: medium correlation; [0.7, 1]: strong correlation; 1: deterministic correlation. Since τ can be both positive and negative, the associated sign is also relevant, as it determines the type of the relationship. A negative (positive) τ value means that the higher the level of one variable, the lower (higher) the level of the other.

4. The Results of the Research

4.1 General State of Affairs

We have examined mode, means and relative standard deviation (RSD). The results are summarised in Table 2. We have marked the columns of the table with a light brown (low value) to dark brown (high value) colour scale.

Table 2: Descriptive Statistics

Cat.	Var.	Questions	Mode (1-4)	Mean (1-4)	Relative standard deviation (%)
I.		*How has digital transformation changed the following factors in the organisation?*			
	1	Demand for human workforce	2	2.15	26.55
	2	The challenge presented by a lack of digital skills of the employee	3	2.70	27.96
II.		*What has been the impact of digital transformation on the importance of the following soft skills?*			
	3	Adaptability	4	3.52	19.01
	4	Creativity	4	3.54	19.46
	5	Critical thinking	3	3.19	24.05
	6	Complex problem solving	4	3.61	17.31
	7	Resilience	4	3.47	20.60
Colour scale interpretation for each column: lower					**higher value**

The majority of the answers have assigned similar importance to certain soft skills (questions 3-7). The majority of the respondents considered all soft skills either very important (answer 4) or important (answer 3). The answers 'mean points to the same conclusion, as the opinions of respondents do not deviate much from the mean (relative deviation is less than 30%).

The following figure (Figure 3.) illustrates the answers to the question of how digital transformation has impacted the demand for human workforce at the organisation. The results show that 21% of respondents believed that the demand for human workforce has increased at the organisation, while 79% indicated a rather moderate decrease in the demand for human workforce.

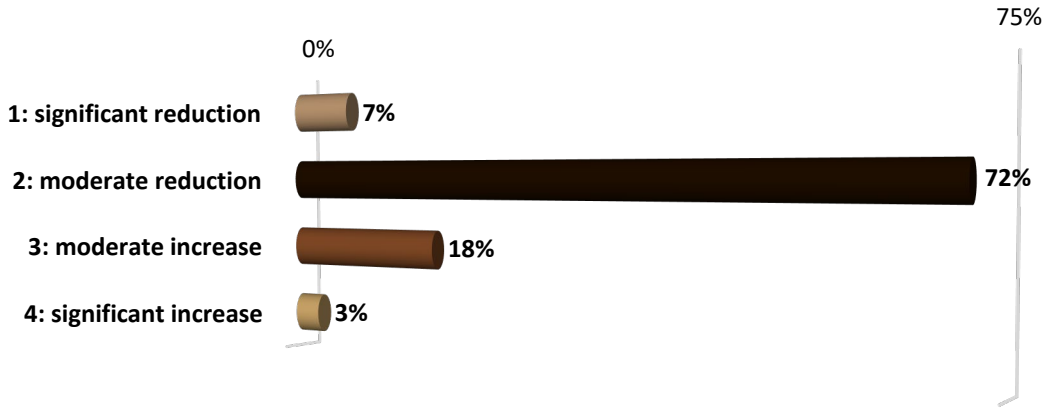


Figure 3: Demand for Human Workforce

The majority of respondents have considered the lack of digital skills to be a major challenge. 95% of respondents believe that the significance of the challenge has: somewhat increased (33%), greatly increased (49%) or absolutely increased (13%) due to the lack of digital skills of the employee.

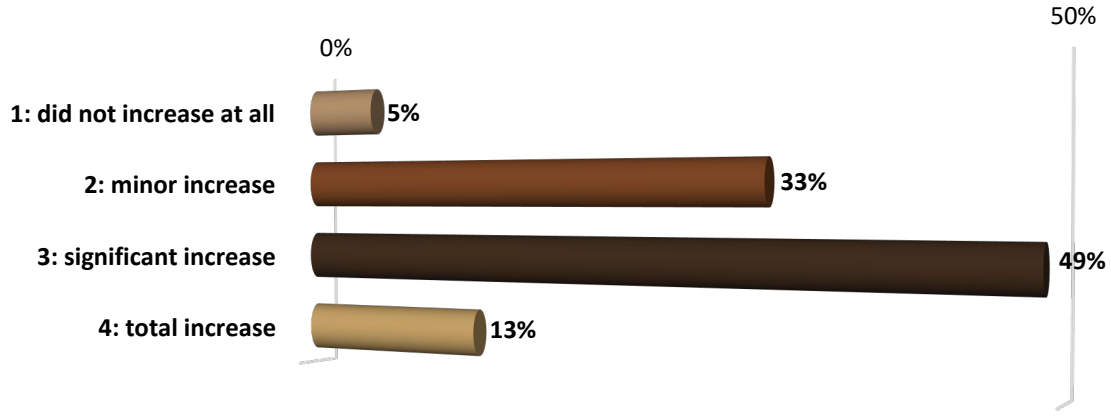


Figure 4: The Challenge Presented by a Lack of Digital Competence of the Employee (no. of Persons)

We also examined the importance of soft skills. The more important a skill, the darker brown the background colour. The majority of respondents have considered all soft skills to be very important (or important). Based on the mean from Table 2, the most important soft skill is complex problem solving, the second most important is creativity, then adaptability, followed by resilience and, in last place, critical thinking.

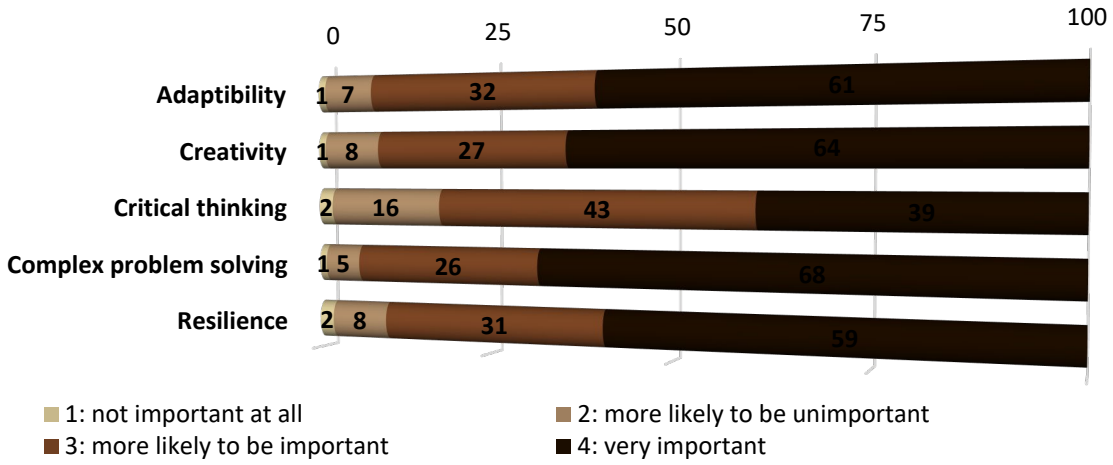


Figure 5: Importance of Soft Skills (%)

4.2 Correlation Analysis

The diagonal sections of Table 3 show the deterministic correlations with a black background, which means that each variable is in perfect correlation with itself. As for the empty cells, there we have found no significant correlation.

Table 3: The Significant Kendall's tau (τ) Correlations

Cat.	Variables		I.		II.				
			How has digital transformation changed the following factors?		What has been the impact of digital transformation on the importance of the following soft skills?				
			1	2	3	4	5	6	7
I.	1.	Demand for human workforce				0.119	0.109		

	2.	The challenge presented by a lack of digital skills of the employee			0.146	0.118	0.116	0.119	0.108
II.	3.	Adaptability		0.146		0.407	0.272	0.413	0.271
	4.	Creativity	0.119	0.118	0.407		0.476	0.502	0.414
	5.	Critical thinking	0.109	0.116	0.272	0.476		0.405	0.395
	6.	Complex problem solving		0.119	0.413	0.502	0.405		0.474
	7.	Resilience		0.108	0.271	0.414	0.395	0.474	

Weak	0 <	|τ|	≤ 0.2
Medium	0.2 <	|τ|	≤ 0.7
Strong	0.7 <	|τ|	< 1
Deterministic		|τ|	= 1

Among significant correlations, cells with a light brown background indicate weak, those with a darker brown background indicate medium correlation (we have found no instances of strong correlations). All τ values are positive, which means that where the answer to the question had a higher code assigned to it, respondents to the questionnaire were also assigned higher codes. Based on the results of the correlation analyses, the changes resulting from digital transformation (Category I., variables 1-2) have shown significant (weak) correlation with the importance of soft skills (Category II., variables 3-7):

- The more the demand for human workforce (variable 1) resulting from the digital transformation grew, the more important employee creativity (variable 4, $\tau = 0.119$) and critical thinking (variable 5, $\tau = 0.109$) became.
- The greater the challenge posed by the lack of digital skills of the employee (variable 2), the more important all soft skills became.

In Category II. (variables 3-7), all correlations were significant at a medium level.

- The more important one soft skill, the more important another.
- The strongest correlation was between the importance of creativity (variable 4) and complex problem solving (variable 6) ($\tau = 0.502$).

This means that of the 5 skills examined, if one was more important, the other would be more important as well.

5. Summary and Conclusions

The purpose of the research was to investigate how the digital transformation has changed the demand for human workforce (Q1a) and the challenge in the lack of digital skills (Q1b) and to examine the importance of soft skills as an impact of digital transformation (Q2). There were two main research questions, the first was descriptive and the second was related to relationship analysis.

The first hypotheses were: H1a. Digital transformation has reduced the demand for human workforce. H1b. Digital transformation has intensified the challenge posed by a lack of digital skills of the employees. Based on the analyses, we have accepted hypothesis H1a. and found that they correspond to the theory put forward by Bertani et al. (2020) and Szabó-Szentgróti et al. (2021), as they determined a decreasing need for employees performing manual tasks. Based on the findings, we have accepted hypothesis H1b. Our results are consistent with the findings of past research (Karacay, 2018) in that one of the most significant challenges during digital transformation is that organisation do not have or cannot find employees with appropriate digital skill.

The second hypothesis was: H2. A list of soft skills can be determined, which are important factors as an impact of the digital transformation. Based on our results, we have accepted hypothesis H2. We can conclude, that critical thinking, complex problem solving, adaptability, resilience and creativity, as soft skills, are important

factors from a digital transformation perspective. Our findings are consistent with past research, Trenerry et al. (2021); Grundke et al. (2018) and Chuang-Graham (2018).

The results of the relationship analyses shows that these soft skills are very important as companies need to ensure that their human labour has the right skills for digital transformation. Our finding is outstanding because a coexistence can be observed regarding the soft skills. That is why it is necessary to focus on the appropriate training and upskilling of the human labour.

5.1 Practical Implication

During digital transformation, it is particularly important that employees are able to acquire and develop digital competencies and decisive soft skills. Digital transformation means challenge, change and uncertainty for both the organisations and their employees. Organisations struggle to be competitive, and are therefore looking for employees with high adaptability. Resilience and adaptability are relevant skills, as they are both linked to adaptation and coping with significant change and difficulties. Employees with such skills are more successful during the transformation, as they prove to be more proactive and take on more responsibility with regard to adaptation to evolving situations. Organisations that develop and involve their employees have the advantage of being able to automate knowledge. Further education is an important precursor of digital transformation considering that, according to our findings, the more and more digitalised work environment demands both digital competence and soft skills from employees. A key factor in the future successful implementation of digital transformation is providing digital attitude training to employees, which prepares them to accept the usage of complex digital solutions. The organisation is responsible for providing its employees with sufficient information and education, and therefore for alleviating resistance to adaptation. Based on the results of prior studies, we have developed a digital identity development program focusing on preparing employers and employees for collaboration with digital technologies during the digital transformation. The final program is a postgraduate course recommended for business partners, enterprises and individuals.

5.2 Limitation and Futures Studies

The current study has some limitations. The survey's result was based on a Hungarian sample of manufacturing companies. As further research, other countries from the European Union should be analysed focusing on those where the DESI index is higher. In the future we plan to expand our study to a qualitative research to get more deepen insights. A case study methodology would allow exploring the topic.

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Knowledge-Oriented Leadership to Enhancing Corporate Sustainable Performance in Small and Medium-Sized Enterprises: Development Potential Perspective

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Abstract: Corporate sustainability is perceived as a multidimensional construct of social, economic, and environmental development, as well as a business strategy that considers future development needs. It is one of the organization's responses to the new challenges of the turbulent external environment. Currently, the overall business performance also includes the organization's performance in various non-financial aspects, such as ecological or social dimensions of sustainable development, and this approach differs from traditional financial business performance. Thus, the construct of corporate sustainable performance (CSP) is a response to the requirements of stakeholders and society. Top leadership recognizes the importance of CSP in core business from the perspective of environmental, social, and economic issues. The implementation of principles and practices of sustainable development and the measurement and continuous improvement of CSP require advanced knowledge that must be disseminated throughout the organization. Knowledge-oriented leaders can play an essential role in effective CSP management. Knowledge-oriented leadership has increasingly been recognized as an essential element for organizations to enhance knowledge management in every area of business activity, especially at the strategic level. From this perspective, the main aim of the study was to investigate the impact of knowledge-oriented leadership on the CSP in terms of its environmental, social, and economic dimensions, and thus on the organization's development. Following a review of the literature, the questionnaire survey was developed and implemented in 2023. The research sample consisted of 200 small and medium-sized enterprises from Poland. The results of this study confirmed the statistically significant correlation between knowledge-oriented leadership and CSP in all dimensions.

Keywords: Knowledge-oriented leadership, Corporate sustainable performance, Sustainable development, Small and medium-sized enterprises

1. Introduction

Knowledge-based management in organizations can help make more meaningful decisions on important issues and improve knowledge-based practices. Therefore, knowledge management is considered more important than knowledge itself, and organizations try to explain how individual and organizational information and knowledge are transformed into individual and group knowledge and skills (Sadeghi & Rad, 2018). Contemporary management researchers emphasize the importance of the effectiveness of acquiring, developing, and implementing knowledge, pointing out that the acquisition of new knowledge depends on the transformation of the organization that adapts to changing environmental conditions (Sadeghi & Rad, 2018).

The evolution of knowledge economies is an essential framework for global growth based on the three pillars of sustainability: economic, social, and environmental (Kordab, Raudeliūnienė & Meidutė-Kavaliauskienė, 2020). Business leaders could use the knowledge gained from many stakeholders to develop strategies to generate greater economic benefits, but also to achieve ecological and sustainable goals (Sun, Shahzad & Razzaq, 2022).

The main aim of this study was to investigate the impact of knowledge-oriented leadership (KOL) on corporate sustainable performance (CSP) terms of its environmental, social, and economic dimensions. The novelty of the study results from focusing on the influence of leaders (managers) as subjects in knowledge management on CSP, whereas usually knowledge management is most often considered through the prism of its impact on employees of the organization. The contribution of the paper creates a reference to the sector of small and medium-sized enterprises (SMEs), whose management process is unique and significantly different from the management process in large organizations. Meanwhile, business literature is based on solutions and examples of good practice that come from large enterprises and corporations, hence the value of the survey among SMEs (Havierniková, Lemańska-Majdzik & Mura, 2017).

The paper is organized as follows. Following the introduction in Section 1, the author provides a review of the literature in Section 2. In Section 3, the research methodology was discussed. Section 4 reports the empirical results. The author concluded in Section 5 by pointing out limitations and future research directions.

2. Literature Review

2.1 Corporate Sustainable Performance

There is now a growing view that in organizations sustainability must be embedded in the value system (Wirtenberg et al., 2007), and the principles of sustainability must be incorporated into corporate strategy to eliminate the tendency to manage sustainability issues as a separate (Etzion, 2007), individual strategic issue for the organization.

CSP is a strategic issue in sustainable development. Sustainability from a corporate perspective is defined as the right combination of economic, environmental, and social aspects (Elkington, 1994). Therefore, companies should prioritize financial and economic goals, pay attention to social benefits, and protect the environment (Septa et al., 2021). In addition, CSP forces an organization to meet the needs of the present without sacrificing the needs of future generations (Baumgartner & Rauter, 2017). According to Gimenez, Sierra and Rodon (2012), businesses should consider economic benefits along with responsible social and environmental behaviour to achieve sustainability. Getting a company to achieve CSP requires significant changes to orient it to a sustainability framework (the Triple Bottom Line concept) that measures a company's success in three key areas: profit, people, and planet. This approach provides a framework for measuring an organization's performance and success using economic, social, and environmental lines (Goel, 2010).

Organizations achieve sustainability through economic performance and operational performance. Economic CSP is the financial benefit resulting from return on investment and cost reductions throughout the supply chain (Eltayeb, Zailani & Ramayah, 2011). Business development is another measure of economic performance. Operational performance (productivity) is directly related to sustainability performance, which leads to overall organizational development. Both economic and operational performance of a business have an impact on society (Chabowski, Mena & Gonzalez-Padron, 2011), just as the economic instability and financial stability of an organization have an impact on employment (Choi, 2011). Thus, the economic dimension of sustainability links the growth of an organization to the growth of the economy and how well it contributes to supporting it. This in turn determines the ability of the economy, as one of the subsystems of sustainability, to survive and evolve in the future to support future generations (Spangenberg, 2005).

The environmental dimension of CSP refers to an organization's efforts to minimize its impact on the environment and its use of energy and waste production in order to reduce its environmental footprint (Correia, 2019). Environmental CSP is highly dependent on energy consumption, resource optimization, and waste reduction, which are directly related to CO2 emissions (Yusuf et al., 2013). Greening the market is becoming an increasingly popular trend, indicating the need to spread green products, eco-labelling, or ISO 14001 certification. Some authors argue that the environmental dimension of sustainability is the most important, while the economic and social dimensions are secondary, as all other areas depend on the Earth's resources, constraints, and systems (Bansal, 2005).

The social dimension of CSP refers to improving the quality of life for all stakeholders. It refers to conducting beneficial and fair business practices for employees, human capital, and the community. In addition to the moral aspect of being "good" to society, disregarding social responsibility can affect a company's performance and sustainability. Social CSP focuses on the interaction between the community and the organization and addresses issues related to community involvement, employee relations, and fair wages, etc. (Alhaddi, 2015). Social aspects are measured by investments in CSR projects, employee well-being initiatives, accident reduction, etc. Social sustainability not only ensures that business is profitable but also ensures that business activities do not cause social degradation (Tsai & Chou, 2009).

2.2 Knowledge-Oriented Leadership

Effective knowledge management is designed to influence performance by improving communication, the exchange of ideas, and interaction and knowledge sharing within the organization (Zia, 2020). Thus, knowledge management is an organizational approach to the acquisition, development, and use of individual and group knowledge to support an organization's business strategy. Employees do not always recognize the value of knowledge and frequently fail to take full advantage of new tools and approaches because they do not want to spend time learning. As a result, the company should establish mechanisms such as knowledge-oriented leadership (KOL) to make knowledge management tools visible and used effectively (Donate et al., 2022).

KOL is defined as a collective or individual attitude or action that encourages key cutting-edge knowledge to be shared, created, and used in a way that results in a shift in thinking and a positive collective outcome (Zahur, Ali,

& Gul, 2022). Hence, leaders encourage institutionalized learning by empowering and motivating their subordinates through training and incentives (Naqshbandi & Jasimuddin, 2018). Leaders who exhibit KOL behaviours, including sharing compelling visions, stimulating followers intellectually, and setting ambitious goals and expectations, impact the entire organization (Donate et al., 2022). So, KOL behaviours, compared to other leadership styles, affect all cognitive states of employees: intellectual, communicative orientation, problem description, formulating criteria, and developing solutions (Fachrunnisa et al., 2020). This leadership style becomes especially useful in dealing with innovation, as it helps to develop or challenge the existing vision and goals of the organization, successively increasing the corporate knowledge resources (Zia, 2020). As an important factor is leadership style and behavior, which have a significant impact on the direction and effectiveness of knowledge management in an organization, enterprises can use KOLs to develop knowledge management practices and improve employee engagement in terms of their innovative performance.

KOL supports motivation and communication within the organization. Leaders create the conditions to promote proactive behaviour among employees and teams and become mediators in the sharing and application of knowledge. This type of leadership focuses on evaluating employees on the basis of accepting mistakes and fostering learning, and seeks to raise employees' expectations of the quality of their work by leveraging their creativity (Donate et al., 2022). In addition, knowledge-oriented leaders encourage subordinates to rise above their own interests in pursuit of organizational goals (Campbell et al., 2012).

KOL is described in the literature as combining the characteristics of transformational and transactional leadership as well as communication and motivational abilities, all of which are used to create a favourable environment for knowledge flows that influence innovation and creativity. While transactional leadership is best used to institutionalize, reinforce, and refine existing knowledge, transformational leadership is best used to challenge an organization's current situation (Chaithanapat et al., 2022).

2.3 Hypotheses Development

Many studies emphasize the importance of knowledge as an organization’s sustainable competitive advantage (Septa et al., 2021). There is evidence that techniques for sustainable development could be developed based on knowledge management (Alboliteeh et al., 2023). Scholars are rapidly discovering different methods that tend to move towards knowledge integration and knowledge development to attain sustainable performance (Katic, Cetindamar & Agarwal, 2021). However, using knowledge to enhance sustainable performance requires specific organizational leadership.

Athayde et al. (2017) argue that sustainable development is a developing approach that involves the application of knowledge in organizations by creating an innovative learning environment and generating best practices through collective action. In turn, Akram et al. (2018) indicate that in order to achieve sustainable development, organizations should implement effective knowledge management and innovative practices. In general, the effective implementation of such knowledge management processes as knowledge acquisition, creation, storage, transfer, and utilization positively affects sustainable organizational performance (Kordab, Raudeliūnienė & Meidutė-Kavaliauskienė, 2020).

In recent years, the increasing importance of knowledge management in relation to the sustainable development of organizations striving to achieve uniqueness and leadership has been observed (Raudeliūnienė, Tvaronavičienė & Blažytė, 2020). Knowledge management has an integrated impact on the perspectives of sustainable development in economic, environmental, and social dimensions (Centobelli, Cerchione & Esposito, 2019). Knowledge is often identified as a strategic resource related to the sustainable functioning of an organization, and the knowledge-based view of the organization emphasizes that a successful change to a sustainable business model requires the implementation of the principles of sustainable development and disseminating them throughout the organization's activities and business processes (Atkočiūnienė, Gribovskis & Raudeliūnienė, 2023).

It is emphasized that a knowledge-oriented leader can help in the search for open innovation and thus lead to a sustainable competitive advantage (Banmairuroy, Kritjaroen & Homsombat, 2022). The behaviour of knowledge sharing, promoted by leaders, increases the capabilities of employees’ ambidexterity, which develops the acknowledgement of changeable employee behaviour for attaining the firm’s sustainable performance (Aamir et al., 2021). Moreover, KOL plays a role in developing social sustainability in an organization as it is a management style effective in mitigating task management conflict and reducing internal tensions during task development (Degn et al., 2018).

Based on these arguments, the following hypotheses were developed:

H1: KOL has a positive effect on the economic CSP of the organization.

H2: KOL has a positive effect on the environmental CSP of the organization.

H3: KOL has a positive effect on the social CSP of the organization.

Research on the relationship between corporate sustainability (CS) and financial performance has confirmed that incorporating sustainability into business can bring economic benefits. The commitment to sustainable development coincides with their interest in satisfying key stakeholders and has an impact on the competitiveness and economic performance of the organization (Maletič et al. 2015). Organizations can benefit from greening their operations in terms of cost reduction, productivity, innovation, and economic performance (Koo et al., 2014). Similarly, Chang and Kuo (2008) indicate that there may be a positive reciprocal causation between sustainability and profitability.

In contrast, some empirical studies have also revealed a negative relationship between environmental performance and economic performance (Maletič et al. 2015). Some authors advocate an inverted U-curve, especially when discussing the relationship between environmental effects and economic outcomes (Schaltegger & Synnestvedt, 2002), suggesting that there is an optimal level of environmental effects. Furthermore, when the importance of the three aspects of sustainable development (environmental, economic, and social) is emphasized, some authors note that sustainable development should not be treated as an infinite phenomenon and that the development potential is dependent on the carrying capacity of the environment (Bencsik, 2022).

As such, we can define the hypotheses as follows:

H4: Economic CSP has a positive effect on the development potential of the organization.

H5: Environmental CSP has a positive effect on the development potential of the organization.

H6: Social CSP has a positive effect on the development potential of the organization.

Knowledge-oriented leadership is directly related to organizational performance (Rehman & Iqbal, 2020). When it comes to sustainable performance, knowledge-based companies have a strong opportunity to generate high returns in a sustainable way. The creation of new knowledge and methods can bring benefits to the organization and society, the environment, and the economy, but the style of leadership determines the success of knowledge management for the development of the organization in a key way (Sapta et al., 2021).

The authors consider how KOL increases organizational performance. As an answer, they try to create a chain of relationships with elements of KOL, the organization's ability to manage knowledge, innovation performance, and organizational performance, which ultimately translates into the development of the entire organization. It remains unclear what role the dimensions of corporate sustainability play in this relationship (Gürlek & Çemberci, 2020).

Coutinho et al. (2018) emphasize that CSP depends on its strategy and practices, and that the principles of sustainable development affect the overall performance of the organization. To build such strategies and practices, an organization needs effective KOL. Behind the sustainable operation of the organization lie leadership qualities adequate to the principles of sustainable development, which fundamentally affect the performance of the organization. In order for more and more organizations to operate in accordance with the principles of sustainable development, they must understand many important interconnections, hence the importance of having and using appropriate knowledge, especially by the leaders of the organization (Bencsik, 2022).

Based on these arguments, we propose the following hypotheses:

H7: Economic CSP has a mediation effect on the relationship between KOL and the development potential of the organization.

H8: Environmental CSP has a mediation effect on the relationship between KOL and the development potential of the organization.

H9: Social CSP has a mediation effect on the relationship between KOL and the development potential of the organization.

3. Methods

To test the main hypothesis, there was data collected from a sample of 200 Polish SMEs. 81% of the research group were small enterprises, and 19% were medium-sized enterprises. The dominant activity profile of the surveyed companies was services (47%), followed by manufacturing (27%), and trade 26%.

Based on a literature review, the questionnaire survey was prepared and realized in 2023. The selection of the research group was not representative, which is a research limitation and, at the same time, a challenge for the authors' future research. The survey questionnaire contained questions that the respondents answered using a five-point Likert scale. The variables were created as a sum of items.

The items of economic (EC-CSP), environmental (EN-CSP) and social (SO-CSP) sustainable performance were prepared based on previous research (Dey et al., 2020; Abdul-Rashid et al., 2017) as a variable that consists of six items. The six items that make up the KOL variable ware drawn from the research of Donate and Sánchez de Pablo (2015). As the variables were the sum of their component items, the response scale ranged from 6 to 30. The development potential (DP) variable consists of four items (scale: 4-24) and includes changes in turnover, assets, investments, and employment over the last three years.

The reliability of the research was investigated using Cronbach's alpha coefficient as a measure of the internal consistency of a group of items. As the accepted value of Cronbach's alpha is 0.7, it should be indicated that for all variables the level of Cronbach's alpha is satisfactory, and for EN-CSP and SO-CSP – high (Tab. 1).

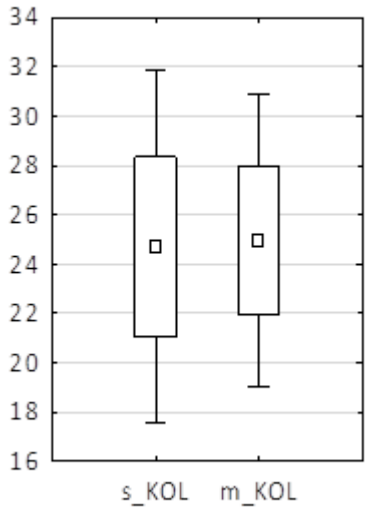
Table 1: Cronbach's Alpha Reliability Test

KOL	EC-CSP	EN-CSP	SO-CSP	DP
0.739	0.839	0.900	0.906	0.832

4. Results

In order to diagnose the differences in the opinions of respondents in SMEs, first, descriptive statistics for individual variables were presented, broken down by the size of the enterprise.

For the KOL variable (Fig.1), the average response for SMEs was very similar and amounted to approximately 24 (on a scale of 6-30). A higher standard deviation for small enterprises (s_KOL) suggests a greater dispersion of responses. In addition, negative skewness values of responses in small enterprises indicate a left-skewed distribution, which means that observations with values higher than the average prevail in the sample.

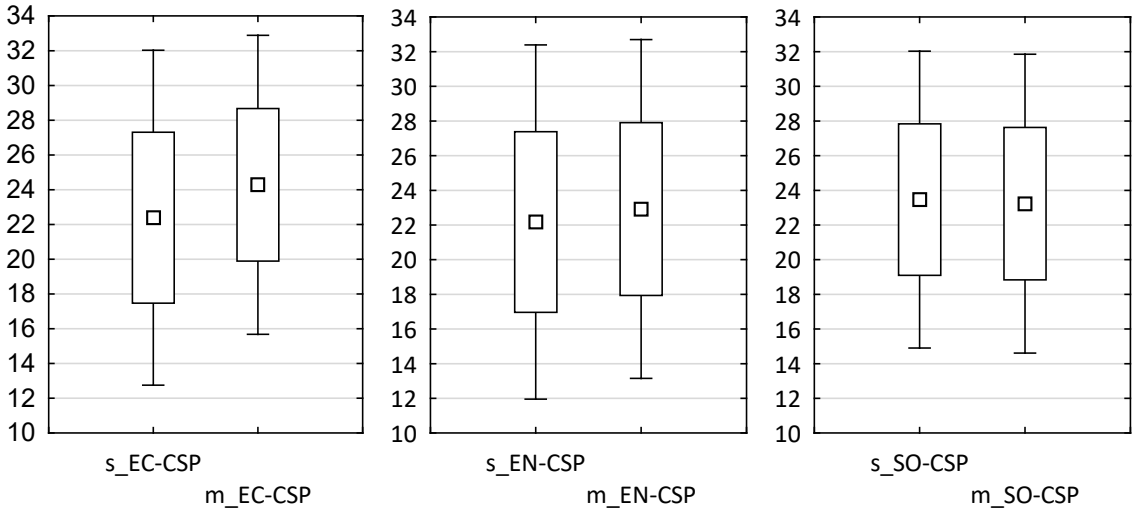


□ Mean; □ Mean±St.dev.; ⌶ Mean±1.96*St.dev.

Figure 1: Descriptive Statistics for Knowledge-Oriented Leadership

Figure 2 presents the descriptive statistics for the CPS variable, successively for its economic, environmental, and social dimensions. For the economic CSP, the mean responses varied. For small companies, the average was s_EC-CPS = 22.4, while for medium-sized companies, it was significantly higher, i.e. m_EC-CPS = 24.3. For the environmental CSP, the mean score was at 22.2 for small enterprises and 22.9 for medium-sized enterprises. A

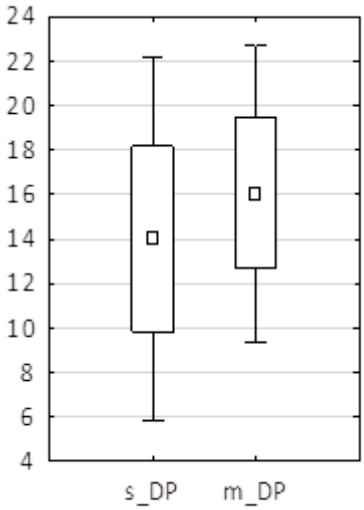
larger standard deviation (5.2) occurred in small enterprises than in medium enterprises (5.0). For the social CSP, we can see a slightly lower average of respondents' answers in medium-sized enterprises, with a very similar level of standard deviation. For all dimensions of CSP and both sizes of enterprises, the distribution of answers is left-skewed.



□ Mean; □ Mean±St.dev.; ⌶ Mean±1.96*St.dev.

Figure 2: Descriptive Statistics for CSP: Economic, Environmental and Social

When assessing the development potential (DP) of SMEs (Fig. 3), it is visible that the results of the survey indicated a higher development potential for medium-sized enterprises (m_DP = 16.1) than small ones (s_DP = 14.0), on a scale from 4 to 20. A clearly higher standard deviation is visible for small enterprises (4.2), which suggests a greater dispersion of respondents' answers. In medium-sized enterprises, the standard deviation was 3.4. For both sizes of enterprises, the distribution of answers is left-skewed.



□ Mean; □ Mean±St.dev.; ⌶ Mean±1.96*St.dev.

Figure 3: Descriptive Statistics for Development Potential

The correlations between predictors ware identified using the Kendall Tau correlation indicator to find correlations between variables. The analysis of Kendall's tau correlation showed statistically significant dependencies with a positive direction for all examined dimensions (Tab. 2).

Table 2: Correlation Analysis (n=200; p<0.001)

	Mean	S.D.	KOL	EC-CSP	EN-CSP	SO-CSP	DP
KOL	24.74	3.53	1.00				
EC-CSP	22.76	4.87	0.29	1.00			
EN-CSP	22.32	5.17	0.28	0.18	1.00		
SO-CSP	23.42	4.37	0.31	0.21	0.59	1.00	
DP	14.40	4.10	0.24	0.51	0.18	0.20	1.00

The next step of the research was the structural model development with path analysis. The statistical significance of direct effects was confirmed, except for the relationship between economic sustainable performance and the development potential of enterprises. Fig. 4 presents path coefficients for the variables analysed.

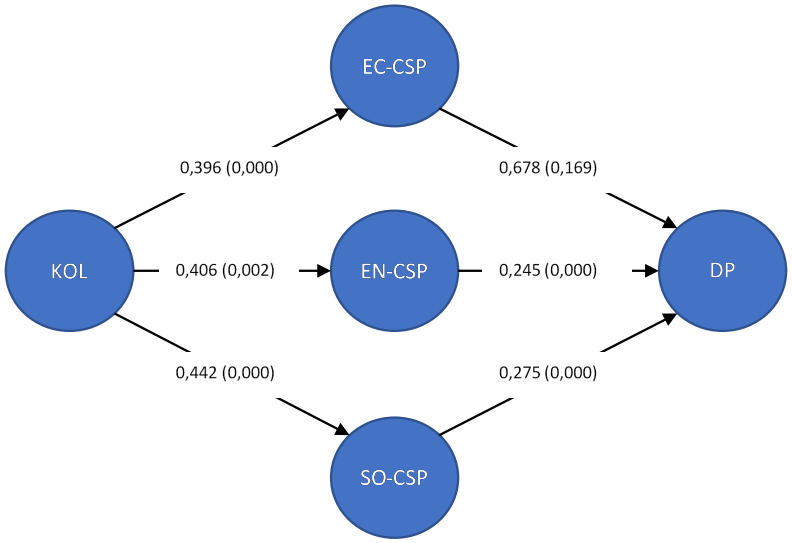


Figure 4: Structural Model: Path Coefficient and p-Values.

The hypotheses' testing result is presented in Table 2. Seven out of nine hypotheses were confirmed, including both direct and mediating effects. In general, KOL have an impact on the CSP in all dimensions. However, it was not possible to confirm the economic impact of economic sustainable performance on the development potential of enterprises or the statistical significance of this dimension as a mediator of KOL-DP relations.

Table 3: Direct and Indirect (Mediation) Effects

Hypotheses		β	t	p-Value	Conclusion
H1	KOL → EC-CSP	0.396	4.113	0.000	Supported
H2	KOL → EN-CSP	0.406	3.211	0.002	Supported
H3	KOL → SO-CSP	0.442	5.017	0.000	Supported
H4	EC-CSP → DP	0.678	1.379	0.169	Not supported
H5	EN-CSP → DP	0.245	8.043	0.000	Supported
H6	SO-CSP → DP	0.275	5.465	0.000	Supported
H7	KOL → EC-CSP → DP	0.268	1.307	0.191	Not supported
H8	KOL → EN-CSP → DP	0.099	2.982	0.003	Supported
H9	KOL → SO-CSP → DP	0.122	3.696	0.000	Supported

KM leadership is positively associated with the overall financial and non-financial performance of organizations (Liu, Tsui & Kianto, 2022). However, in this context, earlier research rarely refers to the area of sustainable development as an area that must be considered in the activities of modern enterprises. Atkinson (2000) pointed out that it is crucial to understand sustainability strategy beyond the scope of standardized standards so that the company monitors business results not only through profit creation or customer satisfaction as indicators of economic achievement but also through the lens of the environment and society (Stahl, Matzler & Hinterhuber, 2003). To achieve this, business leaders are needed who will implement new solutions and knowledge. Leaders should not only provide employees with clear instructions on how to do the job, but also on the tools and methods that will help them perform their tasks at work and how they should use them (Wakefield et al., 2008). There is evidence that KOL can be treated as an attitude or action, observed or attributed, that encourages the creation, sharing, and use of new knowledge in a way that appears to bring about a change in thinking and collective results (Naqshbandi & Jasimuddin, 2018). This becomes particularly useful in implementing the principles of sustainable development in the enterprise. Managers should create contextual conditions to drive and optimize the use of knowledge management practices and initiatives in the organization by creating tools, especially with regard to human resource management (Safari & Azadehdel, 2015).

5. Conclusion

Knowledge management is a factor affecting many areas of an organization's activity. Knowledge-oriented leaders ensure effective implementation of knowledge management principles and practices, which brings multifaceted benefits, including in the area of sustainable development. However, it should be remembered that stimulating the sustainable performance of an organization, despite its great popularity and legitimacy in management sciences, is not always tantamount to the development potential of the enterprise as an economic entity. Implementing the principles of sustainable development, especially in the ecological and social areas, does not necessarily translate into financial benefits in the long term. Hence the need for research in this area, but also for the successive application of new innovations and knowledge.

The contribution of the present research is visible in the confirmation of the significance of the chain of relationships, in which knowledge-oriented leaders stimulate CSP, and consequently, the organization shows greater development potential and has a chance to improve its competitive position.

Within the research process, several limitations could be identified. First, the research sample covers SMEs, however, the proportions are slightly off. The solution would be the extension of the research in the future so that the results can be generalized, also in relation to other characteristics, such as the industry or maturity of the organization. A certain limitation is to conduct only quantitative research, which, based on a questionnaire built on the basis of a literature review, which limits the flexibility of these studies. In the course of qualitative research, it would be possible to select variables that directly and indirectly affect the examined dependencies and to indicate the circumstances that constitute specific conditions for the research.

The current study makes many contributions to the existing literature. To fill in the gaps in existing research, it first reviews the state of the art to highlight the importance of knowledge management in CSP while taking into account the overall development of the enterprise, especially with regard to growth rates. This study revealed the direct impact of KOL on CSP in social and environmental areas and subsequently confirmed organizational development, shedding light on the role of CSP implementation, which had previously been little explored. While previous research has noted the impact of knowledge management on CSP in general, our findings highlight the importance of leadership in achieving benefits for all stakeholders involved in sustainable goals, which broadens the scope of knowledge.

This research has implications for management practitioners as well, emphasizing the importance of knowledge in the management and organizational development processes, as well as the need for knowledge acquisition, storage, and sharing from the perspective of organizational sustainability and in relation to socioeconomic instability. The research results can therefore be used by business practitioners to improve business processes at both operational and strategic levels. The obtained results deepen the developed approach in applied research on KOL and CSP and can thus be used to develop management tools to strengthen the implementation of sustainable development principles in organizations while ensuring the organization's development.

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A Comparative Study of ECKM Papers 2017-22

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Abstract: The purpose of this paper is to analyze and compare all the academic papers in the proceedings of ECKM in 2017 (Barcelona), 2018 (Padua), 2019 (Lisbon), and the digital conferences in 2020 and 2021. In 2022 the conference was arranged in Naples but was also a digital conference. The study classifies the papers according to methodology, analysis, discussion, and conclusion regarding their contribution to the four paradigmatic boxes. The approach uses the five philosophy of science framework and compares this to the content of the research papers. We will use the findings in four representations of Knowledge, two typologies of concepts, four paradigmatic classifications, and the concluding framework for knowledge management research. The five conferences heavily emphasize knowledge-itis and instrumental itis and much less on problem-itis. The papers are mostly centered around existing Knowledge and accepted methodology and are less related to new problems. The results indicate a conference based upon as-is Knowledge and less upon new and often unsolvable issues. The ECKM academic papers in 2017, 2018, and 2019 have relatively low complexity and are presented in an empirical and materialistic paradigmatic framework through definitive concepts representing a form of atomistic research. The papers in 2020, 2021, and especially 2022 are delivered within a more robust, clarified subjectivity and action research-based framework through definitive and sensitizing concepts. What would ECKM have been with more complexity in action and subjective paradigmatic framework through sensitizing concepts representing holistic research? A more creative, engaged, and relevant conference. It will also be a more scientific conference discussing what is acceptable or not acceptable and what is adequate. Studies concerning sustainability, digitalization, and globalization might require another research approach. The more critical and green papers in the 2020 and 2021 conferences are open to new perspectives on methodology, problems, and Knowledge. The 2021 and 2022 conferences represent a turning point for critical sustainability and digitalization papers that clarify subjectivity through action-based research. The 2021 and 2022 papers represent the turning point of ECKM into improved relevance through more critical and constructed studies based on the societal climate crisis and sustainable strategies and business models.

Keywords: Paradigms, Concepts, Perspectives, Knowledge creation, Knowledge accumulation, Sustainability

1. Introduction

Tornebohm (1983) conceives social science as a sequence of partly cumulative and partly non-cumulative transformations of Knowledge (K), problems (P), and instruments(I). Tornebohm (1983) argued that if the sciences and social sciences progress, there must be a balance between K, P, and I. An overemphasis on any of them will hinder a free scientific discourse and the development of any scientific field. For instance, a central notion from the compound (K1, P1, I 1) to (K2, P1, I2) occurs when the problems P1 are solved to increase the stock of Knowledge from K1 to K2. In problem-solving, new instruments may be developed or borrowed from other disciplines, changing I1 to I2. If one of the three aspects dominates the other two, the domain becomes less relevant. Overemphasis on Knowledge ("knowledge-itis") may result in empirically empty structures irrelevant to the problems.

The initial KPI maps the aspect of interest (in this case, a feature of knowledge structures or processes). The KPI compound in this process filters through what is called the "researchers' orientation and worldview" or perspectives in Tornebohm's words (1983) or paradigms in Kuhn's words (1970) or research domains in Olaisen's words (1985). These authors are all referring to the fact that there are alternative ways of approaching the social sciences and, by that, also knowledge management research. The aspects studied are not given once and for all. New Knowledge widens the boundaries, as might happen after broadening knowledge management research. Thornebohm believes that pluralism is needed in any discipline to accumulate Knowledge.

Galtung's (1972) idea was to identify four ways of approaching the social sciences in a triangle of theory, data, and values:

- Empiricism – is what we are presenting true or false (if true consonance, if false dissonance)
- Criticism – is what we are giving acceptable or not acceptable (if acceptable consonance, if not acceptable dissonance)
- Constructivism – is what we are presenting as adequate or inadequate (if adequate consonance, if not adequate dissonance)
- Pluralism – a triangulation of empiricism, criticism, and constructivism (if congruence consonance, if not congruence dissonance)

Galtung (1972) assumes that a common goal of all social sciences is to establish what are called sentences dichotomizing their "world space" by including some defining the empirical world by having some "world points" and excluding others. Hence, data sentences explain the empirical world by including what they observe and eliminating what they do not see or imagine. On the other hand, theory sentences (hypotheses or propositions) define the foreseen world, including aspects predicted by the underlying theory. Finally, value sentences refer to the preferred world, including what is accepted and excluding what is rejected. Galtung's proposed that all social sciences needed criticism, constructivism, and pluralism in addition to traditional empiricism. Constructivism might be constructing our data or practice to develop new alternatives. The constructed worldview is dependent upon our judgment and interpretation. The constructed story demands great imagination and creativity to tell an excellent relevance. Galtung believed all the social sciences could be analyzed according to this framework. Our research paper is the first time Galtung's and Tornebohm's approaches are used to analyze a research discipline.

Blumer (1969) argued that research concepts in any social sciences might be divided into definitive concepts and sensitizing concepts. Definitive concepts are the empirical concepts defining what is true or not true while sensitizing concepts look for new directions asking about what is adequate or inadequate. The concepts have an essential role in any scientific inquiry. They are usually the anchor point in the interpretation of findings.

The purpose of the definitive concept is to:

Describe-Explain-Predict and Control and Rule (A definitive and objective process). Bunge (1967) named this process "the process of all serious systematic research."

The sensitizing concepts have another purpose:

Describe-Explore-Reflect-Participate and Change (A subjective and relative process). Glaser and Strauss (1967) named this process “Grounded-theory-research."

Olaisen (1985) divided any Knowledge into four types of Knowledge:

- What we know about defining
- What we do not know implying
- What we do not know that we know as a part of
- What we do not know that we do not know

According to Olaisen, to get a scientific, intuitive, and creative movement between these four types of Knowledge to represent the essence of representable and non-representable knowing modes in any science and social science. The known directs us to the known unknown and further to the unknown known together with the unknown.

Olaisen (1985) divided the social sciences into four paradigms in a quadrate of harmony versus conflict and objectivity versus subjectivity:

- The empirical paradigm
- The materialistic political paradigm
- The clarified subjective paradigm
- The action paradigm

According to Olaisen, any social science paper could be placed within these four paradigms.

These are the five scientific philosophy frameworks used as analytical tools for analyzing academic papers.

2. Methodology

This paper aims to analyze and compare all the academic papers in the proceedings of ECKM in 2017, 2018, 2019, 2020, 2021, and 2022. A total of 661 double-blind reviewed academic documents within a framework of 5000 words and ten pages each. The approach uses a philosophy of science framework and compares this to the content of the research papers.

We have used five philosophy of science frameworks to analyze all the papers:

1. Tornebohm's Knowledge, problem, and instrument description (1983)
2. Galtung's scientific perspective triangle (1972)
3. Olaisen's four kinds of knowledge identification (1985)

4. Blumer's two types of scientific concepts (1969)
5. Olaisen's four types of paradigms identification (1985)

This paper combines (4) and (5) as pluralistic proposals for future knowledge management research progress.

Each paper has been classified according to the following:

- Problem
- Methodology
- Theoretical foundation
- Propositions or hypotheses
- Analyze
- Discussion of results
- Conclusions
- Theoretical and practical implications

A decision has been made for each of the five frameworks according to which format the paper fits within each academic writing. The decision is based on the reading of the article. For two-thirds of the documents, placing them into a category was clear. We had to decide which type we set them within for one-third of the papers. The decision is based upon our notes from each piece; if in doubt, we reread the article.

The classification within each of the eight criteria is done after reading each section in the paper. When the session is missing, our decision is based on our classification. The subject classification is done according to the keywords in the documents, the abstract, and the introduction. The exactness of the category has continuously been approved. For that reason, we have reclassified 2017, 2018, and 2019 for our 2023 paper. The paper follows up on the analyses of the IFKAD papers (Jevnaker & Olaisen, 2022).

3. Knowledge-Itis, Instrument-Itis, and Problem-Itis

The papers are suffering from "instrument-itis" and to some extent from "knowledge-itis," but they are indeed not suffering from "problem-itis." Problem-oriented research demands systematic and logical argumentation (Lawrence, 1992). Problem-orientated research might need to be improved for knowledge management researchers. The researchers do the statistical tests well, presenting the data in "nice" total packages as a form of scholarly truth. However, only some results conflict with existing marks. 2 of 3 hypotheses are correct, and 1 of 3 needs to be corrected. There are many similar hypotheses/propositions (54%) in papers dealing with knowledge sharing and knowledge management, while 61% reach the same result and 39% reach a different outcome for similar propositions and hypotheses. The Popperian falsification process (1973) is used for both explicit and tacit knowledge processes even if 82% in 2017, 84% in 2018, 83% in 2019, 68% in 2020, 57% in 2021, and 52% of the papers in 2022 do not make any distinction between tacit and explicit knowledge processes. The un-ableness to distinguish between tacit and explicit Knowledge might represent a lack of theoretical sophistication. Two-thirds of the papers need a definition of Knowledge, information, management, leadership, or the situations included in these concepts. The lack of definitions presents a kind of storytelling where a story exemplified by statistics is told. The scholarly and scientific storytelling is what Kuhn (1970) defined as a pre-scientific situation where anything might be equal in importance or what Popper (1973) described as the situation for psychology as a field. Kuhn (1970) called this "something less than research." The lack of problem-itis makes it challenging to make progress and accumulate Knowledge; as Nonaka (2018) noted, there had yet to be any progress in understanding and performing tacit Knowledge. There is, however, a greater degree of sophistication in the 2021 and 2022 papers regarding problem formulations and the knowledge content making the papers more relevant at a business and societal level. The sustainability and green leadership questions have increased the imagination and creativity of solving several problems that have yet to be solved or even pure speculation.

More than 60% of the papers write about the need for new ways of green and knowledge leadership, management, and organizing. The documents, however, are centered around traditional leadership, management, and organizational issues. The paper's label and marketing propose new leadership, management, and organizing ways. However, they neither define today as the situation nor how we will take us tomorrow. The papers are promising the "promised land," but in the end, tomorrow's management is the same as today's management. The papers' problems are centered around solvable matters and seldom relate to unsolvable problems. In knowledge management research, we define "instrument-itis" and "knowledge-itis" as a misdirecting striving for respectability. Sixty-three of 661 papers (10%) discuss our ecological systems' problems

and what we need to do to solve the climate crisis through sustainable businesses. These green ecological papers ask several questions they cannot answer and are thus speculative and are all conceptual papers without any empirical basis. The 2020 and 2021 conferences doubled the number of such papers and increased the conference's relevance for our actual and future business situation. The bearing, creativity, and scientific quality are enormously improved from our earlier analyses of these aspects (Jevnaker & Olaisen, 2021). The 2022 papers confirmed the trend toward critical papers discussing sustainability, the climate crisis, and moral issues of what is morally adequate and morally inadequate for businesses. Artificial standard intelligence is addressed from the angle of what is good for our civilization versus what is suitable for AI businesses. Human control is compared to machine control according to consequences. The 2022 papers are more pluralistic in their problem formulation, choice of methodology, and discussion of findings.

4. The Aspects of the World Studied

We are making a distinction between four areas of Knowledge in management research: "What we know" (1), "What we know that we do not know" (2), and "What we do not know that we know (3) and What we do not know that we do not know" (4). Area (1) will define area (2), while there will be a misinterpretation and bias towards area (3) and area (4).

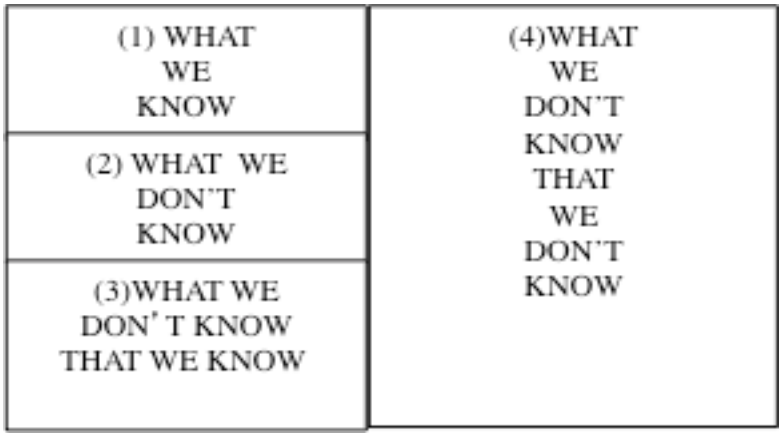


Figure 1: Knowledge Representations (Olaisen, 1985)

For areas (3) and areas (4), will imagination and intuition be necessary for the creativity needed to make a scientific movement in knowledge management in zone 3 and 4? If we expand only into area two, it will be limited knowledge research emphasizing instruments and Knowledge while the problems will be defined by what we know. We distinguish between the known, the known unknown, the unknown known, and the unknown. The exciting part is the dynamics between the known and unknown and how we make a part of the unknown known in our research process. The papers have progressed from 2016 to 2022 in defining what is unknown and discussing why tacit Knowledge remains unknown in most situations. There is also a beginning discussion of the need to approach the unexplored areas and the challenges looming in the unknown domains.

If we want to move between areas one and two, logical, empirical studies ("secure and clean studies") will be ideal. However, the source of bias and misinterpretations start as soon as we move into what we do not know anything experienced. We will here begin to involve imagination and intuition. Experience-based intuition is the starting point of any essential research effort. Simultaneously, the movement from area one to area two is only instrumental puzzle-solving, often without knowledge accumulation (Minzberg, 1979; Morgan, 1980). “The way to improve our technique is not to attempt to analyze things into their elements, reduce them to measure and determine functional relations but to educate and train our intuitive powers to make the unimaginative and the unknown known” (Knight, 1936, p. 103). Suppose our role is only to produce some publishable or travelable research. In that case, we are reduced to mechanical puzzle-solving, demonstrating that we can master the techniques we learned in our Ph. D's. Between 60 and 70% of the research papers at ECKM represent this kind of mechanic puzzle-solving (Morgan, 1980). The empirical ECKM researchers are sending out a questionnaire to a large sample getting a 5-20% response rate. Applying statistics and getting a research classification results in nice tables, diagrams, and figures, getting more of the same trivial already known Knowledge. The 2020 and 2021 papers are based on qualitative in-depth interviews, constructed datasets from several studies, and theoretical foundations. Primarily the 2021 and 2022 papers represent an improvement with more problem-oriented papers and more speculative papers, including imagination and speculation as a part of the research

process. The unknown and unknown areas have gotten more interest, including a few papers (5) in 2021 based upon a constructed empirical basis where the authors discuss unexplored areas to see solutions for sustainability for discussing what green leadership and a green organization represent. The ECKM academic papers at their best in 2021 represent the societal issues addressed later at the Cop 26 conference in Glasgow (Olaisen, 2022). The papers of 2022 follow up on these critical issues wondering if knowledge management represents the problem or the solution.

5. Scientific Orientations

Galtung (1972) assumes that a common goal of all social sciences is to establish what are called sentences dichotomizing their "world space" by including some defining the empirical world by having some "world points" and excluding others. Hence, data sentences explain the empirical world by including what is observed and excluding what is non-observed. On the other hand, theory sentences (hypotheses or propositions) define the foreseen world, including aspects predicted by the underlying theory. Finally, value sentences refer to the preferred world, including what is accepted and excluding what is rejected. Most of the papers (65%) in 2017, 63% in 2018, 61% in 2019, 52% in 2020, 46% in 2021, and 41% in 2022 do not develop hypotheses but only describe the theory's findings without concluding them into hypotheses for testing (Bunge, 1967). However, the research compares data sentences with theory sentences without using Popper's falsification principle (Popper, 1972). The increasing number of papers using hypotheses or propositions increases the discussion of verifying and falsifying the findings. The testing of hypotheses and propositions is making the ECKM conferences more scientific. Dissonance does not produce new theory sentences, while consonance notes that the research results align with mainstream knowledge management research. Criticism is a scientific activity where data sentences are confronted with value sentences. By the tenets of this orientation, consonance is created by producing new data sentences by changing reality into an acceptable condition. Criticism is a creasing part of the ECKM 2017, 2018, 2019, 2020, 2021, and 2022 papers (15% versus 16% versus 18% versus 23% versus 26% versus 28%). The trend is towards more criticism-based pieces. Criticism is needed through values, speculations, and ad hoc methods to advance a field, even if the validity and reliability are lower.

Constructivism implies comparing theory sentences with value sentences to see to what extent the foreseen world is preferred. Consonance refers to what is adequate, and dissonance to what is inadequate. In dissonance, theory and value sentences are prioritized equally, and both might be changed in knowledge management research. Constructivism represents 31% of the papers, increasing from 15% in 2017 to 31% in 2022. The business reality is today complex and global. A combination of understanding wholisms and atomisms is needed in a good research strategy (Minzberg, 1979) and actionable puzzle solving (Morgan, 1980). Imagination and intuition are required for this process (Bunge, 1967; Alvesson & Skjoldberg, 2009). The intuitive powers are less trained among the ECKM researchers even if the number of papers, including a constructed empirical basis through speculations and intuition, increases to meet a higher degree of complexity, like the solutions of future sustainability problems.

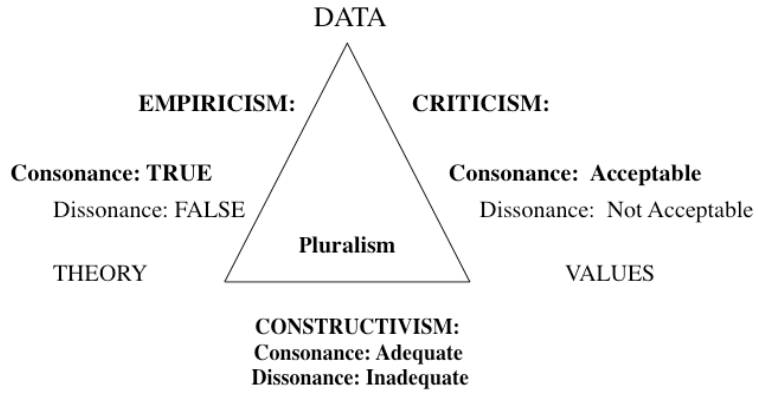


Figure 2: Empiricism, Criticism, and Constructivism

6. The Rise and Fall of Paradigms

Kuhn's position (1970) is that paradigms serve a normative and conserving function. When a standard prevails in a discipline, "normal" science practice evolves as a puzzle-solving activity. During normal science, the scientific community works under the assumption that "it knows what the world is like" and is prepared to defend this

assumption "at any cost." (Kuhn, 1970, p. 5). Normal science often suppresses "major novelties, conceptual or phenomenal" (Kuhn, 1970, p. 36). Thus, scientists are only preoccupied with solving problems/puzzles according to accepted rules according to traditional viewpoints or preconceptions. With such anomalies built up and scientists losing faith, the field enters the crisis stage.

Kuhn writes that "there can be a sort of scientific research without paradigms, schools, perspectives"… (1970:11); in such research, "… though the field's practitioners were scientists, the new findings of their activity were something less than science or social science" (1970:13). He further notes that "… every individual researcher starts over again from the beginning" (1970: 13), "… that some competing schools are directing their publications where they may be published. A continued discussion over the same fundamentals and no scientific progress is made at all" (1970: 159). In the KM papers at ECKM, we have not found any schools of KM or any clearly defined KM research domain. There are no competing schools or paradigms, but mainly papers repeating more or less the same findings. There are new perspectives but not an accumulation of Knowledge or defined scientific progress.

We may sum up Kuhn (1970) in this way:

- Only readily available facts are collected.
- At this stage, all points seem equally relevant.
- To get " false " respect, the instruments are overemphasized and often presented in "quasi-fanciful" ways to get "false" respect.

Looking at knowledge management research at ECKM, we conclude that this is the situation for more than 65% of the papers. The 2020, 2021, and 2022 papers were more scientific than the 2017, 2018, and 2019 papers – 65% versus 83%. In 2020-2022, progress was made in making knowledge management more scientific and robust. We found that Kuhn's description fit the situation in knowledge management research well. Every researcher starts over again from the beginning with was easily collected survey, and case data are assembled and presented in fancy scientific ways. The papers in 2020, 2021, and 2022 (24%) focused on sustainable businesses, greener businesses and societies, and the future of knowledge work, representing a positive change. The 2021 and 2022 conferences might illustrate a turning point for making knowledge management research more relevant and scientific.

7. Alternative Concepts

The concepts have an essential role in any scientific inquiry. They are usually the anchor point in interpreting findings (Blumer 1969 and Baugh 1990). The concepts are the glasses we have used since our Ph.D. We discuss two different worlds of ideas. The definitive concept is based on empirical data or "evidence" and often searches for causal relationships. Blumer(1969:52) wrote, "… to do robust research is defining and handling your concepts … research without concepts is not researching, but something else….".

In knowledge management studies, the definitive concepts are taking over the ground of the sensitizing concepts. Taking all the papers and dividing them into one of these ideas, around 65% of the studies rely on definitive deductive theories, while 35% rely on inductive sensitizing concepts. In the ECKM 2020, about 55% depend upon definitive concepts, while 45% rely upon inductive sensitizing concepts compared to 50/50 in 2021. The induction process described as "directions along which to look and use intuition and curiosity" instead of facts or data is less used. Intellectual curiosity might be the path to choose for creative scholars. The papers are becoming more inductive and sensitizing in the 2020,2021 and 2022 conferences than in 2017, 2018, and 2019. The papers regarding sustainability and green leadership have a higher complexity focusing upon internal business models as drivers for an external greener and more innovative market and a sustainable societal environment.

8. Alternative Research Paradigms

It is here proposed to analyze knowledge management research from four main perspectives. These alternative realities are different meta-theoretical assumptions about the nature of social science. The empirical paradigm, where its explanatory power establishes causal variables between variables. The knowledge systems and the knowledge technology relations have a concrete, actual existence and systematic character producing quantitative and qualitative findings according to the need of the societies and businesses. The business world is considered primarily conflict-free and harmonious at a higher level of aggregation. 50% of the studies in 2018 versus 45% of the 2019 papers belong here, compared to 38% in 2020, 36% in 2021, and 31% in 2022. The trend is towards fewer traditional empirical papers and more subjective and exploring papers. We explain the change

towards more articles about green sustainable business models and a new class of younger European researchers and consultants. Today's green reality is a higher external complexity met by clarified subjective and action-based business models. The modus is explorative versus explaining business models. ECKM is in 2021 and 2022, starting to complete this change in the content of their academic papers.

In the materialistic political paradigm, physical events and behavior are the surface manifestations of underlying mechanisms. The materialistic paradigm relies on the assumption of predictable uniformities in the knowledge systems. The world of knowledge systems exchanges is defined by concrete, measurable, ontologically fundamental structures and interdependencies in knowledge systems. 20 % of the studies in 2018 are here versus 21% in the 2019 conference, 16% in 2020, 15% in 2021, and 13% in 2022.

The clarified subjectivity paradigm holds that social reality does not exist in any concrete sense but is the product of individuals' and organizations' subjective and inter-subjective experiences. According to this paradigm, knowledge behavior must be understood from the employee and organization's viewpoint rather than the outside observer. We can only get such understanding by direct, give-and-take interaction with the employees and organizations. We can get in surveys as questionnaires, but then we define the questions and the business situation. 25% of the studies in 2018 are here versus 27% of 2019, 32% of 2020, 35% of 2021, and 36% of 2022. The action paradigm (5% of the studies in 2018 and 7% of the studies in 2019 compared to 14% in 2020,15% in 2021, and 20% of the 2022 studies) also assumes that what passes for reality is socially determined. The move towards clarifying subjective and action-based paradigms in 2020, 2021, and 2022 is significant. Most ECKM studies are now found within the clarified subjectivity and action paradigm. The change is impressive over a concise period. The change represents a movement from explaining to exploring and exploiting studies. Most studies are empirical, but the findings are discussed through open-sensitizing glasses rather than definitive glasses. The implications and interpretations are drawn much further, representing complex issues like sustainability, digitalizing, globalization, robotics, and AI. In some studies within the clarified paradigm, the empirical part is constructed to grasp future implications.

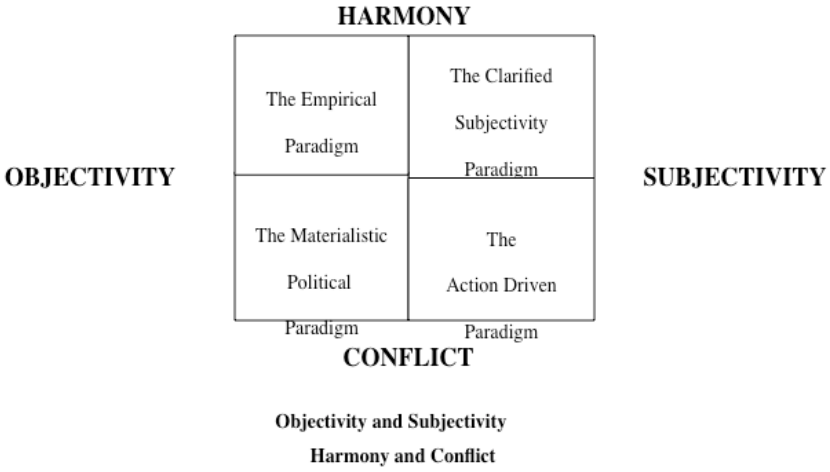


Figure 3: Research Paradigms

9. The Fall of Knowledge Management as Objective Research?

The action-driven and the clarified subjectivity paradigms represent a different degree of complexity and subjectivity. They represent both harmony and conflict. Various levels of complexity require different research paradigms; Pluralism is demanded to catch other aspects of reality. Subjectivism is necessary to capture complexity. The greener and more sustainable business models, the higher complexity and internal focus to get green action-driven business models. Traditional business models reduce complexity and uncertainty through a higher external market focus. The reality offers inductive exploring versus deductive explaining business models. The driving force for the explorative models is to be ahead of the market, offering new sustainable solutions.

In contrast, they explain that business models are already existing market needs in the traditional industrial way. Disruption, efficiency, and connectivity versus scale economics and effectiveness. Explorative inductive models versus deductive explaining models. Kuhn(1971) will describe it as different paradigms fighting as the standard business science paradigm is under attack, not explaining a new business reality. More and more academic

papers at ECKM explore the sustainable and new green reality using more subjective and action-based business models, criticizing existing models and constructing new models. The times are 'changing, and the research methodology with new problems demands other instruments to be helpful in another reality (Jevnaker & Olaisen, 2022).

Consequently, we will have to define this discipline as a subjective multidiscipline, and we will have to explore, innovate, and simulate an experiment to a much higher degree. We need more subjectivity conflicts and minor harmony and objectivity in our research. Leadership and organizational methodology movement toward phenomenon research takes research out of the iron jacket into a flexible and soft jacket opening up for alternative realities (Doh, 2015; Schwartz & Stensaker, 2014; von Krogh et al., 2012). The driving force for the future might be green business models giving KM research new possibilities for understanding the green-creating corporation. A green vision, strategy, and business models were nonexistent in the 2017,2018, and 2019 conferences but appeared as fashion in the 2022 studies.

10. Synthesis and Conclusion

Figure 4 presents a form of synthesis of our reflections. One of the axes represents the degree of complexity, and the other the level of subjectivity. The definitive concepts represent a small degree of subjectivity (i.e., a high degree of objectivity, if possible), while the sensitizing concepts express a high degree of subjectivity. The four paradigms might be subjective or objective. The problematic question is: if we choose one model, will it be possible to move on from a low degree of complexity to a higher level of complexity (i.e., can we generalize from a tiny part of reality to a more substantial portion) of the reality)? Corporations with green business models, management, and organizational systems will drive societal and market changes. Societies and needs are changing too slowly, and the green knowledge-creating corporation is changing faster and might be the driving force for societal changes. The question is: How does KM's research contribute to green business models and green public strategies and alterations? There may be a new era for KM research.

Are the models interchangeable? It might be impossible or desperate to move up the line from origo to a higher degree of complexity and from the top to Origo (Alvesson & Skjolberg, 2009; Bunge, 1967). The knowledge research reality in both sustainability and climate conflicts offers global complexity. To understand this, we must apply subjective paradigms combined with empirical investigations for theory building (Eisenhardt & Grabner, 2007). We have to use sensitizing concepts coupled with actionable definitive ideas. We have a field like knowledge research to understand whether applying it is subjective, but it is systematic and logically rigid. Future green business models will move from high complexity and subjectivity (i.e., more explorative and exploiting internal models) to more definitive and objective ones. Today, politics demand green models, superior solutions, promises, and concrete green business deliveries.

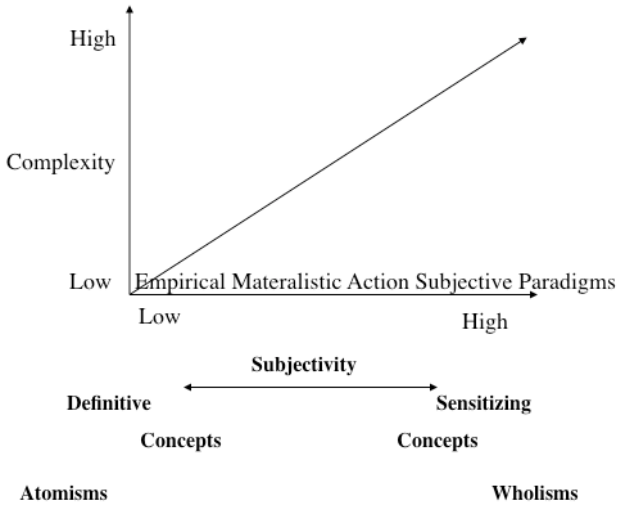


Figure 4: Complexity Versus Paradigms and Concepts for Green Business Models

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The Knowledge Economy and Quality of Work in the Future: An Exploratory Study

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Abstract: The emergence of digital technologies is transforming economic paradigms and leading to significant changes in product and factor markets, as well as how businesses operate. While these technologies enhance productivity, they also present new challenges for businesses regarding manufacturing methods, sources of competitive advantage, and market structures, impacting how work is conducted. Workplace transformations are happening at a faster pace than anticipated, raising important questions for employees, business decision-makers, and policymakers. We conducted an exploratory study to analyze the realism of the Knowledge Economy model's perspective on workplace changes. The study was based on a non-exhaustive literature review and an empirical study conducted with professionals from companies in Portugal belonging to several sectors of activity. Our research leads to the conclusion that the Knowledge Economy model, through technological innovation, has shaped the quality of work, bringing new insights and self-engagement of employees. However, digitalization might induce urgent needs for reskilling and upskilling. Therefore, it is essential to request such a challenge not only to employees but also to organizations and public authorities by investing in lifelong education and training and implementing policies, actions, and tools to facilitate the digital economy transition. Such proactive measures will propel the labor market towards greater availability of decent work, foster a more inclusive society, and promote social well-being and economic prosperity.

Keywords: Knowledge economy, Technological innovation, Labour market, Quality of work, Sustainability

1. Introduction

In the era of the Knowledge Economy and Sustainable Development, where countries integrated into the World Trade Organization, businesses, and markets are undergoing significant structural changes driven by digital transformation, impacting work conditions. This question has become even more pertinent in the new millennium, particularly after the recent Covid-19 pandemic. The digitalisation of processes in businesses and companies has experienced a sudden acceleration, leading to the rapid adoption of organisational innovations, and significantly increasing work flexibility in terms of both mode and location (Jaumotte, Oikonomou, Pizzinelli, & Tavares, 2023; Stalmachova, Chinoracky, & Strenitzerova, 2022; Williamson et al., 2021). The shift towards remote working has been accelerated, and the development of digital technologies has enhanced their implementation for this way of working (Battisti, Alfiero, & Leonidou, 2022).

Globally, it is estimated that approximately 81% of the workforce has been impacted by total or partial workplace closures, necessitating swift adaptation to a new reality dominated by rapid and irreversible technological changes (Savić, 2020). This period has marked a fundamental milestone, prompting individuals and organisations to navigate the challenges and opportunities presented by the digital age.

To ensure the sustainable growth of businesses, it is crucial for entities to adapt to the new needs and demands of an increasingly skilled workforce to attract and retain the best talent (Forbes, 2021), in accordance with the *Decent Work Agenda* (International Labour Organization, 2023). The 2018 reports from the World Economic Forum (2018a; 2018b) confirm the urgent need for the reskilling of millions of jobs that are at risk of becoming obsolete. In line with this reasoning, an earlier report by McKinsey (2017) states that for about 60% of occupations, at least one-third of activities could be automated, implying significant transformations and changes for all workers, who should, together with their employers, determine how to remain relevant and which tools to utilise.

In a relatively recent report from the International Labour Organization (2019), the following aspects are highlighted as needing increasing attention: the universal right to lifelong learning, support for individuals during transitions, a transformative agenda for gender equality, and stronger social protection in the face of the imminent threat to jobs resulting from digital transformation. The report also emphasises that all countries should prioritise investment in people's capabilities as part of government policy, valuing work as a driver of human development.

The European Commission's research and policy initiatives since the last decade have shed light on the multidimensional nature of quality of work and provided valuable insights into its determinants and strategies for improvement (European Commission, 2016, 2017 and 2019). Organisations and policymakers can create high-quality work environments that foster employee well-being, productivity, and sustainable growth by addressing working conditions, psychosocial risks, skills development, and promoting social dialogue.

In this current global economic scenario of transformation and uncertainty regarding modes of work, job satisfaction, technology, and learning, this research aims to answer the question: What is the future of work in most sectors of activity globally and, incidentally, in Portugal?

Essentially, the objective is to identify the main challenges, opportunities, and risks for individuals based on an exploratory study, encompassing theoretical contributions from "classic" authors such as Adam Smith and Karl Marx, as well as evolutionary and new institutional economics perspectives. The discussion also includes authors affiliated with management theoretical currents, particularly resource-based, transaction cost, and agency theories (Teece, 2019). The novelty of this paper lies in its empirical evaluation, which includes a heterogeneous spectrum of companies and organizations, both in the private and public sectors. Overall, the paper aims to contribute to the knowledge and understanding of workplace changes within the context of the knowledge economy in Portugal, providing insights for policymakers, scholars, and other stakeholders.

Bearing in mind the object of our research, the paper contains the following structure. The Section 2 includes a literature review focused on this research's underlying concepts and key issues: the concept and foundations of the knowledge economy, the historical antecedents of the economic concept of quality of work, and digitalisation and expected consequences for the future of work. The Section 3 describes an empirical study on the Portuguese labour market aimed at gathering data on the perception of employed individuals, followed by the analysis of the results in Section 4 and the research conclusions in Section 5.

2. Theoretical Framework

The literature supporting this article was collected using several databases: B-On-Online Knowledge Library, Scopus, and Web of Science. To refine the search, we have set limits on the publication dates of articles to include papers published mostly from 2014 onwards, with a special focus on last 4 years. Older references were included in our research due to their valuable insights and significant theoretical contributions pertaining to our research question.

2.1 Knowledge Economy

The knowledge economy refers to an economic system in which knowledge generation, distribution, and application play a central role in wealth creation and economic growth (Foray, 2004; OECD, 1996; World Bank, 1999). Unlike traditional economies that heavily rely on tangible resources and physical labour, the knowledge economy places a greater emphasis on intangible assets and dynamic capabilities such as intellectual capital, learning, innovation, and information (Bogers et al., 2019; Florida, 2002; Lundvall, 1992; Machlup, 1962). As key characteristics, the literature widely recognizes the following:

- Knowledge Creation and Innovation: The knowledge economy (KE) thrives on continuously generating new knowledge through R&D and innovation (OECD, 1996). It recognises the importance of intellectual property and encourages the protection and commercialisation of ideas (Hou et al., 2023; Carayannis & Campbell, 2009).
- Information and Communication Technologies (ICT): These are fundamental enablers of the KE. Digital platforms, internet connectivity, and data analytics facilitate the efficient dissemination, interactive learning and knowledge spillovers across borders and sectors (Yang et al., 2023; Hwang & Krackhardt, 2020; Audretsch & Feldman, 1996; Drucker, 1992, 2017; Lundvall, 1992).
- Human Capital and Skills: The KE relies on a highly skilled workforce capable of acquiring, applying, and adapting knowledge to address complex challenges. Education, lifelong learning, and a culture of innovation are essential for developing human capital in such an economy (Öberg & Alexander, 2021; Oliveira & Turčinková, 2019; Florida, 2002; Audretsch & Feldman, 1996).
- Collaboration and Networking: Partnerships between individuals, organisations, and institutions are vital to leverage collective knowledge, share expertise, and promote cross-sectoral collaborations (Cai, Ferrer & Lastra, 2019; World Bank, 1999; Edquist, 1997; Oliveira & Natário, 2016; Machlup, 1962).

The Knowledge Economy (KE) plays a vital role in driving economic growth, fostering innovation, and enhancing competitiveness. It promotes the transition from low-value, labour-intensive industries to high-value, knowledge-intensive sectors (Hwang & Krackhardt, 2020). Knowledge-based industries such as technology, finance, research and development, and creative services contribute significantly to GDP and job creation in the world economy (UNCTAD, 2022).

Furthermore, the KE encourages sustainable development by focusing on social innovation. New problem-solving insights, concepts, activities, services, and applications can provide an appropriate platform for the exchange of creative and innovative ideas, research findings, experiences, and skills between university, industry, and society in a kind of "community engagement" to meet business and social needs (Phonthanukitithaworn et al., 2023; Rashid et al., 2023; Bogers et al., 2019).

To synthesise, the KE represents a shift towards an economy driven by the creation, distribution, and application of knowledge (OECD, 1996). It emphasises the importance of intellectual capital, technological advancements, and skilled human resources (Phonthanukitithaworn et al., 2023). Understanding the concept of the KE is crucial for policymakers, businesses, and individuals to adapt to the changing dynamics of the globalised, digitalised, and innovation-oriented world. By harnessing the power of knowledge, societies can foster economic prosperity, sustainable development, and societal well-being (Wang et al., 2022).

2.2 Quality of Work

Work conditions have been a significant aspect of the history of economic thought. Adam Smith was a pioneer in addressing the topic of work quality, analysing the process of creating competitive advantages for countries in international markets based on labour costs and free trade. In "The Wealth of Nations" (1776), Smith argued that improving facilities, tools and providing a safe and healthy environment for workers could increase their productivity, reduce unit labour costs, and consequently contribute to the accumulation of capital for the nation. This pioneering author recognised that the labour division could lead to monotonous and repetitive tasks for workers, having eventually negative effects on their psychological and emotional well-being, resulting in a sense of alienation. However, despite these concerns, Smith believed that the overall balance of such division would be positive for society due to the productivity gains it provided.

With a less optimistic view than Adam Smith regarding the virtues of private initiative and the "invisible hand", Karl Marx proposed a radical analysis of the process, relationships, and the very concept of work. In "Das Kapital" (1867), Marx exposes his thesis on the asymmetrical relationship between workers and employers: the former sell their labour power as a common commodity, while the latter purchase that labour-power with the prerogative to determine the time and value paid for it. Based on this premise, during each daily work shift, the worker receives enough to ensure their subsistence. At the same time, there exists a surplus period that benefits the employer (the holder of capital), during which "surplus value" is generated. Surplus value is defined as the portion of the value obtained at the expense of the worker and appropriated by the capitalist (employer). This dichotomous perspective advocate for an antagonistic relationship between employers and workers.

A more contemporary approach is labour market segmentation, proposed by Doeringer and Piore (1971). According to the authors, such market is divided into primary and secondary segments. In the primary segment, you find the "good" jobs, occupied by the most skilled workers, with better salaries and the possibility of career progression, without the risk of losing their jobs to less qualified and poorly paid workers. In the secondary segment will be found only the jobs considered as "bad," intended for workers with low qualifications, lower wages, more precarious working conditions, and having to deal with competition from cheap labour from abroad. Thus, in the theory of labour market segmentation, contractual relationships and job characteristics play a fundamental role in determining the quality of work.

Over the past decade, the European Commission has undertaken extensive research and policy initiatives to promote high-quality work environments. The European Commission emphasises that quality of work encompasses various dimensions beyond mere job stability and income. It includes factors such as job security, work-life balance, skills development, social dialogue, health and safety, and career progression (European Commission, 2017 and 2019). Understanding these dimensions helps to identify the key determinants of high-quality work and shape effective policies.

Previous academic studies also provide recommendations such as promoting work-life balance, providing support for mental health, fostering positive working relationships, and implementing prevention measures (e.g., Wynne et al., 2014). Skills development is crucial for ensuring high-quality work and maintaining

employability. About this the EC highlights the importance of lifelong learning and continuous upskilling to adapt to evolving job requirements (European Commission, 2016). Initiatives such as the *European Skills Agenda* emphasise the need to enhance digital, green, and social skills to promote quality of work and facilitate transitions in the labour market.

More recently the European Commission has emphasised the importance of social dialogue and worker involvement in shaping the quality of work (European Commission, 2019). Engaging workers and their representatives in decision-making processes leads to more inclusive workplaces and better outcomes. The 2019 report also highlights the significance of factors such as work intensity, job demands, work schedules, and job control in determining the quality of work. It suggests that favourable working conditions contribute to higher job satisfaction, increased productivity, and better overall well-being of employees. Psychosocial risks, such as stress, bullying, and harassment, pose significant challenges to the quality of work.

The report emphasises, in a final statement, the need to address these risks through effective policies and practices through effective social dialogue mechanisms, worker participation, and collective bargaining to improve working conditions and promote the quality of work (European Commission, 2019).

2.3 Digitalization and the Future of Work

Digitalisation, also commonly known as digital transformation, refers to the adoption of digital tools, such as cloud computing, artificial intelligence (AI), machine learning, and the Internet of Things (IoT), cloud computing, among others, aiming to create value for organizations and clients (Calderon-Monge & Ribeiro-Soriano, 2023). These technologies enable the collection, storage, analysis, and utilisation of vast amounts of data, facilitating efficient decision-making and improving the overall operational effectiveness of organisations.

The impact of digitalisation on the quality of work – e.g., new processes such as telework, remote work or hybrid work - is a crucial area of study (Gifford, 2022), as it has significant implications for employees' well-being, productivity, and job satisfaction (Eurofound, 2023).

Technological innovation, underlined to digitalisation as defined above (which is commonly accepted as the back stone of digital transformation in productive systems), has revolutionised the way we work, transforming industries and redefining the concept of quality of work (Brynjolfsson & McAfee, 2014). How technological advancements have influenced the quality of work, highlighting both positive and negative aspects.

Drawing on relevant research and studies, we can gain valuable insights into the multifaceted relationship between technological innovation and work quality, namely:

- Enhanced efficiency and productivity: Technological innovation has significantly improved efficiency and productivity in the workplace. Automation, artificial intelligence, and machine learning have streamlined processes, reduced human error, and increased output (Ramachandran et al., 2022). A study by Brynjolfsson & McAfee (2014) found that advanced automation technologies led to a 5-20% increase in productivity across various industries. The improved efficiency resulting from technological innovation positively impacts the quality of work by enabling employees to focus on more complex tasks and fostering a sense of accomplishment.
- Skill enhancement and workforce adaptability: Technological innovation has shifted the required skill sets for many job roles. While automation may replace repetitive and mundane tasks, it also creates opportunities for skill enhancement and workforce adaptability. Employees can acquire new skills to operate and manage emerging technologies, leading to a more knowledgeable and versatile workforce. A study by the Organisation for Economic Co-operation and Development (OECD, 2019) highlights that individuals with higher levels of digital skills tend to have better job prospects and higher job quality. Thus, technological innovation contributes to improving work quality by encouraging continuous learning and professional development.
- Work-Life balance and flexibility: The advent of technological innovation has brought about remote work and flexible work arrangements, significantly impacting work-life balance. Employees now have the freedom to work from home or choose flexible working hours, allowing them to better manage personal and professional commitments. This flexibility has been shown to positively influence work quality, job satisfaction, and overall well-being (International Labour Organization, 2022). Technology-enabled communication tools and collaboration platforms facilitate seamless connectivity and efficient teamwork, further enhancing the quality of work in a remote or flexible work environment (Allen et al., 2015).

- Potential for deskilling and job insecurity: While technological innovation has numerous benefits, there are concerns regarding deskilling and job insecurity. Automation and AI can potentially replace certain job functions, leading to a mismatch between workers' skills and the demands of the evolving job market (Au-Yong-Oliveira et al., 2019). This could result in job insecurity and decreased work quality for individuals who are unable to adapt. A study by Acemoglu & Pascual (2020) highlights that workers in industries that are highly exposed to automation experience adverse effects on job quality, showing theoretically that robots may reduce employment and wages. It is crucial for organisations and policymakers to address these challenges and provide reskilling opportunities to ensure a sustainable and inclusive work environment (World Economic Forum, 2018b).

According to the previous points it is possible to draw the following considerations with respect to the purpose of our research, Technological innovation has both positive and negative implications for the quality of work. It enhances efficiency, productivity, and workforce adaptability, improving job satisfaction and opportunities for skill enhancement.

Additionally, technological advancements enable flexible work arrangements, promoting work-life balance. However, concerns regarding deskilling and job insecurity need to be addressed to ensure a smooth transition and inclusive work environment. Organisations, policymakers, and individuals must collaborate to harness the benefits of technological innovation while mitigating its potential negative consequences (European Agency for Safety and Health at Work, 2023), thus fostering a high-quality work environment in the era of technological advancement (Eurofound, 2023; Ramachandran et al., 2022).

3. Empirical Study

To gather empirical evidence regarding Portuguese employees' perceptions concerning digitalisation's future impact on their jobs, we rely on data collected from an inquiry fully presented in Anjos (2021). The inquiry utilised online questionnaires. All the issues included ordinal scales of response, as well as multiple choice to realise a descriptive analysis strictly based in relative frequencies.

Regarding to data collecting a non-probabilistic sampling method of the snowball type was applied during the pandemic years of 2020-21. A total of 280 workers from various sectors of activity, including banking, insurance, management, consulting and accounting services, education, real estate, public administration, ICT, health, warehouse and logistics, and legal services, participated in the survey. The most frequent activity was banking and finance sector (66%), overrepresented in our sample compared to Portuguese share. About the other activities essentially these are services divided into a huge diversity, where public services are reduced to around 6% of the inquired people (which is underrepresented according to the national reality).

Most respondents were senior workers with over 20 years of professional experience in their respective fields, mainly in the financial services sector, almost all with effective work contracts. Regarding to age, 88% were 42 or more years old, and 61% were men. Notice that 18% had a secondary level of education. About education level, 81% have tertiary education (54% have a bachelor, 15% a post-graduation and 10% a master's degree). Personal's gross monthly income was mainly between 1.500 and 3.000€ (41%), followed by the interval of 3.001 and 5.000€ (26%).

In the following section, we present and discuss the results derived from the survey realised in 2021, going further in terms of illustration and discussion by bringing new insights.

4. Results Analysis

In the context of digitalisation, with the aim of assessing the potential replaceability of current job positions by machines, approximately 75% of the respondents stated that they engage in tasks involving complex problem-solving, imagination, and creativity on a weekly basis.

These tasks rely on typically human characteristics and are difficult to replicate by machines, indicating that a significant portion of the workforce involved in such activities is unlikely to be automated. This finding aligns with the insights provided by Forbes (2020), which emphasise that strategic decision-making, creative work, and critical thinking are among the types of jobs that are less susceptible to automation.

However, it is important to note that 50% of the respondents mentioned the need to identify errors and irregularities as part of their daily tasks, followed by a percentage of 26% admitting doing so more than once per week (although not weekly). Noticed that such activity can be carried out with greater accuracy and

efficiency by machines. This development is beneficial for workers as it relieves them from routine tasks, allowing them to focus on more challenging endeavours to create sustainable competitive advantage.

Furthermore, a significant 75% of the respondents acknowledged the relevance of automation in their respective industries, highlighting the widespread presence of digitalisation in the workforce. Regarding skills and learning, around 50% of the respondents reported regularly engaging in tasks such as advising, planning, and negotiating, both within and outside their organisation. These tasks are challenging for machines to replicate, suggesting that approximately half of the sample is actively developing skills that make them valuable in an increasingly digitalised work environment. Moreover, over 65% of the respondents expressed the need to continuously learn new tools and work methods, at least weekly.

When asked about the most valuable skill to develop, 70% of the respondents chose technical competencies such as computer programming and industry-specific knowledge. In comparison, only 10% selected a social skill, specifically negotiation.

Regarding social protection, around 58% of the respondents believed that technology would lead to a significant overall loss of jobs within their organisation. This perception aligns with a projected scenario, although subject to debate, indicating that 47% of jobs in the United States are at risk of automation in the next 10 to 20 years (Frey & Osborne, 2013).

About the impact of technology on work, 63% of the respondents recognised experiencing changes in their job roles, consistent with the findings of the McKinsey & Co report (2017), which suggests that approximately 50% of work activities have the potential to be automated. Notice that 39% admitted a huge change suggesting that affected employees had very likely to adapt themselves to new modes of work, including new tools and practices. Only 16% had to change of job because of technological novelties.

About the risk of unemployment, when asked who should bear the responsibility for mitigating potential adverse consequences of technology diffusion, such as replacing workers with machines, 50% of the respondents believed that individuals should be accountable for safeguarding their well-being.

Concerning work quality, defined as *the level of well-being derived from work*, 57% mentioned the wish of working fewer hours and having time for other activities outside of work. Only 20% indicated an attractive salary, lower than the percentage of responses indicating job security.

About the potential impact of digitalisation 65% believe that it can contribute to improving the balance between personal and professional life, with 30% specifically highlighting the benefits of flexible working hours. The percentage of responses assuming wage improvement is extremely low (2%).

In overall, these employees' expectations results suggest they are more concerned with non-monetary aspects of their wellbeing in their jobs. These can be the result of relevant charges in the respective organizations, considering the specific features of the surveyed sample (especially, seniority).

These findings align with a study reported by Business Insider (2021), which revealed that 68% of respondents considered a career change and prioritised work-life balance over a higher salary.

Regarding teleworking, 91% of the surveyed workers identified this as an opportunity to improve the quality of their work, but 77% still recognize the importance of having periodic face-to face meetings of the team.

Additionally, 65% believe that working from home 2 or 3 days a week is the ideal arrangement, indicating a preference for a hybrid work model. These findings align with Eurofound (2023) and and Forbes (2021) perspectives.

Finally, regarding to job security, considering many workers are confident in their current employment. However, 35% expressed a high (or even very high) level of concern about losing their position, highlighting a strong sense of competition among highly educated employees within organisations and significant workplace tensions in the Portuguese labour market.

5. Conclusions

Digital transformation is profoundly impacting industries and services on a global scale, moulding the dynamic between humans and machines in the workplace. Our research contributes to demonstrating how this transformation has reinforced the significance of the Knowledge Economy model in shaping the quality of work. It systematically enhances individual cognitive and technical skills, prioritising creativity, critical thinking,

and strategic analysis. Repetitive and routine tasks can now be automated, allowing workers to redirect their focus towards more complex and innovative activities. This shift improves work efficiency and overall quality.

Digitalisation has facilitated remote and flexible work expanding employment opportunities and improving the work-life balance. The Internet and digital technologies provide convenient access to information and learning resources. Individuals can independently acquire new skills and knowledge, enabling them to adapt to changes in the job market. The rapid pace of digital transformation requires professionals to engage in continuous learning and adaptation, ensuring that their skills remain up-to-date and relevant.

In essence, the ongoing technological revolution necessitates governments, businesses, public services, and individuals to be prepared to embrace these changes. This preparedness involves investing in lifelong education and training and implementing policies, actions, and tools to facilitate the digital economy transition. Such proactive measures will propel the labour market towards greater availability of decent work, foster a more inclusive society, and promote social well-being and economic prosperity. This approach aligns with the holistic concept of sustainability advocated by the United Nations Sustainable Development Goals (United Nations, 2015).

As limitations the research lacks more data, following a more representative sample of the Portuguese reality using a stratified sampling process according to the most recent Census edited by Portuguese Statistics (2021). It would be also interesting to analyse how workers, especially those working in public administration (including education sector), evaluate digitalization impact in their quality of work after the pandemic situation and the huge pressure to change considering the new paradigm of labour valuation and the challenge of decent work for all.

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Ethical commitment

The authors declare that in the collection and use of data referred to in the paper all ethical aspects were considered.

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Capabilities for Knowledge Management in Virtual Collaboration: A Systematic Review

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Abstract: Virtual collaboration has become an integrated part of knowledge-intensive work, especially after the pandemic. Researchers claim that working partly in the physical workplace and partly working virtually will persist in the future among knowledge workers. As knowledge sharing is a challenge when working across distances, it highlights the need for knowledge-intensive organizations to develop capabilities for knowledge management (KM). Capabilities will be investigated as organizational factors that create, extend, or modify behavior, aiming for effective KM across distances. This systematic literature review explores how knowledge creation, retention, and transfer are managed in virtual collaboration and the required capabilities for this process. Based on 33 articles, the study found that organizational structures facilitating frequent interactions and transactive memory, supported by technology, enable capabilities for KM. Hence, retention and transfer of tacit knowledge are challenged and might be a hindering factor.

Keywords: Virtual collaboration, Knowledge management, Capabilities, Knowledge-intensive work, Knowledge-intensive organization

1. Introduction

Virtual collaboration has increased, particularly after COVID-19, when knowledge workers were forced to collaborate virtually (Miles et al. 2021). Researchers claim that working partly virtual and partly from the physical office is the "new normal" (Kattenbach, Kump & Moskaliuk 2021; Holdt Christensen 2022), especially among knowledge workers (Wang et al. 2020; Hamouche 2021). An ongoing discussion about KM enablers focuses on the KM processes, e.g., Sahibzada et al. (2022), however, the study does not focus on the context of virtual collaboration in hybrid work or virtual teams when working across time, space, and culture. Hence, research demonstrates challenges with knowledge-sharing, spontaneous interaction, and coordination when working from geographical distances (Waizenegger et al. 2020; Kirchner, Ipsen & Andersen 2022). Typically, knowledge work is characterized by being intellectual work with autonomy, requiring extensive communication and coordination (Alvesson 2004:21). Therefore, challenges with KM, e.g., knowledge-sharing, are critical for knowledge workers, as the success of virtual collaboration is highly dependent on effective knowledge processes (Townsend et al., 1998). An increased level of virtual collaboration among knowledge workers, but challenges with knowledge management (KM) demonstrates a discrepancy in ambitions, assuming to impact future knowledge work unless needed capabilities are developed (Mattarelli et al. 2017). In this study, capabilities refer to organizational factors that create, extend, or modify behavior aiming for effective KM across distances (see 2. Background). Although working across time, space, and culture (Fisher & Fisher 2001) increases complexity, demanding employees to attend the physical workplace is not ideal due to the current state of the labor market and employee preferences (Smite et al. 2023).

Examining the literature, this study aims to explore KM when collaborating virtually in knowledge-intensive organizations, answering the question: *Which capabilities are required to support KM in virtual collaboration?*

2. Background

The increased use of virtual collaboration has entailed different work structures, e.g., telecommuting, remote work, or hybrid work (Dimartino & Wirth 1990; Holdt Christensen 2022). Referring to virtual collaboration in this study includes working partly or fully remote from central offices with the possibility of communicating through technology. Virtual collaboration demands KM processes to overcome distances and persist despite different contexts. In knowledge-intensive organizations, knowledge is a key resource (Jemielniak 2012), and the effectiveness of KM is essential for the organization's survival. Examples of knowledge-intensive organizations are human-resource departments. Organizations focusing on the embrained skills of individual members and the cognitive and conceptual skills of employees will not be objective in this study, e.g., software developers (Blackler 1995).

When experiences are transformed into knowledge, the organizational context affects this process (Argote, Denomme & Fuchs 2012). As research ascertains challenges with knowledge sharing when collaborating virtually (van der Meulen et al. 2019; Kirchner et al. 2022), this support that when the organizational context is divided across time, space, and culture, it impacts the KM process. Argote et al. (2003) describe KM as a process consisting of the following KM outcomes: Knowledge creation, knowledge retention, and knowledge transfer. *Knowledge creation* is the subprocess of creating new knowledge. *Retention* is storing and embedding knowledge, persisting over time. *Knowledge transfer* is when knowledge is disseminated, and experiences from a team or organization affect another team or organization (Argote et al. 2003; Argote 2013) However, the outcomes of these processes are interconnected, meaning that retention makes transfer possible, but transfer can establish possibilities for new knowledge creation (Argote et al. 2003). Responding to these processes, research calls for more research about the development of capabilities and how new organizational forms affect this process (Argote 2011).

Capabilities can be defined as "(…) *the capacity of an organization to purposefully create, extend, or modify its resource base*" (Helfat et al. 2007). Resource base refers to tangible, intangible, and human resources (Helfat & Peteraf 2009), which in this review will be resources for KM, enhanced through, e.g., routines. Taking a behavioral approach, capabilities are apparent through routines, processes, decision-making, etc. (Helfat & Peteraf 2009). In this study, analyzing capabilities related to KM will be defined as organizational factors that create, extend, or modify behavior, e.g., routines and processes aiming for effective KM (creation, retention, and transfer) across distances. The capabilities embeddedness is reflected in "*the extent to which a capability is contextually entrenched within the structural, social, and cultural aspects of the firm*" (Grewal & Slotegraaf, 2007, p. 454). Having multiple contexts through virtual collaboration requires these capabilities to persist between contexts.

3. Methodology

This systematic review explores KM in virtual collaboration and the required capabilities for this process, reflected in enabling and hindering organizational factors. Inspired by a framework, the investigation of KM will focus on the process of knowledge creation, retention, and transfer (Argote et al. 2003).

The search was conducted using two databases: Scopus and Web of Science. Based on the research question, the following keywords were used with boolean logic principles and synonyms. The search was performed through Title, Abstract, and Keywords. Only articles and reviews in English were included.

Table 1: Search

Working virtually	Collaboration	Capabilities	Learning and knowledge	Knowledge workers and knowledge-intensive organizations
"working from home" "online work*" virtual* "disper* team*" "hybrid office*" "hybrid work*" telework* "working from anywhere*" remote* (distribut* NEAR/2 team*) (distribut* NEAR/2 organi*ation*)	collaborat* cooperat* Team* coordinati* "work together*" "online collaborat*"	capabili* capacit* ability* "knowledge enabler*"	learn* knowledge*	knowledge* W/3 work* human resource management* "HRM" int*-organi*ational* int* organi*ational* employe* ("Knowledge intensive compan*") ("Knowledge-intensive compan*") ("Knowledge intensive firm*") ("Knowledge-intensive firm*") ("Knowledge intensive organi*ation*") ("Knowledge-intensive organi*ation*")

The inclusion and exclusion process was based on criteria developed according to the research question and appearing in Table 2. Individual capabilities were excluded since the focus is on team and organizational levels. Studies about teaching students have been excluded, as the focus is on organizations with employees. Healthcare and software contexts have been excluded due to the differences and variances in work practices in knowledge-intensive work (see 1.1).

Table 2: Inclusion and Exclusion Criteria

Inclusion criteria	• Contribute to answering the research question. • Intra-or inter-organizational collaboration • Network and social network • Only journal papers (review or article)
Exclusion criteria	• The context of students and healthcare • Software developers, software teams, software companies • Individual capabilities and individual learning • Algorithms and collaboration networks • Machine learning and modeling.

The flowchart (figure 1) demonstrates the screening. Totally, 338 hits were identified, and after the screening, 33 articles were included in the study.

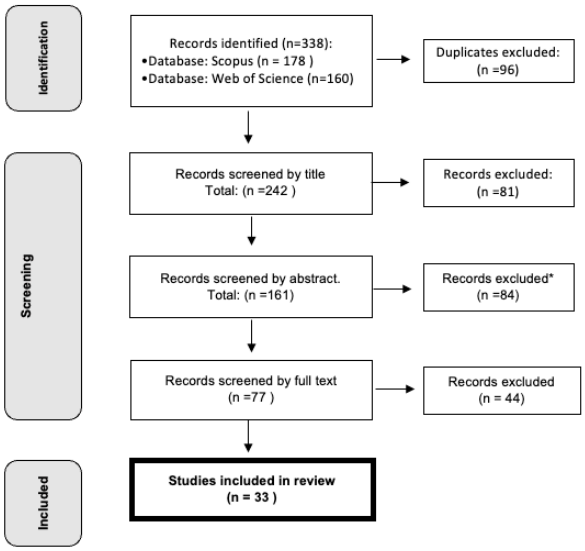


Figure 1: Flowchart

Included articles were systemized through four processes (Figure 2). (1) Sections that involved KM in the included articles were coded with themes. (2) the codes were structured into the KM process: knowledge creation, retention, and transfer. (3) Codes were clustered into themes that emerged from codes. (4) These themes are subheadings in the synthesis, appearing in results (4).

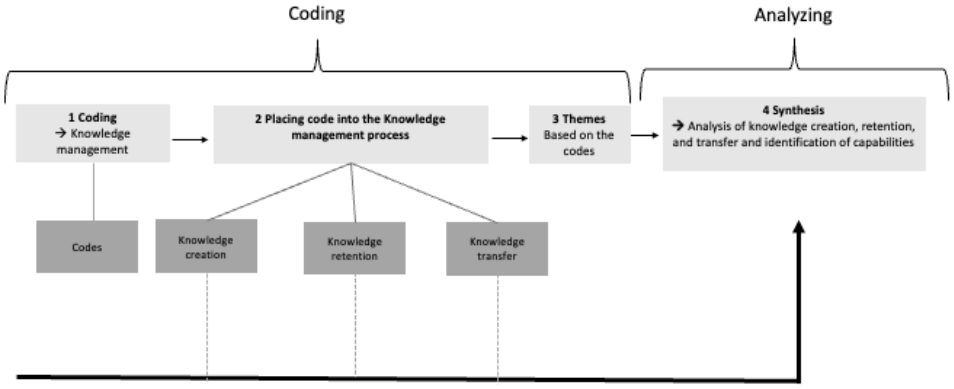


Figure 2: Coding

4. Results

Referring to the codes, table 3 illustrates an overview of the emerging themes connected to the KM process.

Table 3: Themes

	Themes
Knowledge creation	Structure Technology Interaction
Knowledge retention	Shared understanding Transactive memory Technology
Knowledge transfer	Structure Internal and external factors Explicit knowledge

4.1 Knowledge Creation

This section explores how knowledge creation has been managed and identifies needed knowledge when collaborating virtually.

Structure

Studies report how structural changes have been made to enable KM, e.g., implementing a new organizational structure to improve collaboration during the pandemic (Chakrabarti & Mukherjee 2022) or knowledge-sharing platforms to ensure knowledge exchange (Abualqumboz 2022). Regarding intra-organizational structure, research proposes alignment of policies and practices (Harvey, Novicevic & Garrison 2004; Bosch-Sijtsema et al. 2011). Bookhamer and Zhang (2016) argue that IT capabilities must be incorporated strategically to secure KM across distances. Hence, structure and facilitation of virtual collaboration through digital platforms (thinkLets) might be a way to enhance knowledge sharing (Horwitz & Santillan 2012). These studies demonstrate that structures must be established to enable knowledge creation, which needs to be reflected in the organizational structure, policies, and practices.

Technology

As a part of facilitating structure when collaborating virtually, technological tools must be available. Bosch-Sijtsema et al. (2011) found that a lack of communication tools challenged information sharing. However, it is important to consider the technology design (Akoumianakis 2009) and facilitation of knowledge-sharing activities through collaboration tolls (Horwitz & Santillan 2012). Hence, employees need knowledge and experience with technological tools to use them (Thomas & Bostrom 2010), highlighting the need for different skills and realigning employees' skills (MacDuffie 2007; Pass & Ridgway 2022), e.g., technical skills (MacDuffie 2007; Pass & Ridgway 2022). Based on these studies, technology tools and realignment of skills are important in enabling knowledge creation when working virtually.

Interaction and communication

Creating knowledge and shared experiences through heterogeneous backgrounds (Qureshi et al. 2018) depends on how organizations find new ways of communication and organizational abilities (Rezazadeh & Molaei 2018), as traditional social mechanisms do not facilitate communication (Demirel 2020), resulting in communication being challenged (Zeuge et al. 2023). Exemplifying this, joint online breaks during the pandemic were found to be important, strengthening information sharing or creation of informal exchange activities (Zeuge et al. 2023). Arguing that spontaneous communication does not happen naturally when working virtually, it must be concerted action (MacDuffie 2007). Researchers claim that communicating virtually might decrease information sharing (Demirel 2020) and employees' ability to engage in issues (Knoll, Feldt & Zacher 2022). However, leaders also play an important role in minimizing distance through technology and encouraging information flow (Contreras, Baykal & Abid 2020). The frequency of social virtual interactions effectively increases knowledge sharing (Qureshi et al. 2018), which is supported by Gratton & Erickson (2007), proposing that structures and routines of interaction are supported through a "gift" culture enabling collaborative behavior where interaction is seen as a valuable gift.

4.1.1 Capabilities for knowledge creation

Overall, these studies propose managing knowledge creation through (1) generating structures in the organization that facilitate collaboration and are supported by policies and strategies, (2) Supporting structures through technological tools and realigning employees' skills. (3) Interaction, facilitated through joint action and frequent social virtual interaction. Enhancing capabilities for knowledge creation is, therefore, dependent on structures and technology facilitating interaction. However, these studies do not elaborate on how experiences are generated in practices and how experiences are applied in the interaction between employees, which is also a part of knowledge creation.

4.2 Knowledge Retention

This section focuses on both explicit and tacit retention of knowledge. Explicit knowledge can transmit through language, and tacit knowledge is often context-specific and unconscious know-how (POLANYI 1962; Nonaka & Takeuchi 1995).

Shared understanding

Multiple locations in virtual collaboration might affect unwritten norms and assumptions that guide behavior, as some knowledge is stored in the physical context (Assudani 2009). Researchers propose that mobility negatively impacts shared codes, values, common, and collective knowledge (Griffith, Sawyer & Neale 2003; Ali-Hassan, Nevo & Nevo 2010). A study about situated knowledge, which is "*knowledge embedded in the work practices of a particular organizational site*" (Sole & Edmondson 2002:20), found that remotely situated knowledge was harder to recognize than locally situated knowledge, both because norms of participation are different, and the physical context is different. Similarly, Demirel (2020) argues that virtual communication struggles with delivering social and contextual information about tasks. MacDuffie (2007) highlights that shared understanding is especially important in distributed work with interdependent tasks, requiring both receiving consistent knowledge, and organizational members having a common language, common ground, and shared reference frame when facing problems. Often, shared understanding can be challenged in distributed work (Al-Habaibeh et al. 2021), and there might also be a less shared understanding of tasks (Griffith, Sawyer & Neale 2003; Gifford 2022). More studies propose temporary stay in another location, either to get insight into other locations' situated knowledge in dispensed teams (Sole & Edmondson 2002) or as a way to transfer norms and practices (Choudhury 2020)(see 4.3). Similarly, Kauppila et al. (2012) propose that physical meetings are necessary to acquire a shared understanding, enabling the internalization of knowledge. These studies highlight how contextual knowledge and shared understandings are important but challenging to retain when working virtually.

Transactive memory

Transactive memory is a shared system for organizing, storing, and retrieving knowledge (Griffith et al. 2003), which is important for knowledge retention when working across distances (Sole & Edmondson 2002). However, more studies point out that the development of transactive memory can be challenged (Griffith et al. 2003; MacDuffie 2007; Assudani 2009). Griffith et al. (2003) propose that high levels of virtuality have a negative impact on the development of transactive memory. Similarly, Macduffie (2007) argues that familiarity from frequent interactions makes it easier for colocated employees to develop transactive memory than virtual teams. Nevertheless, familiarity between organizational members (Assudani 2009) or a high level of communication and interaction (Al-Habaibeh et al. 2021) can increase the development of transactive memory. An example of a low transactive memory was found in cases where work processes were not stored or shared, which resulted in double work (Bosch-Sijtsema et al. 2011; Zeuge et al. 2023). However, Griffith et al. (2003) propose that the level of transactive memory is connected to the level of technological and organizational systems that support transactive memory development, e.g., an intranet portal (Kauppila 2012). Furthermore, Jackowska & Lauring (2021) found that physical distance and lack of information about organizational colleagues contributed to a negative perception of employees' location and knowledge utilization (Jackowska & Lauring 2021). These studies demonstrate that transactive memory is important but might be challenged when collaborating virtually, highlighting a need for frequent interactions and technology.

Technology

Internet or intranet is an important communication technology in the retention process, creating the possibility for teams to archive information, e.g., monitoring processes of projects (Demirel 2020). However, the use of technology will be affected by the group's social adaption of technology into working styles and routines (Demirel 2020). Corso et al. (2009) found that the use of the intranet has changed from being a top-down channel to a place where employees can find the needed information to learn and interact with others, which is in line with the demands for technology in the retention of knowledge. When collective knowledge is formed in virtual teams, it is more assessable (Griffith et al. 2003). Using technology to communicate and developing norms for knowledge retention through communication channels will develop the possibility of transferring knowledge (Al-Habaibeh et al. 2021).

4.2.1 Capabilities for knowledge retention

Overall, the studies demonstrate the retention process of tacit and explicit knowledge when collaborating virtually. An efficient retention process in virtual collaboration involves (1) Shared understandings and contextually anchored tacit knowledge, which is challenged and, therefore, requires temporary stays in the physical location. (2) An efficient transactive memory enabled by frequent interactions, technology, and familiarity with organizational members. (3) Technology that supports transactive memory and communication. Thus, studies highlight the importance of developing tacit and explicit knowledge retention capabilities but

acknowledge challenges with retaining tacit knowledge when collaborating across distances. Propositions of physical relocation to enable shared understandings might be costly for organizations in the future, and therefore retention of tacit knowledge might be a hindering factor when enhancing the capabilities of knowledge management.

4.3 Knowledge Transfer

Transferring knowledge can be between different organizations (inter-organizational) and within the same organization (intra-organizational). The following studies demonstrate examples of both processes.

Structure

Structural changes within an organization might be needed to enable knowledge transfer when working across distances. A proposition of intra-organizational knowledge transfer is moving employees from the place of knowledge creation to where knowledge needs to be transferred (Choudhury 2020). Moving employees physically would also allow tacit knowledge transfer (Choudhury 2020). Another study demonstrated establishment of virtual teams with expert knowledge – "knowledge activists" facilitating internal knowledge transfer and knowledge sharing in the organization (Kauppila 2012), or "knowledge pools" organized around skills (Baker et al. 1997). Haas (2006) investigated knowledge transfer by employing locals and cosmopolitans (employees with knowledge from different countries) (Haas 2006), assuming that cosmopolitans contributed with technical knowledge and locals contributed with national knowledge (Haas 2006). These findings demonstrate examples of structures increasing capabilities for intra-organizational knowledge transfer.

Internal and external factors

Internal factors can impact the level of knowledge transfer, e.g., when knowledge that is visible and shared, is used and acquired by others (Kauppila 2012), which is considered a motivational factor for knowledge transfer. Similarly, the level of absorptive capacity, defined as the organizational and internal capacity of employees to recognize new knowledge and integrate it, was increased by the level of communication (Rehman, Khawaja & Ali 2019). However, a high level of workload decreased knowledge transfer (Bosch-Sijtsema et al. 2011).

Transferring knowledge inter-organizational can be established through networks (Sabah & Cook-Craig 2010; Caldas & Cândido 2013). Hence, there is a risk that the motivation for sharing and transferring inter-organizational knowledge is limited due to incentives. A study found that an inter-organizational network did not transfer and share information with other participants because they were holding proprietary information and seeking individual benefits rather than collective advantage (Caldas & Cândido 2013). This shows that external and internal factors impact knowledge transfer.

Explicit knowledge transfer

More researchers underline that knowledge transferred through technology is more likely to be explicit, as the transfer of tacit knowledge is challenging (Griffith et al. 2003; Kauppila 2012; Al-Habaibeh et al. 2021). Virtual teams will therefore try to transform implicit knowledge into explicit knowledge (Griffith et al. 2003), but deep tacit knowledge will be hard to transfer (Kauppila 2012). However, according to Demirel (2020), knowledge transfer in virtual teams highly depends on common values, shared understandings, and trust, where the efficiency of knowledge sharing is affected by tacit factors, e.g., organizational trust (Cheng et al. 2022). This is supported further by Al-Habaibeh et al. (2021), arguing that a high level of common ground will make it easier to transfer knowledge and lead to learning. In accordance with the retention of tacit knowledge, these findings indicate that virtual knowledge transfer is more likely to be explicit knowledge, and implicit knowledge must be translated into explicit forms (Griffith et al. 2003; Kauppila 2012; Al-Habaibeh et al. 2021). As implicit knowledge does not have an inherent structure, makes it impossible to write down, requiring multiple interactions, which technology must provide (Baker et al. 1997) However, deep tacit knowledge might still be impossible to transfer into a usable explicit form (Kauppila 2012). These studies propose that enabling structure and considering internal and external factors might increase knowledge transfer in explicit form, but deep tacit knowledge might still be challenged, and therefore be considered as a hindering factor.

4.3.1 Capabilities for knowledge transfer

Overall these studies demonstrate how to manage the knowledge transfer process in virtual collaboration through (1) Establishing structures that facilitate inter-organizational knowledge transfer, e.g., through virtual teams with the purpose of internal transfer of knowledge, (2) Managing internal and external factors which can increase or decrease motivation and time for knowledge transfer (3) Virtual transfer of knowledge will be

explicit, but enabled through tacit factors. Similarly, as challenges with retention of tacit knowledge, these studies highlight challenges with transferring deep tacit knowledge, even though this is considered as an enabling factor for knowledge transfer. Enhancing capabilities for knowledge transfer through these factors might enable explicit knowledge transfer and implicit knowledge that can be translated into explicit form. Hence, transferring deep tacit knowledge is still challenged, assumed to be a hindrance that starts with the retention of tacit knowledge.

5. Discussion and Conclusion

The purpose of this study was to investigate KM when collaborating virtually in knowledge-intensive organizations, exploring the required capabilities for KM. Based on a systematic review of 33 articles, we investigated the enabling and hindering organizational factors in the processes of knowledge creation, retention, and transfer, forming the capabilities for KM.

The findings demonstrate that *knowledge creation* is facilitated through structures that enable interaction and collaboration through technology (e.g. Chakrabarti & Mukherjee 2022). *Retention* of explicit knowledge is established through transactive memory, enabled by interactions, and supported by technology (e.g. Al-Habaibeh et al. 2021). *Retention* of tacit knowledge is challenged, suggesting temporary employee stays (e.g. Sole & Edmondson 2002). Similarly to knowledge creation, intra-organizational knowledge transfer is generated through organizational structures (Kauppila 2012). Hence, transferring intra and inter-organizational knowledge can be affected by internal and external factors, determinizing motivation (e.g. Caldas & Cândido 2013). Transferring knowledge virtually might be explicit (Griffith et al. 2003), as it is challenging to transfer deep tacit knowledge (Kauppila 2012) even though tacit knowledge enables knowledge transfer (Demirel 2020; Al-Habaibeh et al. 2021).

Based on the findings, capabilities for KM in virtual collaboration are enhanced through organizational structures reflecting the needs of virtual KM, frequent interactions, and technology that supports routines for communication and the creation of transactive memory. As organizational structure appears as a central capability, this finding supports that the organizational context affects the KM process (Argote et al. 2012). However, an unsolved challenge and major hindrance is the retention of tacit knowledge and transfer of tacit knowledge without relocating employees. However, tacit factors enable the retention and transfer of knowledge (Demirel 2020), making this a crucial hindrance that might affect the KM process significantly and hinder the enabling factors. This highlights the importance of future research investigating the retention and transfer of tacit knowledge when collaborating virtually. Similarly, this challenge emphasizes research to sheer light on hybrid work – working partly at the office and partly virtual, where partly colocation is an integrated part of the work structure. Therefore, a limitation of this study is limited hits concerning virtual collaboration through hybrid work. Another limitation is the fast-developing technological tools, which makes some of the included articles outdated in relation to technological abilities.

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Autonomy and Knowledge Processes: A Systematic Literature Review

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Abstract: Knowledge processes, such as knowledge creation, sharing and application, enable knowledge production that increases innovation and superior organizational performance. Knowledge processes are ultimately and fundamentally conducted – or not engaged in – by the individuals. Hence, knowledge production is disrupted if individuals are prevented from using their knowledge production potential. One potential factor that causes disruption in knowledge production is the lack of autonomy. As autonomy means self-governance and independency, it enables independent and unique knowledge processing by the individual, and thereby supports both individual and collective level knowledge production. Despite the importance of the role of autonomy in knowledge production, there is no research-based knowledge of which knowledge process have been studied from the perspective of autonomy, and what has been left unexplored. This research clarifies the research literature by finding out which knowledge processes have been studied from the point of view of autonomy. Also, what has been found concerning the relationship between autonomy and knowledge processes is considered. The research was conducted as a systematic literature review supplemented by qualitative content analysis in which the articles up the year 2022 from databases Scopus and Web of Science were reviewed. The most notable finding of this study is the lack of research between autonomy and knowledge identification and the paucity of research between autonomy and knowledge internalization. This is a significant finding since knowledge identification affect what knowledge is processed and produced in the organization. Internalizations in turn affects knowledge-based orientation and knowledge production in the organizational environment. This paper contributes to the organizational research literature by summing up the existing research on the interface of autonomy and knowledge processes and provides a refined understanding on the central role of autonomy in the effective implementation of knowledge processes, as well as avenues for future research.

Keywords: Knowledge processes, Knowledge production, Autonomy

1. Background

Knowledge is critical resource in the organizational context (e.g., Barney, 1986; Grant 1996). Organizations need explicit and tacit knowledge to guide daily operations and goal-oriented activities. Especially, success in the knowledge-intensive business depends on the organization's ability to acquire knowledge, create knowledge, and utilize knowledge. Due to importance of knowledge, each individual's tacit and explicit knowledge and knowledge-related activity which promotes production of new knowledge is needed. Individuals must not only create individualistic knowledge but also strengthen the collectivistic knowledge.

In practice, knowledge production takes place through knowledge processes. One well-known categorization of knowledge processes has been done by Heisig (2009), in which the most well-known processes are identifying, acquiring, sharing, creating, utilizing, storing knowledge. Accordingly, in this study, knowledge processes are defined as knowledge-related activities by which individuals and collectives handle and produce knowledge. However, knowledge processes as such are not enough since successful knowledge management is also influenced by contextual factors (Heisig, 2009). Autonomy has been seen as an important contextual factor for example in the SECI-model (Nonaka, Toyama & Konno, 2000).

Autonomy refers to self-governance or independency (Kühler & Jelinek, 2012). Thus, it is related to the independent and voluntary action of the individual and the community. In this study autonomy is defined as an individual´s independence and self-governance and as an ability to act autonomously. In the organizational context, autonomy can be manifested in the freedom, independence and discretion given to the individuals to conduct their own work (Hackman & Oldham, 1976). Furthermore, autonomy as one of the needs of the individual mediates the impact between job design factors and motivation and is likely to increase intrinsic motivation and improve performance at work (Deci, Olafsen & Ryan, 2017). Also, autonomy given to the individuals is likely to motivate individuals to produce new knowledge (Nonaka, Toyama & Konno, 2000).

The importance of autonomy for knowledge production is that it enables independent and unique knowledge processing by the individual, and thereby enriches individualistic and collectivistic knowledge production in the organizational context. Like Huang, Hsieh and He (2014) have noted, to come up with novel and creative ideas, the individual must be able to link and make use of ideas and viewpoints from various sources to expand the

scope of knowledge. This expansion of the knowledge scope happens through various knowledge processes. If the individual is unable or not allowed to conduct knowledge processes sufficiently autonomously, the unique potential of the individual for knowledge production remains unused. The production of knowledge requires active and goal-oriented management of multiple knowledge processes, in a way which enable autonomy.

Despite the widely recognized significance of autonomy in knowledge production, there is no research-based knowledge of which knowledge process have been studied from the perspective of autonomy. And more importantly, what has been left unexplored. This is a significant research gap since knowledge production is based on knowledge process and autonomy enriches individual and collective knowledge resources. The aim of this research is to conduct a systematic literature research and clarify which knowledge processes have been studied from the point of view of autonomy. The research question is: What knowledge process have been studied from the perspective of autonomy? Also, what has been found concerning the relationship between autonomy and knowledge processes is considered. Furthermore, the need for further research is discussed.

2. Method

The research was conducted as a systematic literature review supplemented by qualitative content analysis in which the articles from years 1978-2022 from databases Scopus and Web of Science were reviewed. The phases of the literature search and content analysis were the following: 1) Defining the database to be used for retrieving the research data, 2) Defining the literature search string (Table 1). Wildcards asterisk (*) were used to expand the search (e.g., shar* to find share and sharing), 3) Determining further inclusion and exclusion criteria – empirical research, article written in English and journal articles were included. Articles concerning non-human autonomy and review-articles were excluded, 4) Article search from Scopus – search found 1419 articles, 5) Selection of articles by title – 253 articles were selected, 6) Selection of articles based on the abstract – 116 articles were selected, 7) Selection of articles based on the full text – 75 articles were selected, 8) Article search from Web of Science – 624 articles were found, 9) Removal of articles already selected in the Scopus search and selection of articles by title – 22 articles were selected, 10) Selection of articles based on the abstract – 5 articles were selected, 11) Selection of articles based on the full text – 3 articles were selected, 12) Qualitative content analysis. In the content analysis, it was extracted from each article which knowledge process has been studied in the research and what has been found concerning the relationship between autonomy and knowledge processes.

Table 1: Literature Search String

Literature search string.
TITLE-ABS-KEY (("Knowledge management" OR "knowledge process*" OR "knowledge shar*" OR "knowledge transfer*" OR "knowledge creati*" OR "knowledge us*" OR "knowledge utili*" OR "knowledge appli*" OR "knowledge identify*" OR "knowledge acqui*" OR "knowledge explo*" OR "knowledge stor*") AND ("autonom*" OR "independen*")). Search was limited to subject categories Business, management and accounting, social sciences and psychology which were considered to cover comprehensively the studies related to the topic.

3. Findings

A total of 78 articles were selected for the content analysis, of which the oldest was from year 2000. The number of studies of each knowledge process is shown in Figure 1. Derived from the content analysis this research has five major findings. *First*, the research on knowledge processes from the perspective of autonomy has been dominated by knowledge sharing (63%) and knowledge creation (18%). For example, studies have found a positive connection between job autonomy (i.e., extent to which employees can decide and control work programs, methods and schedules) and intention to share knowledge (Wu et al., 2022) and engagement in knowledge sharing (Cabrera, Collins & Salgado, 2006). However, Wu et al. (2022) didn't find moderating effect of job autonomy on the connection between attitude toward knowledge sharing and knowledge sharing intention. They suggested that job autonomy may reflect negatively on the intention to share knowledge if the individual experiences excessive social pressure to share knowledge. Correspondingly, Buch et al. (2015) have suggested that in a situation where the individual needs support from a supervisor but experiences a lack of it, high job autonomy may have a negative effect on knowledge sharing. In addition, it has been found that autonomous motivation (identified and intrinsic motivation) is positively related to knowledge sharing intention (Hon, Fung & Senbeto, 2022) and that the more autonomy the job provides, the more the employee will be autonomously motivated to share knowledge (Foss et al., 2015).

In the research addressing knowledge creation, for example, Lloria (2007) and Lloria and Peris-Ortiz (2015) have verified a positive connection between autonomy (freedom to absorb, create, transfer, apply knowledge) and knowledge creation. However, in a study by Song, Uhm and Kim (2012) job autonomy didn't have a moderating effect between creativity and knowledge creation practices. They concluded that task-related support could encourage creative thinking and knowledge creation practices in the organization. Results indicate that autonomy has positive effects on knowledge sharing and knowledge creation but this may require sufficient task-related support from the organization.

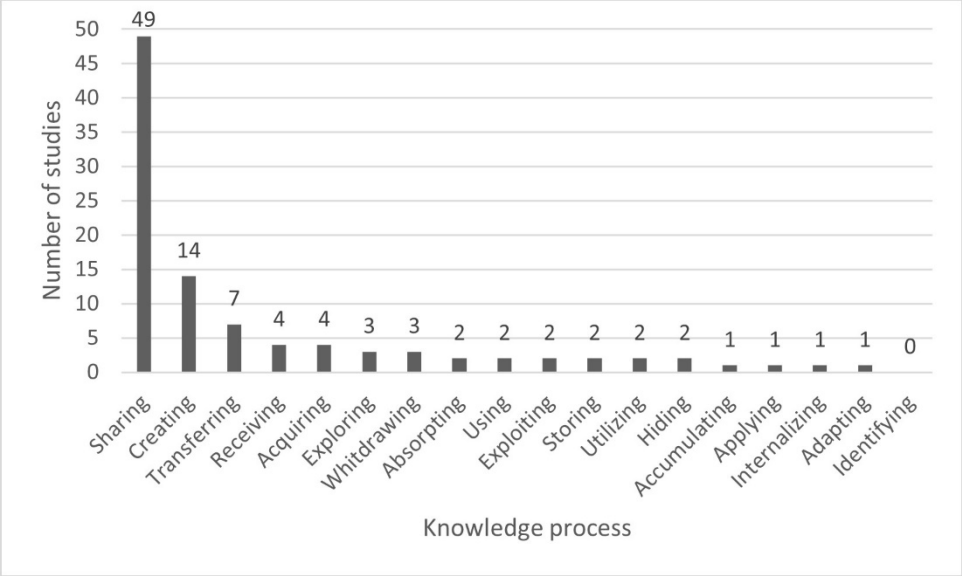


Figure 1: Knowledge Processes and the Number of Studies

Second. Systematic literature search did not find any research concerning knowledge identification. This is a stunning finding when noticing the role of knowledge identification in knowledge production. In the research literature knowledge identification has been connected to knowledge search, finding knowledge and knowledge value assessment (Ortiz, Donate & Guadamillas, 2018). Thus, it relates to the awareness of what and where knowledge is available and what is its relevance to business operations (Wang 2001). Knowledge identification has also been seen as a previous step in the knowledge acquisition and absorption process (Ortiz, Donate & Guadamillas, 2018). The importance of knowledge acquisition and absorption has been demonstrated in the articles considered in the content analysis. For example, Oh and Lee (2022) have defined knowledge acquisition as a process in which individuals in the organization actively explore and retain tacit and explicit knowledge. The point is that as knowledge identification precedes knowledge acquisition and knowledge absorption (i.e., what knowledge is acquired and absorbed) it may have significant role in knowledge production. Consequently, organizations could benefit from the capability to utilize the ability of autonomously thinking individuals to identify different kind of knowledge from different kind of sources, which may contribute to the production of valuable knowledge.

Third. One study has considered knowledge internalization. In that research, Ho et al. (2014) studied how autonomy is related to knowledge management circulation process (creation, accumulation, sharing, utilization, internalization) and its effect on performance at work. They linked internalization to the individual's ability to produce new knowledge through previously obtained knowledge. Contrary to their hypothesis they found that autonomy does not significantly affect knowledge circulation process. Since the knowledge-based orientation of individuals is at least partially based on knowledge stored in memory (e.g., Klein, 2013), the scant study of internalization is surprising.

Fourth. Eight percent of the reviewed articles have concentrated on knowledge process which may hinder knowledge production (i.e., knowledge withholding, knowledge hiding, dysfunctional knowledge sharing). Knowledge withholding means that the individual does not make a full contribution to the production of knowledge (Pan & Zhang, 2018) and knowledge hiding has been linked to an attempt to withhold or conceal knowledge (Gagne et al., 2019). Thus, both of these activities may lead to the loss of knowledge possessed by the individual. Dysfunctional knowledge sharing may take a form of sharing knowledge that is harmful to the organization or appear as an activity in which useless knowledge is masked as useful (Cockrell, Stone & Wier,

2018). Sharing useless knowledge may distort the joint production of knowledge in the organization, whereas sharing harmful knowledge may otherwise impede organizational success. Contrary to their expectations, Pan and Zhang (2018) found a positive connection between job autonomy and knowledge withholding. On the other hand, Stenius et al. (2016) have found a negative association between autonomous motivation and knowledge withholding. Furthermore, Cockrell, Stone and Wier (2018) have found that autonomous motivation is associated with less dysfunctional knowledge sharing. It could be concluded that whereas job autonomy may be related to knowledge withholding autonomous motivation is not. However, Gagne et al. (2019) couldn't verify their hypothesis that autonomous motivation is negatively related to knowledge hiding.

Fifth. Before the year 2011, research has focused almost exclusively on knowledge sharing and knowledge creation. During the last 10 years, the research between autonomy and knowledge processes has increased and diversified. However, systematic and continuous growth concerns only knowledge sharing (Figure 2).

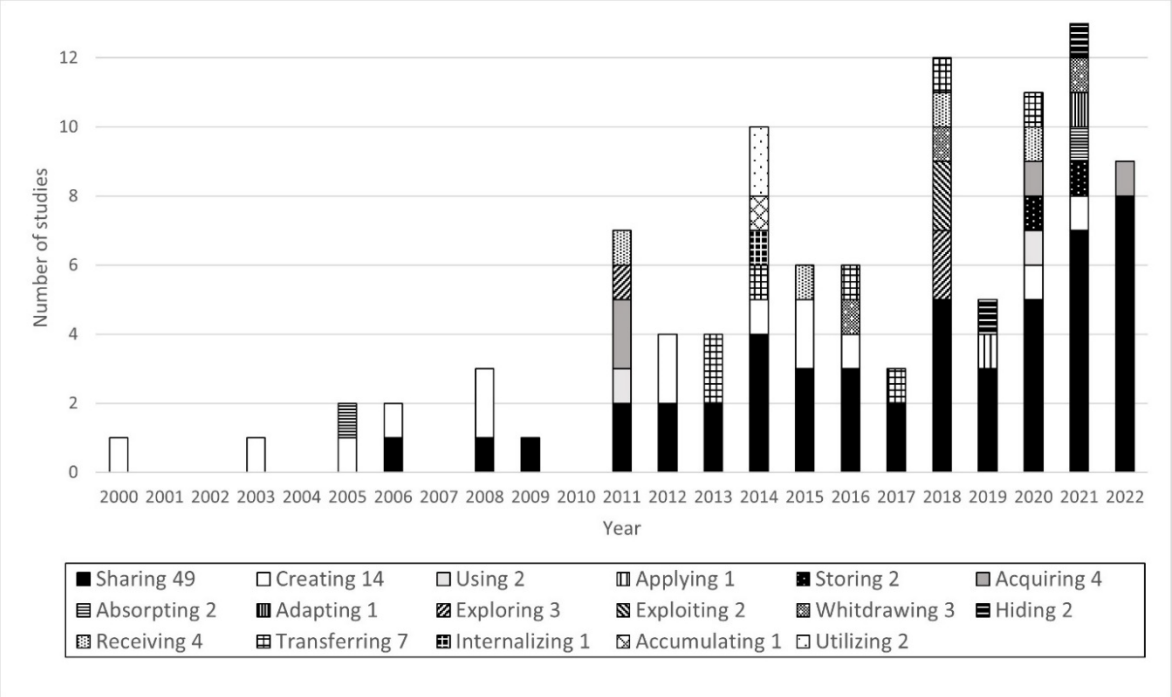


Figure 2: Relative Numbers of Studies Connecting Autonomy and Knowledge Processes in the Years 2000-2022

4. Discussion and Conclusion

A systematic literature review was conducted to clarify which knowledge processes have been studied from the point of view of autonomy. Also, what has been found concerning the relationship between autonomy and knowledge processes was considered. The premise for the research was the importance of knowledge processes in knowledge production and the role of autonomy in enabling the independent and unique knowledge processing by the individuals which supports individualistic and collectivistic knowledge production. This study demonstrated the coverage of knowledge processes in knowledge process-autonomy research and brought out research avenues to promote the utilization of the knowledge potential of the individuals in the organizational context. The key findings of the study are discussed in the following.

4.1 Knowledge Processes In Knowledge Process-Autonomy Research

Knowledge processes-autonomy-research has focused on knowledge sharing and knowledge creation. Particularly, knowledge sharing has been the most popular research subject. This is not surprising, since knowledge sharing is a natural way of learning between individuals, increasing individualistic and collectivistic knowledge and creating shared understanding among the individuals. This is clearly demonstrated in SECI-model (Nonaka, Toyama & Konno, 2000). Research results indicate that autonomy has predominantly positive effects on knowledge sharing and knowledge creation, but this connection is not unambiguous in all circumstances. For example, research has shown that job autonomy is related to engagement to share knowledge (e.g., Cabrera, Collins & Salgado, 2006) and that autonomous motivation is positively related to knowledge sharing (e.g., Hon, Fung & Senbeto, 2022). However, job autonomy may reflect negatively on knowledge sharing in a situation

where the individual experiences social pressure to share knowledge (Wu et al., 2022) or in a situation where the individual does not receive sufficient support from a supervisor and autonomy is perceived as excessive (Buch et al., 2015).

Systematic literature search did not find any research concerning autonomy and knowledge identification. This is notable as knowledge identification has a central role in knowledge production. For example, Wang et al. (2001) have noted that an effective knowledge management requires that organizations understand what and where knowledge is available and how it can be achieved and whatever it fits with business operations. Furthermore, Ortiz, Donate and Guadamillas (2018) have seen that knowledge acquisition is more effective in organizations which have high levels of knowledge identification capability and that organizations should develop identification capabilities especially when competing in dynamic environment. As autonomy at work enables independent and unique thinking and acting it may expand the possibility to identify different kind of knowledge from different sources. Organizations may benefit of the capability to detect and identify strong and weak signals of knowledge which either supports or refines existing knowledge or may be new source of knowledge creation.

Only one research has concerned knowledge internalization. In that research Ho et al. (2014) measured knowledge internalization as a part of knowledge circulation process. Contrary to their hypothesis autonomy didn't have significant impact on knowledge circulation process. Clearly this important topic has not been sufficiently studied. It is known that the knowledge stored in the memory of the individuals affects the orientation to the future and aids to anticipate events and to decide which actions to take (e.g., Klein, 2013). It also promotes the acquisition of new knowledge (Grant, 1996). Furthermore, as knowledge becomes internalized as part of individuals tacit knowledge base in the form of mental model it becomes a valuable part of an individual's knowledge assets and an essential part of collective knowledge creation (Nonaka, Toyama & Konno, 2000). Consequently, in the organizational context it matters what knowledge becomes internalized, as internalizations reflect on knowledge-related orientation and knowledge production. The point is that individuals in the organizations must internalize business-relevant knowledge and act accordingly. In other case, the knowledge production of autonomously acting individuals would be inappropriate or inconsistent in relation to the organizational goals.

Considerably less attention has been paid to knowledge processes which have a detrimental effect on knowledge production, e.g., knowledge withholding and hiding. As knowledge withholding means that the individual does not participate to the knowledge production (Pan & Zhang, 2018), it leads to the loss of tacit knowledge of the individual. Contrary to their expectations, Pan and Zhang (2018) found that job autonomy is positively related to knowledge withholding. Also, Gagne et al. (2019) didn't find a negative connection between autonomous motivation and knowledge hiding or that job autonomy is indirectly negatively related to knowledge hiding through its effect on autonomous motivation. On the contrary, Foss et al. (2014) have found the positive connection between job autonomy and intrinsic motivation to share knowledge. Pan and Zhang (2018) proposed that the unexpected positive relationship between job autonomy and knowledge withholding might be explained by the motivation–opportunity–ability framework or with factors related to power structure, since employees with high job autonomy may keep critical knowledge because of fear of losing power.

On the whole, research between autonomy and knowledge processes has increased and diversified during the last ten years. One explanation for the phenomenon may be the growing importance of knowledge in modern working life in general. Furthermore, modern working life requires that the individuals are more self-directed than before. Together, these developmental trends have led to an increased need to understand how autonomous individuals contribute to the knowledge production. However, there has been systematic and continuous growth mostly only in research on knowledge sharing. Otherwise, research on knowledge processes and autonomy has developed relatively slowly despite its importance.

4.2 Future Research Streams

In general, future research on autonomy and knowledge processes could focus more broadly on different types of knowledge processes. Particularly, it is important to focus on how the autonomous individuals identify different kind of knowledge since it influences what knowledge is acquired, absorbed, created, shared, internalized, used and utilized in the organization. Secondly, more knowledge about the knowledge internalizations is needed as it affects how the autonomous individuals think, act, utilize and produce new knowledge in the organization. As pointed out above internalization is a prerequisite for efficient action. Thirdly, there is some unexpected research results regarding the connection between autonomy and knowledge sharing or knowledge withholding which requires further research. The research should find out why the individual may

experience autonomy or social pressure to share knowledge as excessive or engage in knowledge withdrawal. Fourthly, it was noted that in knowledge processes research autonomy has been studied using various concepts (e.g., autonomy, job autonomy, autonomous motivation) which reflects the multidimensionality of the concept of autonomy. Understanding the various facets of autonomy in autonomy-knowledge processes research is needed.

4.3 Limitations

The systematic literature review was conducted by one person, which gives room for subjective decision-making in the selection of articles. Other author could have reached different results. The impact of subjectivity was minimized by establishing precise inclusion and exclusion criteria and guidelines for the content analysis. However, some relevant articles may have remained unnoted.

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Digital Chain of Custody for a Blue Circular Economy

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Abstract: Discarded fishing equipment and other fishing waste are thought to account for 27% of all ocean litter. To achieve a sustainable circular blue economy, working closely with all stakeholders to eliminate waste and preserve marine ecosystems is crucial. By integrating data, technology, and waste reduction into business processes, businesses can adopt more sustainable practices and reduce the impact of plastic pollution in the ocean. This paper promotes circularity and recyclability through a blue circular economy approach. The primary objective is to establish a digital chain of custody that traces the transformation of marine debris from fishing operations into secondary raw materials. A case study is presented, highlighting the active involvement of fishermen in the recycling process. The paper introduces a framework for evaluating organisational collaboration in adopting circular economy strategies and incorporating knowledge into their business processes. The solution encompasses a data governance approach and a digital chain of custody, facilitating stakeholder collaboration towards a shared objective.

Keywords: Data governance, KPI, Blue circular economy, Digital chain of custody, Social awareness

1. Introduction

Marine plastic pollution (MPP) poses significant environmental and socio-economic challenges, impacting the marine ecosystem and posing risks to biodiversity, food security, and human health (Barboza et al., 2019). In response to this issue, the European Union (EU) has committed to adopting a sustainable blue circular economy approach that addresses the recyclability of plastics and lost or abandoned fishing gear, thus tackling marine litter (COM240, 2021; Brink et al., 2018). This commitment has led to implementing measures to mitigate the cumulative impact of MPP, including visible pollution like plastic litter and invisible pollution such as microplastics.

The EU emphasises the importance of engaging stakeholders in waste prevention and preserving marine ecosystems to establish a sustainable blue circular economy. By promoting collaboration and implementing strategic actions, the EU strives to reduce the adverse effects of MPP and work towards a cleaner and more sustainable marine environment. An example of such an initiative is the Single-Use Plastics Directive[1], which specifically targets single-use plastic products and fishing gear that currently contribute to 70% of marine litter in the EU (EIA2022).

The circular economy (CE) paradigm provides opportunities to move toward circular production models (Jonker et al., 2022). These models facilitate the transformation of value chain activities, creating new avenues for growth and maintaining competitive advantage. Manufacturers can devise eco-friendly initiatives by comprehending the circular relationships within the value chain. Organisations can adopt more sustainable practices by integrating data governance and waste reduction into their business processes (Awan, U., 2022).

Within the Blue Circular Post Branding Project (BCpbP) scope, this paper presents a case study conducted in Portugal, which outlines a digital chain of custody (dCoC) combined with a data governance approach. The objective is to foster social awareness regarding MPP by involving stakeholders from different areas, including fishermen, local authorities, associations, and industry. The case study scenario establishes a value chain that facilitates collaboration between fishermen and industrial partners, who incorporate the collected marine litter into new products. The case study also provides guidelines for fishermen to deposit the marine debris they encounter during fishing operations into designated ecopoints. Each ecopoint is associated with an identified collector assigned to a specific fishing community. Figure 1 shows one of these ecopoint containers equipped with a Bigbag.

[1] Directive (EU) 2019/904, the reduction of the impact of certain plastic products on the environment.



Figure 1: Example of a BCpbP Ecopoint Container

The project aligns with the EU strategy for plastics in a circular economy (ESPCE 2018), which aims to transform how plastic products are designed, produced, used and recycled in the EU.

The blue circular economy is a growing field of study, with an increasing number of scholarly activities exploring the relationship between sustainability and ocean economy growth (Martínez-Vázquez et al., 2021). Indeed, the blue economy operates as a dual-loop regenerative system, optimising environmental and economic performance (Ziegler et al., 2023). It aims to transform the marine economy into a sustainable solution by optimising resource utilisation (recycling), revalorisation, and rethinking production and consumption. This means that the blue economy encompasses commercial, research, and innovative activities (Alhawari et al., 2021). Many authors also sustain that leveraging the potential of science and innovation is crucial for ocean sustainability (Awan et al., 2020; Alcalde-Calonge et al., 2022; Heras-Saizarbitoria et al., 2023). This paper is aligned with these research findings in exploring co-creation approaches for a sustainable blue economy, fostering skills-building and interdisciplinary dialogues between industry sectors. The case study scenarios provide examples of such practices by joining concepts related to self-sustaining communities, promoting societal engagement, embracing digitalisation, harnessing ecosystem services, and fostering collaborative research.

2. Data Governance in the Circular Economy

A CE is an economic model that aims to efficiently use resources, minimise waste, retain long-term value, and operate within environmental limits. In contrast, a linear economy follows a "take-make-dispose" plan, transforming raw materials into products that eventually become waste. The circular economy offers an alternative approach, considering waste a valuable resource. It follows the principles of reducing, reusing and recycling (i.e., the 3R approach); value is created by prioritising value preservation, minimising resource use, and recycling materials to a high standard. Figure 2 illustrates the difference between circular and linear systems, highlighting the challenge of implementing circular business models.

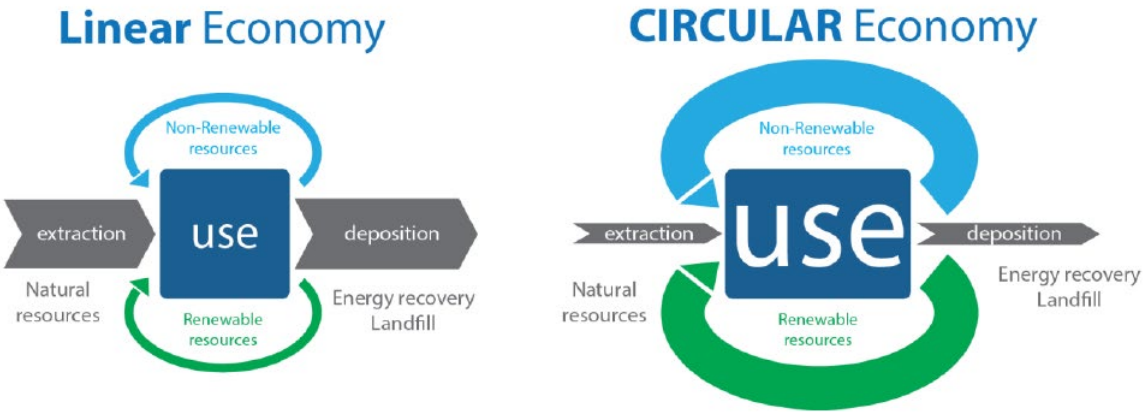


Figure 2: The Fundamental Differences Between Circular and Linear Economies (PBL, 2017)

The concept of a Blue Circular Economy is commonly applied to address marine litter, emphasising the importance of collecting and reintroducing materials like plastics and fishing gear into the economic system to promote resilience and minimise waste. In line with this, the BCpbP has developed a business process that facilitates a recycling journey, where marine litter and fishing gear are collected and transformed into valuable resources for the manufacturing industry. The following examples highlight industrial partners who are interested in being recognised as eco-friendlier producers in this context.

- Biedronka, one of the biggest supermarkets in Poland, is leading a movement to replace its shopping carts, baskets and trolleys with innovative alternatives made with 25% of plastic from fishing ghost nets. The remaining 75% comes from recycled plastic.



- ZOURI, a well-known brand in the footwear sector in Portugal, is willing to cooperate in using fishing ghost nets and recycled plastic in the production of their shoe soles



These two examples show how traditional industrial partners can contribute to circularity and reduce the carbon emissions of producing new plastic by around 20%. The social recognition of eco-friendlier companies is a differentiation factor that consumers cherish.

Tracing the data to know the origins of materials and products is an essential step, meaning that data plays a vital role in achieving traceability, supply chain transparency, and optimising production processes (Patel et al., 2020). However, sharing data among stakeholders poses challenges due to the need for a common language with standardised semantics, ontologies, and taxonomies. Additionally, since these data are primarily computed by machines, fostering interoperability of IT systems using this common language becomes essential. A digital chain of custody (dCoC) with a data governance approach is required to operationalise these goals and establish a functional ecosystem (Ladley 2019).

Sharing data throughout a value chain unlocks new insights that can enhance the efficient utilisation of resources. This knowledge brings value to companies across four dimensions: cost reduction, improved brand image, risk reduction, and increased revenue. In addition, a data governance framework for dCoC provides the structure to leverage these four dimensions, offering opportunities for brand enhancement and consumer recognition. In this approach, a data lineage culture is essential for fostering trust and ensuring transparency within a dCoC.

Within the BCpbP case study context, we will see that the Matrioskas Sequence Framework (MSF) application helps employ a circular data flow approach to expedite the development of data products that aid stakeholder decision-making. This offers a standardised methodology for measuring data cycles and provides visibility into environmental considerations.

3. Overview of the Digital Chain of Custody for the BigBag

The dCoC incorporates metadata, providing comprehensive contextual information for efficient digital management throughout the custody chain. The chain of custody is divided into two phases to ensure simplicity and readability and facilitate auditing stakeholder involvement, including the fishing community's contributions. The scope of the dCoC encompasses all resources involved in the acquisition, collection, transportation, analysis, division, and storage of the collected materials, along with contextual information and timestamp records. Data sharing between links in the dCoC is foreseen as a driving force for circular value creation and innovation in the proposed approach.

Exploring the role of technology as an enabler for implementing a standardised record of digital evidence custody is an essential aspect to consider for dynamically gaining insights into stakeholders' opinions, attitudes, and behavioural intentions. The value chain diagrams in Figures 3 and 5 offer a comprehensive overview of the process landscape for data management within the dCoC. These diagrams follow the guidelines outlined by ISO (2020). The value chain diagrams visually depict the CE business model and illustrate the interconnectedness of

processes throughout the data lifecycle. Each link in the value chain represents a series of business processes that transform input resources into value-added outputs for the following link in the dCoC. This value chain framework aids management in categorising circularity models, assigning ownership and accountability, identifying process integration and hand-off points, and ultimately defining organisational roles and responsibilities.

3.1 Scenario I: Collection and Delivery to the Central Hub

The process initiates by the local authority (e.g., Fishing Port) extending an invitation to the fishing communities to participate in the initiative. The communities are then registered into the system, and ecopoint collectors are assigned to them, as shown in Figure 3. Each ecopoint is associated with metadata that georeferences its location and monitors its fill level, which is manually observed by checking if the collectors are packed. This task is performed by each participant within the BCpbP community.

The fishing community is instructed to deposit nets, fishing gear, and other marine litter, including undifferentiated plastic, into designated collectors aboard their vessels. They are encouraged to consistently fill their assigned collectors, fostering a healthy competitive environment. Each time a complete BigBag is removed from the collector, the achievement is recorded for the respective fishing community. This indicator serves as social recognition of their dedication and active involvement in cleaning the sea of marine litter.

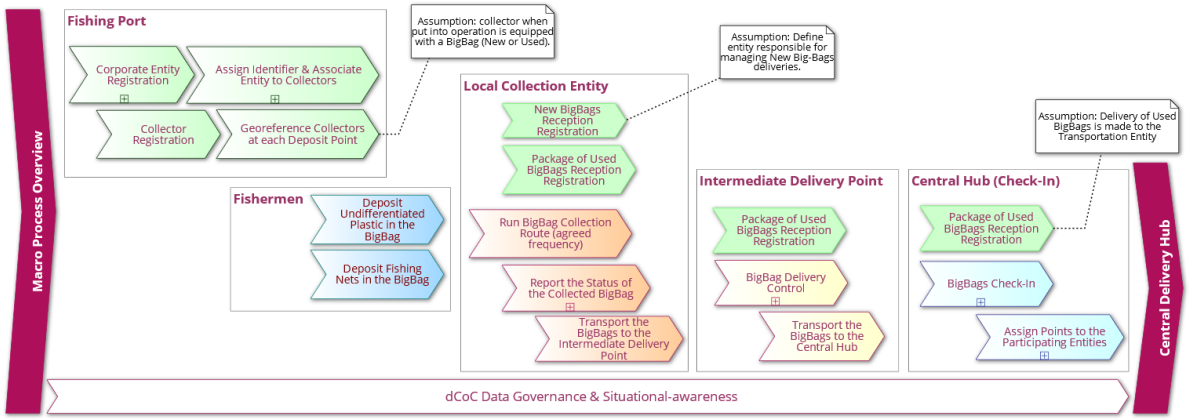


Figure 3: Phase I of the dCoC Within the BCpbP Scope

Many partnerships had to be formed to collect BigBags from each ecopoint. As a proof of concept, the local municipality, responsible for municipal waste collection, took on the responsibility of collecting the BigBags. During this process, the collector scans the QR code of both the ecopoint and the BigBag, establishing a connection between the content of the BigBag and the associated fishing community. Additionally, any damage to the BigBags must be reported, particularly if they are rendered unusable and need to be replaced. This indicator allows for monitoring the efficiency and durability of the delivered BigBags. Figure 4 shows that the BigBags are transported to an interim storage facility before being transported in bulk to a central hub for processing. The logistics carrier oversees the transportation to the central hub.

It is essential to consider the data lineage to implement a data monetisation approach based on the added value derived from tracking the custody of BigBags. The data lineage refers to the end-to-end traceability of data, documenting its origins, transformations, and movement throughout the dCoC process. Tracking the custody of BigBags generates valuable data insights regarding the stakeholders involved at each stage of the process. This data provides crucial information for implementing a sustainable circular economy business model.

In the context of the BCpbP, the data obtained from tracking the BigBags enables a gamified approach where points are assigned to relevant stakeholders, particularly the fishing communities. These data-driven insights enhance the understanding of stakeholder engagement and contribute to effectively implementing data monetisation strategies. By leveraging the data lineage and associated insights, it is possible to optimise data monetisation efforts and unlock the economic value generated by tracking and managing the custody of BigBags within the dCoC framework.



Figure 4: BigBad Deposit at the Intermediate Delivery Point

The dCoC data governance framework determines user access rights and levels of responsibility, ensuring that the same data can be shared across multiple users while maintaining data quality and data integrity. The data governance framework includes rules, processes and procedures that must be followed continuously. The main objective is to enforce and facilitate monitoring performance indicators to analyse who contributes and with what regularity and identify bottlenecks or operational constraints requiring an agile intervention.

3.2 Scenario II: Supply Chain to the Industry

In the second phase, the collected raw material is recycled and looped back into the production cycle (see Figure 5). In this phase, the BigBags circularity is managed at the Central Hub, where the marine litter are cleaned and processed to be used as secondary raw materials by manufacturers. Any CE business model has costs; therefore, its viability depends on the commercial value of the materials used in the circularity or any other financial agreement signed with funding entities. Although not covered within this paper, the market value of a BigBag packed with fishing nets or plastics is an essential data monetisation feature for BCpbP's financial sustainability. The market value of the BigBag is processed at the central hub before shipping to the production phase.

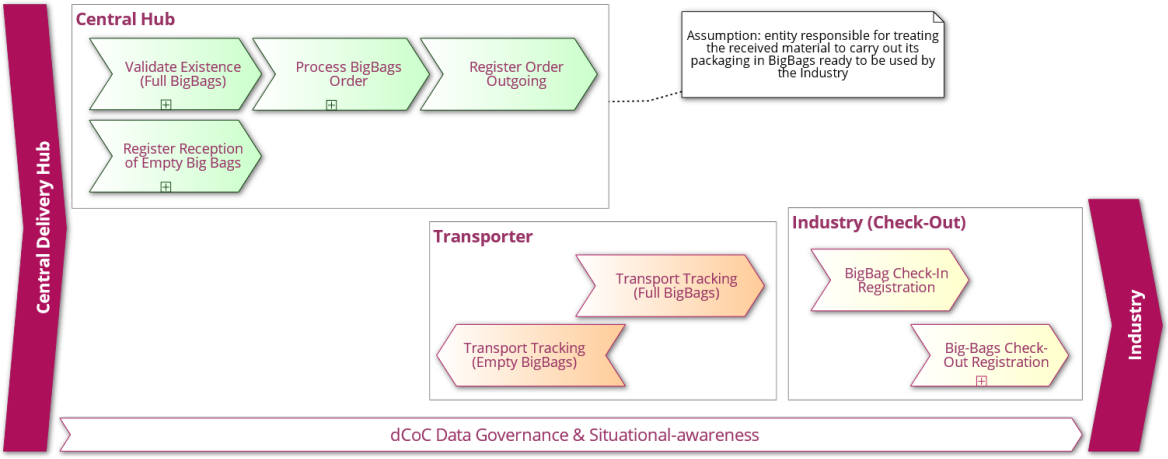


Figure 5: Phase II of the dCoC Within the BCpbP Scope

After the check-in of the received BigBags, the Industrial partner should check-out the custody of any empty BigBags. The transporter assumes the custody of those empty BigBags back to the central hub. At the central hub, available empty BigBags are put into the distribution cycle for reuse by the local collectors during their ecopoints collection circuit (see phase I in Figure 3). Within the scope of the BCpbP case study, keeping a registry of the BigBag status was considered a requirement to trace custodianship at each stage in the dCoC. A QRcode reader provided a quick solution for tracing the BigBags at each check-in and check-out, including BigBags collected by local collection entities at each ecopoint. When a BigBag is damaged, the user selects that option enabling the system to register a loss and trigger an alert when minimum stock is reached.

The two diagrams (Figure 3 and Figure 5) cover the complete circularity of the dCoC, and highlight the circular business models that typically leverage data to drive value. They provide a high-level view of the data flows between participants to standardise the data governance of the custody transfer, triggering context-awareness whenever mishandling of digital evidence is detected. The technologies rely on data exchange between actors, and data is essential for ensuring scalability and realising value from CE business models.

4. The MATSKI Framework Within the Data Governance Circularity

The proposed dCoC process establishes guidelines for adopting standard operating procedures that require data governance workflows to oversee the digital custody of BigBags. It also allows for just-in-time performance control. These data controls are based on maintaining a digital log of the participating actors in the dCoC and providing digital evidence to trace information back to its source. These data controls can also be used to find trends and correlations to plan maintenance and replacement.

The Matrioskas Sequence Framework (MSF) addresses these guidelines as it was developed as a service design framework for empirically assessing how an organisation collects, measures, learns, and integrates knowledge into its culture and operations (Pestana and Rosa,2020). As part of CE's business model, MSF is committed to developing unique differentiated expertise and market share by transforming around three pillars: Processes, Technology and People & Skills. MSF also requires a higher level of digital transformation, including the automation and dematerialisation of business processes that generate more data to track goods or new capabilities that need to be handled by decision-makers. In this regard, the following indicators have been identified to assist decision-makers in taking action.

- *Registered fishing communities (RFC)*, the total number of communities collaborating in the project
- *Fishermen in each fishing community (FFC)*, the total number of fishermen associated with each fishing community
- *Stakeholder Points (SP)*, the total points acquired by a specific actor based on the achievements accomplished within the BCpbP case study (i.e., tasks performed within the dCoC)
- *New BigBag Tagged (NBBT)*, the total of new BigBags available with an identified tag (i.e., with a QR code)
- *Lost BigBag Tagged (LBBT)*, the total of BigBags reported as damaged (i.e., out of circulation)
- *Shipped BigBag Orders (SBBO)*, the total of BigBags shipped to the production line. Possibility to drill down by type of material (i.e., the content of the BigBag)
- *Average Time at the Central Hub (ATCH)*, the average time a BigBag stands at the central hub before being shipped to an industrial partner
- *Quality of Service (QOS)*: users´(e.g.stakeholders) perceptions of the quality of service supplied
- *Customer satisfaction (CS)*: users' (e.g.stakeholders) satisfaction with the service supplied
- *Loyalty & Recommendation (LR)*: users´(e.g.stakeholders) further intent and recommendation of the service

Considering the MSF, these KPIs are placed under the Technology pillar, as shown in Figure 6.

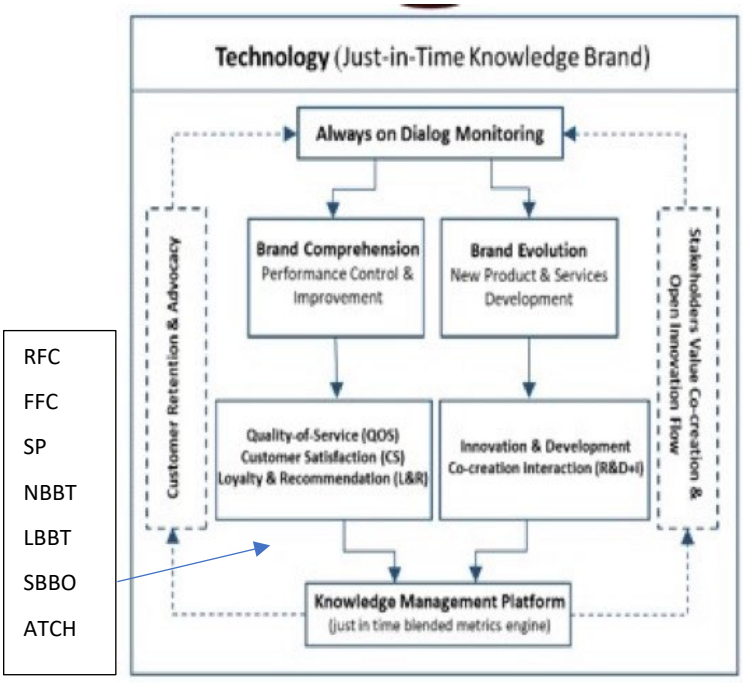


Figure 6: Matski Framework: KPI for Data Governance

It can be argued that considering the intersection of MSF with the CE allows redesigning existing business models to include innovations that can lead to strategic actions aligned with sustainable development (Rosa and Pestana, 2019). Our study expands the discussion around data sharing within dCoC by adding controls to the technological domain. Yet, more will need to be done to understand why and how firms survive industry transformations for CE sustainability. Therefore, it will be necessary for researchers to explain and predict how organisations with different business models will affect each other in the changing CE. Functional areas such as research and development, controlling, and quality assurance also utilise these data for greater accuracy, process automation, real-time analysis and reporting.

5. Conclusion

Combining the challenges of circularity and recyclability requires a pragmatic approach to business innovation. In a blue circular economy, marine litter such as plastics and fishing gear should be collected and reintroduced into the economic system or converted into new valuable resources at the end of the product life cycle. This can be accomplished by encouraging initiatives to implement public-private collaborative networks to work together and bring stakeholders from multiple sectors to create socially and environmentally sustainable business model opportunities.

The paper presented the BCpbP case study as a value proposition to create a robust supply chain, create value from marine litter, reincorporate these materials in the manufacturing industry, and promote sustainable design alternatives to current consumption patterns while raising awareness of ocean sustainability. This can be accomplished by encouraging initiatives to implement public-private collaborative networks to work together and bring stakeholders from multiple sectors to create socially and environmentally sustainable business model opportunities.

Our findings highlight the importance of considering the CE with a dCoC for data governance on value chain activities and how they impact existing business models, drive innovation, and enable value creation. The manufacturing industry is changing from a linear (take–make–use–dispose) model to a circular economy. In addition, technological innovation impacts the value chain as a set of primary and supporting activities necessary to deliver a valuable product to the market. This study also demonstrates how MSF can contribute to the value chain while focusing on manufacturers and providing new opportunities for future research.

Acknowledgements

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Human Capital as a Key Factor for Organizations' ESG Goals

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Abstract. The integration of Environmental, Social and Governance (ESG) in the long-term development strategies of companies is a mandatory condition for ensuring their sustainability and for maintaining competitiveness on the market. Thus, the main objective of this empirical work is to analyze the extent to which European companies currently manage to fulfill certain specific requirements related to ESG and the role played by highly qualified human capital in this process of sustainable development. To achieve this goal, a diverse research methodology is used, consisting of critical comparative analysis of the specialized literature, interpretation of statistical data, and econometric analysis. Our analysis is based in particular on European companies data from various fields of activity and different sizes, extracted by Eurofound through a complex survey. The main results demonstrate how European Union Member States are clustered and ranked based on different ESG pillars, with Sweden, Denmark, Estonia or Finland as the best performers and Greece and Cyprus as the weakest performers. At the same time, the research highlights the limited role of highly qualified human capital in supporting the development of the ESG pillars included in the analysis. We also pointed out the effect on companies' competitiveness and resilience, as well as the need for underperforming companies to develop and integrate human capital in the process of long-term sustainable and inclusive development, being the basic resource of any organization. The article may have a contribution to the literature because it demonstrates how EU Member States can be grouped according to specific ESG criteria of domestic companies, and also the role of highly qualified in boosting these criteria. Our study also may have possible practical implications, both for the academic environment, and also for the managers involved in the development of the business sector. We consider that our empirical results may contribute to the decision-making process regarding the future investments of the organizations.

Keywords: Human capital, ESG, sustainability, Tertiary education

1. Introduction

Geopolitical developments, climate changes, increased urbanization or massive industrialization are just some of the factors that highlight the need for radical transformations in business models. The business environment represents one of the pillars of any economy and society, which is why it becomes imperative that they respond effectively to such challenges and adopt a proactive, responsible, and sustainable attitude.

In order to be sustainable, competitive and inclusive on long-run, the companies must fulfill different Environmental, Social, and Governance (ESG) requirements.

In this context, *the main objective* that we have set for this work is to analyze the current degree of fulfillment of some of the ESG requirements by companies in the European Union (EU) Member States and to test the role of highly qualified human capital in stimulating their achievement.

We consider that through this research, we can make a contribution to the state of knowledge in the field by demonstrating empirically how EU companies manage to fulfill certain specific criteria related to sustainability, the way in which the countries of origin can be grouped according to common characteristics, at the same time testing the ability of smart human capital to positively influence these specific ESG pillars.

The paper is structured as follows: Section 1 presents a summary of the state of knowledge in the field, Section 2 describes the applied research methodology, and Section 3 details the obtained results. The paper concludes with the authors' general conclusions.

2. Literature Review

At the scientific literature level, numerous studies analyze the link between ESG regulations and organizations' performance. On the other hand, other researches analyzes the role of human capital in this process.

Lee and Rhee (2023) analyzed the impact of corporate ESG management on the brand, and their results showed that social and governance activities have a positive effect on brand loyalty, image, and attitude.

Zeng and Jiang (2023) tested the link between ESG and the performance of companies in the agricultural and forestry sectors, and concluded that the two variables are significantly and positively correlated, and that higher ESG ratings are beneficial to improving corporate performance.

Espinosa- Méndez, Maquieira and Arias (2023) analyzed the impact of ESG performance on the value of family firms, and their results showed that only environmental and social performances have a statistically significant positive effect on firm value. Similar results were obtained by Yu and Xiao (2022) based on Chinese A-share listed companies, and by Aras and Kazak (2022) through an analysis carried out at the level of the banking sector in OECD countries.

Galletta, Mazzù and Naciti (2022) highlight also that ESG performance is an increasingly important topic for banking industry.

In a study by Shakil (2021), the impact of ESG on financial risk for oil and gas companies was examined, revealing an adverse effect of ESG performance on total risk. Additionally, the study found that board gender diversity adversely influences both total and systematic risk. In connection to this, Shakil (2021) demonstrates that board gender diversity plays a catalytic role in the relationship between ESG and financial risks.

In addition, Chebbi and Ammer (2022) and Eliwa, Aboud and Saleh (2023) demonstrated that board composition and workplace diversity have a significant impact on ESG responsibility.

Likewise, Suciu, Noja and Cristea (2020) emphasized the importance of diversity, social inclusion, and human capital development for risk mitigation and improving financial performance of companies, using statistical data from 1.722 European companies. Similar results were obtained by Cho, Kim and Mor Barak (2017) for social enterprises, showing that both workforce diversity and management diversity are fundamental factors with a positive influence on organizational performance.

On the other hand, Wu and Li (2023) conducted a study on the impact of digitalization on the ESG performance of companies in China, and their results demonstrated that digital transformation can improve corporate ESG performance.

Alternatively, Popescu et al. (2022) underscore the need for social innovation, circularity, and energy transition in implementing environmental, social, and governance practices.

3. Methodology

The research methodology used in this paper is diversified.

First of all, we used the method of investigating the scientific literature to identify some of the most representative conclusions obtained by other researchers who have analyzed this subject.

Further, we applied the method of econometric analysis to analyze how EU Member States are currently clustered depending on certain factors associated with human resources which most influence the organizations' ESG goals.

The variables used in this analysis are the following:

- Share of persons subject to discrimination at work (%);
- Management quality index (%);
- Employees who had on-the-job training in the last 12 months (%);
- Equal numbers of men and women with the same job title (%);
- The percentage of male bosses (%);
- The percentage of employees who spend more than 60 minutes travelling to and from work (%);
- Organisations that have a health and safety delegate or committee (%).

For our purpose, we used the *principal components analysis* method (PCA), which is used to transform an extended set of variables into a reduced set (namely principal components), which contains most of the information from the extended set.

After observing how the EU Member States are clustered according to the principal components, we will analyze the link between these components (dependent variables) and the employed persons with tertiary education - % of total employment (independent variable), to see the extent to which highly qualified human capital can influence the growth of the degree of achievement of the organizations' ESG objectives.

This relationship will be tested through a correlation analysis.

The data used in the paper are taken according to the mentioned sources and are the most recent official values available at the time of this research, except the employed persons with tertiary education, where the data refer to the year 2021 for comparability. To apply the described methodology we used XLSTAT software.

It should be noted and taken into account in the interpretation of the results that the data were collected by Eurofound based on a survey that took place in 2021, in the context of the COVID-19 pandemic.

4. Results

This section presents the main results obtained, based on the previously presented research methodology, regarding the grouping of EU Member States according to different factors associated with human capital that influence part of the ESG objectives of the organizations, with an emphasis on the social pillar, as well as the role of highly qualified human capital on these factors.

In the first step, we applied the Bartlett's sphericity test and Kaiser-Meyer-Olkin (KMO) measure of sampling adequacy in order to assess the suitability of the data for PCA, and the results are presented in Table 1.

Table 1: Bartlett's Sphericity Test and Kaiser-Meyer-Olkin Measure of Sampling Adequacy Results

Bartlett's sphericity test:	
Chi-square (Observed value)	69.089
Chi-square (Critical value)	32.671
DF	21
p-value (Two-tailed)	**<0.0001**
alpha	0.05
KMO	**0.715**

Source: Author's calculations based on Eurofound data

https://eurofound.link/ewcts2021data

As we can see, the p-value in Bartlett's sphericity test indicates that the variables are suitable for PCA (p-value is lower than the significance level alpha=0.05). The model's robustness is also demonstrated by the value of KMO (0.715), which is close to 1, indicating that the variables are highly correlated and suitable for factor analysis or PCA. Further, we determined the eigenvalues for each factor, as well as their contribution to the total variability (Table 2).

Table 2: Eigenvalues

	F1	**F2**	**F3**	**F4**	**F5**	**F6**	**F7**
Eigenvalue	3.195	1.487	0.751	0.725	0.347	0.332	0.163
Variability (%)	45.642	21.250	10.730	10.355	4.955	4.742	2.327
Cumulative %	45.642	66.891	77.621	87.977	92.931	97.673	100.000

Source: Author's calculations based on Eurofound data

https://eurofound.link/ewcts2021data

Based on the values in Table 2, we see that only two main components (F1 and F2) have supraunitary eigenvalues.

To simplify the interpretation of the resulting components, and to ensure that the variance of the loadings is equal across all components, we used Varimax rotation with Kaiser normalization. (Table 3).

Table 3: Percentage of Variance After Varimax Rotation

	D1	**D2**	**F3**	**F4**	**F5**	**F6**	**F7**
Variability (%)	35.787	31.105	10.730	10.355	4.955	4.742	2.327
Cumulative %	35.787	66.891	77.621	87.977	92.931	97.673	100.000

Source: Author's calculations based on Eurofound data

https://eurofound.link/ewcts2021data

The results in Table 3 also show that there are two principal components with cumulative variability of 66.89%. Starting from these results, we determined the factor loadings in order to analyze the extent to which each original variable contributes to each principal component (Table 4).

Table 4: Factor Loadings After Varimax Rotation

	D1	D2
Share of persons subject to discrimination at work	-0.025	**0.759**
Management quality index	-0.163	**0.608**
Employees who had on-the-job training in the last 12 months	**0.858**	-0.096
Equal numbers of men and women with the same job title	-0.066	**0.832**
The percentage of men bosses	-0.451	**0.689**
The percentage of employees who spend more than 60 minutes travelling to and from work	**0.813**	-0.206
Organizations that have a health and safety delegate or committee	**0.934**	-0.111

Source: Author's calculations based on Eurofound data

https://eurofound.link/ewcts2021data

Typically, factor loadings greater than 0.4 are considered significant. The values presented in Table 4 indicate that three variables, namely *Employees who had on-the-job training in the last 12 months*, *The percentage of employees who spend more than 60 minutes travelling to and from work* and *Organizations that have a health and safety delegate or committee* are strongly associated with the first principal component, while the other variables (*Share of persons subject to discrimination at work, Management quality index, Equal numbers of men and women with the same job title* and *The percentage of men bosses*) are strongly associated with the second principal component and makes a substantial contribution to its definition.

Based on these results, we can define the two principal components as follows:

- *D1* - operativity and security in organization;
- *D2* - variety and culture in organization.

Next, we will proceed to cluster the countries included in the analysis according to *D1* and *D2* in order to observe what are the fundamental characteristics that define them in relation to ESG pillars (Table 5).

Table 5: The Clustering of EU Member States Based on Factor Scores After Verimax Rotation

	D1	D2
Observation	**Cluster**	**Cluster**
Austria	3	3
Belgium	2	3
Bulgaria	4	2
Cyprus	3	4
Czechia	3	2
Germany	2	3
Denmark	1	2
Estonia	2	1
Greece	4	4
Spain	3	3
Finland	1	2

	D1	D2
Observation	**Cluster**	**Cluster**
France	2	2
Croatia	3	3
Hungary	4	2
Ireland	1	3
Italy	4	2
Lithuania	4	1
Luxembourg	2	3
Latvia	3	1
Malta	2	4
Netherlands	2	2
Poland	3	2
Portugal	4	2
Romania	3	3
Sweden	1	2
Slovenia	3	2
Slovakia	2	2

Source: Author's calculations based on Eurofound data

https://eurofound.link/ewcts2021data

We have divided the EU Member States into 4 performance clusters, where Cluster 1 includes the best-performing states, while Cluster 4 includes the least-performing states.

The results in Table 5 indicate that Sweden, Denmark, Finland, and Ireland record the best performances in terms of D1, being included in Cluster 1, while at the opposite pole are countries such as Greece, Bulgaria, Hungary, Italy, Lithuania and Portugal (Cluster 4). This suggests that companies in countries located in Cluster 1 tend to have good job security and well-trained employees. On the other hand, the high length of employee commutes is also a booster for their ESG goals because these countries constantly promote and develop the necessary conditions for bicycle transportation.

This indicates that through work security and the development of employees' skills, companies from such countries manage to improve their ESG goals.

In conclusion, we can affirm that companies in these states have business models that emphasize the importance of human capital and succeed in integrating this resource as an important factor for fulfilling ESG objectives.

Regarding the second principal component (D2), we observed that the highest performance is registered by Nordic states, such as Estonia, Lithuania and Latvia (Cluster 1) , while the lowest performance is registered by Cyprus, Malta and Greece (Cluster 4), the position of these countries in the ranking being influenced especially by the share of persons subject to discrimination at work and by the percentage of male bosses.

By positioning the states in clusters depending on the two principal components, we can see that Denmark, Sweden, Estonia and Finland are the leading countries, having the best performances in terms of both principal components.

On the other side, Cyprus and Greece have the worst performances, according to both variables. The companies located in these states have difficulties in the development of ESG pillars and the role of human capital in this process is reduced.

Up to this point, the results of our research have highlighted which of the selected variables represent strengths or weaknesses for companies in EU Member States in the context of sustainable development with a focus on the role of human capital.

Building on these conclusions, we will now try to identify possible solutions to improve the ESG performance of European companies, especially for those located in countries with lower performance.

The premises that we consider are focused on the role of human capital with higher education.

In this regard, based on a correlation analysis we will test the impact that employed persons with tertiary education have on the other variables of which the two principal components, D1 and D2, are made up.

The results of the correlation analysis are showed in Table 6.

Table 6: Correlation Analysis (Pearson (n-1))

Variables	Share of persons subject to discrimination at work	Management quality index	Employees who had on-the-job training in the last 12 months	Equal numbers of men and women with the same job title	The percentage of men bosses	The percentage of employees who spend more than 60 minutes travelling to and from work	Organizations that have a health and safety delegate or committee
Employment – tertiary education (% of total employment)	0.278	-0.001	**0.477**	0.034	-0.379	**0.406**	0.344

Source: Author's calculations based on Eurofound and Eurostat data

https://eurofound.link/ewcts2021data

https://ec.europa.eu/eurostat/data/database

As we can see, there is a weak connection between employed persons highly qualified and the variables that form D1 and D2, meaning that currently the employed persons with tertiary education are not necessarily a booster for our ESG pillars in many cases.

The strongest correlations are registered in relation with *employees who had on-the-job training in the last 12 months* and *the percentage of employees who spend more than 60 minutes travelling to and from work*.

The first correlation suggests that highly educated individuals are more interested on long life learning, understand much better the benefits of continuous development and therefore seek out companies that offer such programs.

The second correlation may be explained by the fact that many higher-paying jobs are offered by companies located in major cities, making the employees who can apply for such jobs to spend a longer time commuting.

Considering these aspects, we can state that currently highly qualified human capital does not have a significant role on the ESG pillars included by us in this research.

5. Conclusions

Our research centered on assessing the level of company development in EU Member States based on diverse ESG criteria, while also exploring the influence of highly skilled human capital in driving this development.

The main results showed that the highest performances, both in terms of job security and operativity, as well as job variety and culture, are recorded by companies in Nordic countries such as Sweden, Denmark, Estonia, or Finland, while those in Greece and Cyprus are at the opposite end of the spectrum.

Regarding the role of highly skilled human capital in stimulating the ESG pillars included in the analysis, the research has shown that it has an overall limited influence, with significant correlations being recorded only in relation to employees who had on-the-job training in the last 12 months and the percentage of employees who spend more than 60 minutes traveling to and from work.

We can also conclude that companies that fail to develop their ESG pillars are subject to certain risks, both in terms of profitability and competitiveness, as well as of sustainable development and resilience in relation to

external shocks. Many companies from different EU Member States must find concrete solutions and strategies in order to stimulate these sustainability pillars and to integrate much more human capital in this process, being the basic resource of any organization.

Given the results obtained, we consider that we have achieved the main research objective.

This study presents a series of limitations related to the availability of statistical data for other types of variables characteristic of the ESG components of companies.

Future research can be focused on other ways of stimulating the ESG variables used in this research, and on the other hand, what would be the ESG variables significantly influenced by human capital, especially in the context of the knowledge-based and innovation economy.

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The Challenges faced by Banco Crédito Agrícola in Portugal to the changes in the European Commission's Sustainable Finance Action Plan

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Abstract: This article relates to the necessary changes that Banco Crédito Agrícola in Portugal must consider; at the level of strategy, processes and organizational culture, to meet the European Commission Action Plan for sustainable finance, published in 2018 (European Commission, 2018). The Action Plan obliges financial institutions to redirect capital flows towards more sustainable investments to ensure sustainable and inclusive growth, manage financial risks arising from climate change, resource depletion, environmental degradation, and social issues, as well as promote transparency and long-term vision in economic and financial activities (European Commission, 2018). The study seeks to give greater relevance to the approach on Resource-Based View and Dynamic Capabilities supported by knowledge management as the main sustainable competitive advantage for Banking in Portugal to meet the Action Plan requirements described above. Firstly, qualitative, and secondly quantitative methodologies were used. The qualitative part was made by analyzing the sustainability reports of the 2013-2020 period of Banco Crédito Agrícola and by interviewing key employee stakeholders of the institution. The quantitative part was made by applying questionnaires to two different samples; one representing the Portuguese population and the other, consisted of employees of Banco Crédito Agrícola based in Portugal. We conclude that there is a relationship between sustainable finance and knowledge management in the banking sector. This relationship implies a need for strategic, cultural, and process changes in Banco Crédito Agrícola, in the context of its organizational development.

Keywords: Sustainable finance, Knowledge management, Banco Crédito Agrícola in Portugal, Strategic, cultural and process changes

1. Introduction

This article seeks to highlight the movement toward the need for sustainability in the financial system, with a greater focus on the banking sector. It considers the perspective of several authors, namely Cornand & Gimet (2012), for whom the 2007 crisis exhibited disastrous myopia in the banking sector, identifying macroeconomic variables and specific determinants in a banks' risk decision-making, that have become evident since the beginning of 2000. The conclusion of Climent's study, (2018), by comparing two banks, one conventional and one ethical/sustainable (Banco Santander vs Triodos Bank) over a four-year period (2012-2015), points to the fact that economic agents are increasingly attracted to social investments and financial transparency, critical success factors of ethical/sustainable banking, guided by sustainability criteria. It is important to highlight Santos (2015), for whom the banking sector and the financial services sector, are those in which the Portuguese least trust, and their performance has been perceived by a large majority of the Portuguese as being quite bad. In this context, Henriques and al (2016), stressed that a financial system must serve the real economy with several functions, namely: "to operationalize the payment system, to allocate financial capital, to transfer economic resources, to share and manage risk, to inform prices of goods, services and financial assets". This perspective regarding risk sharing is very much developed by the work, Economics of Mission, by (Mazzucato, 2021) for whom the optics of risk sharing must be equally accompanied with profit sharing.

Thus, for a matter of delimitation of the theme, we start from the Action Plan of the European Commission (2018) on sustainable financing, considering the historical framework of 1992 that created the Earth Summit, and with reference to the international economic and financial crisis (2007-2009). It is within this context that the management, organizational behavior, and human resources management of the Crédito Agricola are analyzed in the paper.

The objective of this paper is to analyze if Crédito Agrícola has followed the Action Plan guidelines to become more sustainable. To achieve that objective, the paper is organized in six sections: 2. Literature review, 3 Methodology, 4 Results, 5 Discussion, 6 Conclusions.

2. Literature Review

2.1 Strategic Organizational Change

An organization can be understood as the "process of establishing relationships between people and available resources, in view of the objectives that the company sets out to achieve as a whole" (Teixeira, 2013, p. 117).

Strategic sustainability materializes in practice through what we can call strategic process, which can be grouped into four major blocks: strategic presence, strategic thinking, entrepreneurship, leadership, strategic projects and strategic progression (Pinto, 2008).

According to Bratianu (Bratianu, 2019), knowledge has been shown to be a strategic resource of any organization and a key ingredient of core competencies that lead to a competitive advantage. The efficient management of knowledge and knowledge dynamics means developing organizational learning and creating learning organizations. The difficulty of achieving such goals stems from the complex nature of knowledge and inertial thinking in making a paradigmatic shift in the interpretation of knowledge and knowledge dynamics, beyond Newtonian logic and Cartesian body-mind dualism. Knowledge as flow or knowledge as stock-and-flow are the most used metaphors.

Cardeal (2018), mentions that strategy can be thought of as the way, decisions, plans, among others, to achieve a certain end. Referring to the military background of strategy, the author draws attention to the work, The Art of War, in which Sunzi explains five factors that we must know to predict the outcome of war: first, the way; second, the time; third, the terrain; fourth, the leadership; and fifth, the rules (Sunzi, 2005).

It thus becomes clear that a strategy for sustainability requires constant analysis of changes in society, technology, and resources, so that it is possible to determine how they will impact on a company- and requires at the same time, the creation of objectives that link its success to the positive trends that it sees unfolding (Werbach, 2010).

The focus in this paper is on the Resource-Based View and Dynamic Capabilities. The capability-based view of the enterprise starts from the assumption that companies know how to do things. In fact, it is accepted that companies and other organizations 'know how to do things', things like build cars or computers, or transport people from one continent to another. Come to think of it, this means that if there is no sense in which only a human mind can possess knowledge, this proposition can somehow be framed with the idea that organizations know how to do things or even organizational knowledge as a real phenomenon one must know what principles govern it as it is acquired, maintained, extended and sometimes lost (Dosi, Faillo & Marendo, 2008).

The advanced framework at this level, can help scholars understand the fundamentals of long-term entrepreneurial success, while helping managers to outline relevant strategic considerations and the priorities they should adopt to improve business performance and escape the profitless trend with operating in open markets and associated global competition (Teece, 2007).

In this context (Tan, 2013) states regarding the Resource-Based View that "firms should focus on the cognition of core attributes that will improve their responses to environmental uncertainties. Firms should dedicate resources to build enduring client relationships, design innovation, managerial cognitive capability and reputation that will support their firm-specific strategies in the marketplace".

2.2 Organizational Culture Change

The link between organizational culture and sustainability was addressed by (Bruno and al, 2019), among others. These authors identified various types of culture depending on whether it is more focused on the financial, social, or environmental component. This same study concluded that: (1) a hierarchy culture is associated with greater emphasis on financially sustainable organizing and with better financial outcomes, (2) a clan culture is associated with greater emphasis on socially sustainable organizing and with better social outcomes, (3) a market culture is associated with greater emphasis on ecologically sustainable organizing and with better ecological outcomes, and (4) an adhocracy culture is associated with greater emphasis on holistically sustainable organizing and with better holistic outcomes.... These results suggest that organizational culture is related to sustainability in predictable ways, that a configuration theory approach is useful in understanding this relationship and provide a basis for future research to explore additional configuration elements in sustainable organizing (Bruno and al, 2019).

2.3 Processes Organizational Change

Taking as reference (Pires, 2005) and in accordance with ISO 9000, a process is a set of interrelated and interacting activities, which transform inputs into outputs.

Pires, 2005, when relating the theme of organizations to the processes, even stated that "the management by processes is a great challenge for organizations, since if on the one hand "horizontalizes" the organization, on the other hand, forces to manage articulately two structures; namely the functional (vertical) and the processes (horizontal)".

For (Silva, 2015), processes are not an end for companies, but a means for them to design more efficient management models, oriented to performance requirements, to "deliveries" that should happen through the application of organizational resources-people, technology, materials and capital.

2.4 Hypotheses and Theoretical Model

The hypotheses aim to help understand how Banco Crédito Agrícola is contributing to the objectives of the European Commission Action Plan: financing sustainable growth.

H1: The knowledge of Banco Crédito Agrícola's employees contributes to the European Commission's Action Plan: financing sustainable growth.

H2: The Portuguese population's recognition/appreciation of Banco Crédito Agrícola's sustainability practices contributes to the European Commission's Action Plan: financing sustainable growth.

H3: The Alignment with the European Commission's Action Plan: financing sustainable growth, implies cultural organizational changes in Banco Crédito Agrícola.

H4: The Alignment with the European Commission Action Plan: financing sustainable growth, implies Strategic organizational changes at Banco Crédito Agrícola.

H5: The Alignment with the European Commission Action Plan: financing sustainable growth implies organizational changes in the Processes at Banco Crédito Agrícola.

3. Methodology

According to (Vilelas, 2017), qualitative and quantitative research are both distinguished as to their paradigms: the former obeys the constructivist paradigm, while the latter the classical paradigm (positivism). This means that while positivism privileges the natural sciences, combining modern logic with empiricist ideas, the qualitative approach seeks to interpret phenomena, presenting them as one among several research possibilities, arising from an interaction between observation and conceptual formulation, between empirical research and theoretical development, between perception and explanation. There is, however, a divergence between the two: different epistemologies and research styles, as well as the way in which theoretical construction is carried out.

4. Results

4.1 2013-2020 Sustainability Reports of Banco Crédito Agrícola in Portugal

4.1.1 Content analysis

It is possible to highlight some aspects of the reports year by year, depending on their structure.

In the 2013 report the dimension of trust becomes visible as customers feel security for their deposits, since the bank provides good credit risk management. Also, costumers are close to the communities and are thus a bank of local trustworthiness. The strong relationship with employees and the fact that costumers benefit from some perks and training is highlighted. In addition to other themes, the environmental issue was already addressed with a greater focus on a more efficient consumption of resources.

The structure of the 2014 report is more attractive, extensive, and detailed. Several aspects of the Bank's action are detailed regarding the governance model, the compliance model, risk management such as: innovative and modern products, close relationship with and trust of customers, products with social and environmental benefits, solidarity with the community and employees, financial literacy and social responsibility, employee training and performance assessment, and finally equity in human capital management.

The 2015 report highlights sustainability as belonging to the "DNA of Crédito Agrícola" as a cooperative group, stresses the underlying responsible banking model, greater democracy in its governance model and adds internal audit to the topic of compliance and risk management. Indeed, the universal banking model with the associated innovation is starting to become clearer; modernity and innovation in products is followed by the evolution of the main products, with their benefits, social and environmental impacts, and with this, closer to the real economy. Details follow such as the benefits and training of the teams, the supports, contribution to development and other aspects as mentioned in the previous ones for the employees.

In 2016, the organization of the report, the wealth of content and its visibility increased. The report to addresses sustainability as something strategic in the Bank's development. Specific aspects mentioned were the products and associated solutions, the promotion of investment in sustainable projects, the products with social and environmental benefits, and the promotion of culture as a social responsibility project. Finally other interesting topics addressed were financial literacy, human capital management-staff profile, training, remuneration and benefits, the Bank's governance, the internal control model, compliance, wealth management, internal audit and issues related to supervision.

What was mentioned in the 2015 and 2016 reports is maintained in this 2017 report. There is concern about financing to strategic sectors and sustainable projects, main products and solutions, financing with social and environmental benefits, measures to support competitiveness and entrepreneurship in all regions of Portugal, the impact on local development and others referred to as culture, training, promotions, and benefits, unionized employees and compliance with sustainability standards and financial regulation.

The 2018 report, a consolidated version of previous reports, addresses the main indicators of the banking business, the governance of the group, responsible banking model, the various sectors to which the Bank has responsibility, the economic environment of the financial and banking market. Furthermore the risks and uncertainties of 2019 are anticipated, and a further analysis of indicators is made from an integrated perspective.

In 2019 the report is more compressed at the topic level. It addresses the impacts of the group in society, its sustainability plan, the share of credits and the commitment of partners, the investment in the community, the environmental impact, the economic value generated, the investment in communities, the services provided and the upcoming challenges.

In 2020, the themes are closer to what the European Commission's Action Plan requires. The following topics are considered: the risks and opportunities, the financial and climate impacts, the opportunities arising from the fight against climate change, the management of environmental, social and governance risks, the approval of a sustainability policy for three years, the priority objectives for sustainable development, the economic value generated.

4.1.2 Discussion of the reports

At this point, it is important to highlight some general aspects. Firstly, the level of organization, which has evolved into a more appealing construction for readers, creating a better quality in terms of information, tables, images, colors and graphics; more interactive, rigorous, innovative, and up to date.

The resulting attractiveness appeals to the underlying strategy of publicizing products and services that meet the interests of stakeholders, the trust of the institution, the actions and events organized, in accordance with the objectives and policies outlined and above all with the concern of losing the position that the same institution has in the market, in terms of sustainability.

The growing appreciation of stakeholders, followed by a more careful management of processes, with greater management and development of cohesive teams is very clear in recent reports.

Finally, it can be said that the pace of work in the realm of sustainability and even Sustainable Finance is fast, and reports are not far removed from national and international norms, agreements, and agendas. The comparative table presented above can elucidate the arguments referred to here.

4.1.3 Conclusions of the reports

We are left with the idea that the evolution of the reports analyzed are not marginal to the same themes, whether one thinks of the international evolution of the themes related to sustainability or of the approach itself on sustainable finance and adjacent areas.

To this, we can add the idea of their level of complexity and the repercussions on their operationalization.

The ideal seems to be to follow a phased evolution, with well thought out and appropriate strategies and their impacts on the associated processes, with respect for the existing culture and the effort to adjust to new challenges.

The associated investment and teamwork must go hand in hand with the training given to employees and the positioning of the institution in the market in which it carries out its activities. For the time being, that is all that can be said.

4.2 Interviews based on the Theoretical Model, Hypotheses and Associated Script

4.2.1 Characterization of the participants

The interviewees in this study are people with positions of responsibility in top management of Banco Crédito Agrícola in Portugal. The context did not allow extending the sample to more than five employees, but they are people with solid knowledge in the institution. This allows us to build the text based on our interview guide which is related to the theoretical model and this with the starting questions, objectives and even the hypotheses. There are several departments with which we interacted, including; the Office of Communication and Institutional Relations for Sustainability that, along with the CEO and the Human Resources Department, welcomed the author as a trainee to gain a better understanding of the theme in the Institution. Afterwards, they made the sustainability reports and other documents available. The same Office mentioned above then liaised with the Departments of Strategic Marketing, Credit Risk, Strategic Planning and Management Control, Global Risk Department and CCAM Compliance Department; so that the interviews could be done in the context of the thesis. The internship allowed for hands on experience dealing with the topic daily. throughout the internship in a very participatory manner for more than six months.

4.2.2 Discussion of the interviews

At this point it is necessary to retain some fundamental issues. First, the approach on Sustainable Finance has been on the international agenda since 1992, but it was only in the European public space that a dynamic implementation plan was approved in 2018, and it is expected to soon become mandatory in the institutions covered by this normative. Institutions are expected to comply.

Banco Crédito Agrícola, has been following the evolution of these issues in Portugal, subscribing to the letters of commitment that have been running and as the sustainability reports show, it has invested heavily in projects related to sustainable investment because it realizes that Sustainable finance can leverage its organizational development in a long-term perspective.

Nevertheless, it has a great advantage in having a secular history in the primary sector, in the real economy, with all the advantages, profits and positive results that the crises have not allowed to be affected.

It therefore has more lessons, more experiences, and its evolution must also be accelerated in these areas.

The interviews have many points in common, but some divergences because they were applied to people with very high positions of responsibility, even if in different directions. Obviously, we are referring to the level of aggregate information.

As can be read above, it is noted that among the interviewees, at least 40% are more focused on the directions in which they direct, they do not approach the topics with greater clarity, security, simplicity in a transversal way.

On the contrary, it was felt and it is possible to affirm that of the remaining 60% who transmit a more solid and comprehensive training, approach the topics in a more informed and more comfortable way, which allows us to deduce a greater involvement in relation to the others who transmit some fear in feeling comfortable in sharing this knowledge in a logic that "the secret is the soul of the business".

This behavior does not apply to many others who could not be interviewed but could only interact, for other reasons. We must recognize that Crédito Agrícola's management shares a vision of growth, innovation and development. This helps to understand how easy it is to deal with the CEO and the receptionist of the institution, and even to access them. It is considered, however, that the persons in positions of responsibility whom were interviewed, must apply more knowledge to prevail in the organizational memory as it appears they are in a phase of transition to retirement based on their ages.

Some interviewees stay very much in the primary sector, others already claim that it is evolving towards a universal banking model. The ESG designation, environmental, social and governance criteria still need to be

very well incorporated. It is still limited to the term sustainability. There is a concern for environmental and climate issues, but the basic issue is the measurement tools. The rating models should include these issues in their criteria. Developing metrics that facilitate the quantification of these themes may catapult CA's ambitions to meet the demands of the plans in question. Even though there are some strategies and attempts to incorporate them into the culture, there is still a great fragility at the process level.

The satisfaction for the qualification of employees, for more employability associated to sustainability criteria such as those living closer to the branches to be hired or those from the locations where the banks exist is very good, but it is always important to balance it with the policy described in the reports, when raising awareness on alternative strategies, culture and processes more aligned to sustainable development and particularly to Sustainable finance.

The evaluation methods of the projects to be approved can be more systematized and thereby clarified or continuously improved. Employees should not think they are good because the market is bad. They should always have references to improve themselves, always gaining autonomy for the benefit of the institution. Market share must evolve in a stable manner, without too many oscillations, even if it is often the economic, political, and social situation or the market itself, to speak of exogenous factors, that determine its value and the associated oscillation.

In any case, we are talking about a Bank that has been publishing sustainability reports since 2013 and was on its seventh report, when there are still banks without a code of ethics on their website.

4.2.3 Conclusion of the interview analysis

At this point we have much to highlight, but the characterization of the participants allowed us to contextualize them even if briefly, in the Bank. The structure of the questions highlights the relevance of the topic, the coding of the interviewees and the conduct of the interviews. The third point led us to present the answers, respecting the themes and the interview scripts, and in a simplified manner present the answers given by the participants, theme by theme, question by question. It is a very challenging mental exercise and understanding the logic of the answers, the language, the sensitivity on the subject, the expertise or not, the examples, even certain personality traits, is something that remains alongside the answers themselves. The fourth point served more to give us a position on the interviews. This exercise enriches and expands upon the use of Nvivo or Maxqda alone, and by doing it through a method that favors more the reasoning, autonomy, and dynamism, we end up with a more complete process of analysis and treatment of data and information.

4.3 Quantitative Study

4.3.1 Internal consistency of the scales for both cases: Employees and Portuguese population

As written by (Pestana & Gageiro, 2014), the internal consistency of factors is defined as the proportion of variability in responses that results from differences in respondents' opinions. When elucidating the various consistency measures, the authors point out that Cronbach's alpha is defined as the correlation expected to be obtained between the scale used and other hypothetical scales from the same universe, with the same number of items, which measure the same characteristic. It varies between 0 and 1, meaning that: $\alpha>0.9$=Very good; α between 0.8 and 0.9 =Good; α between 0.7 and 0.8= Fair, α between 0.6 and 0.7 = Weak and $\alpha <0.6$, unacceptable),(Pestana & Gageiro, 2014).

Next, a summary table is presented with the Cronbach's alpha values for each dimension of the theoretical model. Then follows the summary of the values of the sample addressed to employees and then to the Portuguese population in general.

Table 1: Summary Table of the Alphas of the Banco Crédito Agrícola employees' sample

Employee sample variables	Logic of each variable in the Theoretical Model	Cronbach's alpha	Cronbach's alpha based on standardised items	Number of Items	Relevant items above 0.7
European Commission action plan: financing sustainable growth	Mediating Variable	0.840	.847	5	5
Strategic organisational change	**Independent variable**	0.857	0.857	5	5
Change in Organisational Culture	**Independent variable**	0.673	0.681	5	0*
Change in Organisational Processes	**Independent variable**	0.740	0.743	5	Obs:**
Knowledge management	**Dependent variable**	0.903	0.904	5	5
Recognition of the Portuguese population	**Dependent variable**	0.848	0.851	5	5

*The variable "change in organizational culture" did not have a relevant effect on the sample above because it presented values below 0.7. The reason has to do with redundancy in the questions on the one hand and the interpretation in the sense that employees did not recognize the need for strategic changes according to the theoretical foundation of the model in question.

** In the case of the variable about change in organizational processes, the respective values are as follows: values described in table ,740 and ,743 refer to Cronbach's alpha and Cronbach's alpha based on standardized items. The values related to Change in organizational culture are 0.673 and 0.681.

The conclusion that can be drawn is that of the six variables belonging to the model, four had a relevant effect. The change in organizational culture and organizational processes are not the ones considered by the employees as priorities, relatively to the others, for Banco Crédito Agrícola to meet the European Commission Action Plan on sustainable financing.

Table 2: Summary Table of Alphas of the Sample Addressed to the General Portuguese Population

Sample variables addressed to the general Portuguese population	Logic of each variable in the Theoretical Model	Cronbach's alpha	Cronbach's alpha based on standardised items	Number of Items	Relevant items above 0.7
European Commission action plan: financing sustainable growth	**Mediating Variable**	0.859	0.876	5	5
Strategic organisational change	**Independent variable**	0.951	0.951	5	5
Organisational culture	**Independent variable**	0.921	0.921	5	5

Change in Organisational Processes	**Independent variable**	0.935	0.937	5	5
Knowledge management	**Dependent variable**	0.929	0.930	5	5
Recognition of the Portuguese population	**Dependent variable**	0.931	0.931	5	5

Note: as can be seen, in the sample related to the general population, all six variables have a relevant effect.

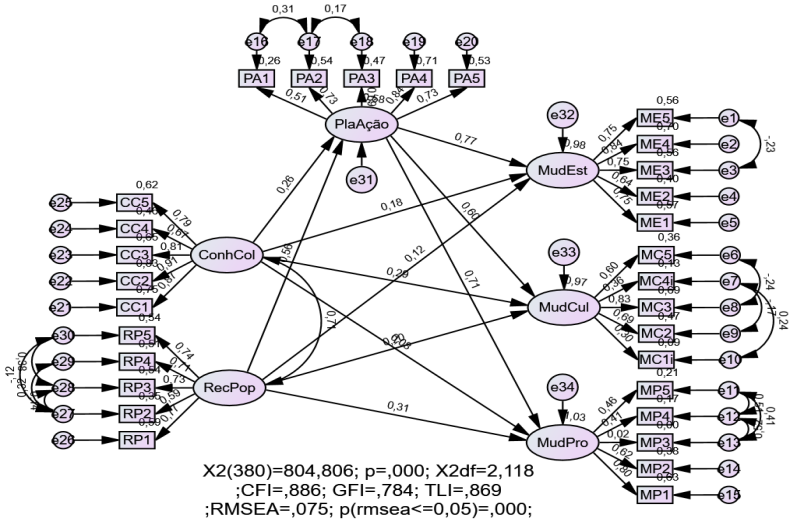
4.3.2 General structural equation model employees

At this point it is worth noting that the study we proposed follows a confirmatory factorial analysis, so the structural equations model presented below, depending on the theoretical model of the thesis and the respective samples will consider the objective of the estimation of the structural equations model that aims to find a set of estimates for the model parameters, such as factorial weights, regression coefficients, covariance, means; that maximize the probability of observing the correlational structure of the manifest variables observed in the sample. This idea is suggested in the SEA (Structural Equation Analysis) that the data are the variances and covariances of the manifest variables and not the observations of each subject in each manifest variable (Marôco, 2014).

The General Structural Equation Model of the employees is slightly saturated with a reasonably better fit index than the population. There are factorial weights with values below 0.50. In any case, the AMOS (Analysis of Moments Structures) suggests that the data are fitted to the sample.

What we mean in practice is that the implementation of the Action Plan of the European Commission-Financing sustainable growth-has been achieved in Banco Crédito Agrícola in Portugal, with strategic organizational, cultural and process changes and always with the knowledge of the Bank's employees and the recognition of the Portuguese population in general.

Nevertheless, it should be noted that the employees of Banco Crédito Agrícola in Portugal believe in the above, recognize the need for the European Commission's Action Plan -Finance sustainable growth- to be implemented in the Bank, so that organizational changes happen.

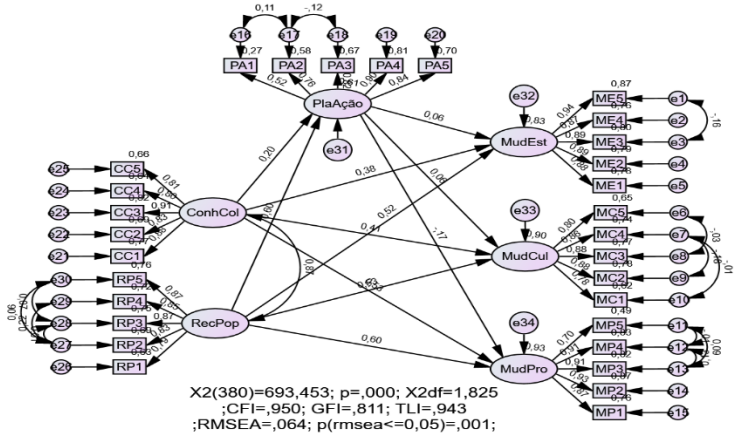


4.3.3 General structural equations model and Portuguese population in general

At this point it is worth noting that the study we proposed follows a confirmatory factorial analysis, so the structural equations model presented below, depending on the theoretical model of the thesis and the respective samples will consider the objective of the estimation of the structural equations model that aims to find a set of estimates for the parameters of the model, such as factorial weights, regression coefficients, covariance, means; that maximize the probability of observing the correlational structure of the manifest

variables observed in the sample. This idea is suggesting that according to SEA (Structural Equation Analysis) it follows that the data are the variances and covariances of the manifest variables and not the observations of each subject in each manifest variable (Marôco, 2014).

The hypothesis about the Action Plan of the European Commission-Financing sustainable growth, to be implemented in Banco Crédito Agrícola in Portugal, with strategic organizational, cultural and process changes, and always with the knowledge of the employees of the same Bank, and with the recognition of the Portuguese population in general, is something that follows the rationale of the Structural Equations Model below.



How the hypotheses behaved

The table below summarises how the hypotheses had an impact on the samples of employees and the general population. This impact was translated into percentage.

Hypotheses	Employees	Overall Portuguese Population
H1:	It is confirmed in 65% of cases	It is confirmed in 72% of cases
H2:	It is confirmed in 73% of cases	It is confirmed in 75% of cases
H3:	93% confirmed	93% is confirmed
H4:	96% confirmed	74% confirmed
H5:	96% confirmed	67% confirmed

5. Conclusion

It was clear that the question, model, and associated scales were adapted according to the studies of (Santos, 2012, 2015) on the Financial sector, Banking, environmental, social and ethical aspects; (Vilelas, 2017), (Miranda, 2017), (Tan, 2013), (Pires, 2005), (Cardeal, 2010), (Lagerkvist, Edenbrandt & Wahlstedt, 2020) and those followed by (Baptista 2017) and (Mackay, 2008); on a 5-point Likert type scale with the following correspondence: 1-Strictly disagree, 2- Disagree, 3- Neither disagree nor agree, 4- Agree, and 5- Strongly agree; and that the reference of these authors becomes relevant because their studies meet the starting questions of the thesis and the variables that constitute the theoretical model of the same, the associated hypotheses and objectives. Thus, we started with the literature review regarding concepts and theories, understood the analogous cases, created our hypotheses and theoretical models, and made the empirical study of the thesis more consistent.

In the empirical part of the thesis, the institution under study and the Portuguese society in general are the sources of study. Following their study, the methodology, both qualitative and quantitative, was detailed, highlighting the fact that the written sources and the interviews are interconnected and these with the questionnaires in general. Some sources required further work than others.

Therefore, it was clear that the European Commission's action plan for sustainable finance brings challenges that imply organizational changes at the level of culture, strategy, and processes, which can be overcome with a greater focus on employee knowledge and a greater attention to valuing or recognizing the population, as in

our case, the Portuguese society and Banco Crédito Agrícola. This brings a new worldview, insofar as employees are now seen as strategic resources, with dynamic capabilities to redirect capital flows towards more sustainable investments to ensure sustainable and inclusive growth; to manage financial risks arising from climate change, resource depletion, environmental degradation, and social issues; and to further promote transparency and long-termism in economic and financial activities.

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Building Knowledge Absorptive Capacity in South African Public Companies Through Recruitment Practices

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Abstract: Most state-owned companies (SOCs) in South Africa are in a perpetual struggle to recruit human resources and replenish their intangible knowledge asset losses that are largely due to high employee turnover. The study is interdisciplinary in nature, presenting a strong link between recruitment practice, employee turnover, knowledge loss and knowledge absorptive capacity. The research project used a mixed methods exploratory sequential design by gathering in-depth qualitative data through interviews with 20 human resource managers in 9 SOCs. Survey data was collected from a 25% response rate to the 585 distributed questionnaires. The survey instrument was tested for reliability with a Cronbach's alpha at 0.94. The qualitative data extracted through the interviews were analyzed thematically using Atlas.ti software, whilst the quantitative data were analysed using Statistical Analysis Software (SAS). The findings revealed that due to increased human resources mobility, human resource management (HRM) establishments in many SOCs were in a perpetual struggle to fill vacancies in mission-critical areas. Knowledge-loss induced by human resource attrition was a serious challenge in most SOCs. On a positive note, the study revealed that recruitment practices were knowledge-driven, largely because they supported SOCs in the sourcing of the required company-specific human and knowledge resources, albeit some extant challenges. The study concluded that HRM recruitment practices build knowledge absorptive capacity in South African SOCs.

Keywords: Knowledge management, Recruitment practices, Human resource management, Knowledge absorptive capacity, Knowledge loss, Knowledge risk management, State-owned enterprises, South Africa

1. Introduction

Employee turnover across the globe has been a well-documented phenomenon in the literature on human resource and knowledge management (Allen and Vardaman 2021). Similarly, it is a well-established fact that the coronavirus (COVID-19) has exacerbated the problem, resulting in what it is described as the great resignation in which employee turnover (voluntary or involuntary) has been at the highest level experienced over the last few years (Phaladi and Ngulube 2022). However, the current great resignation is more than just a human resource management (HRM) or talent management crisis facing many businesses but is a great knowledge exodus with rippling effects on companies and economies across the world (Serenko 2023). The study is mainly grounded in the theoretical lens on the knowledge-based view of the firm. Proponents of the knowledge-based view theory (KBVT) of the firm argue that enterprise intangible knowledge assets such as knowledge, skills and competencies are drivers of competitiveness, productivity and superior business performance (Grant 1996). From a knowledge management perspective, the crisis creates a knowledge exodus, resulting in massive knowledge loss risks which threaten the sustainability and competitiveness of business enterprises. The effects of the global-wide labour market have affected South African companies as well. South African state-owned companies have always had their fair share of higher-than-normal resignations compounded by a lack of retention plans with most of the experienced knowledge workers in critical market sectors retiring in large numbers (Wöcke and Barnard 2021; Phaladi 2021). In a similar vein, it is a well-established fact that the country was facing serious gaps in skills and employers in both the private and public sectors are in a perpetual struggle in seeking to attract and retain top skilled knowledge workers. The demand for highly skilled professionals in the local labour market complicated by a scarcity of suitably skilled talent to fill vacant positions in mission-critical areas means that South African state-owned companies are also always in a struggle to source and retain talented employees. Moreover, South Africa has a special case of the great resignation in that older workers were given early retirement packages due to avoid the health risks associated with COVID-19 in the workplace. The great resignation translates to a knowledge exodus or loss in organisations (Serenko 2023).

Recruitment refers to the practice of sourcing and connecting companies to external sources of tacit knowledge (Mwangi and Olouch 2022). Tacit knowledge, unlike explicit or codified knowledge, is defined as a type of knowledge that is deeply ingrained in the source agent, which includes intangible assets, know-how and know-why forms of knowledge that are difficult to share and retain in a tangible matter without losing its value (Polanyi 1958). Simplistically put, tacit knowledge is therefore accumulated knowledge gained through individual lived experiences, and therefore remains subjective and difficult to share. It provides companies with the capacity to act and remains a source of competitiveness and superior performance. Tacit knowledge is the type of knowledge that is lost when the source or agent leaves an organisation. The loss and sourcing of the enterprise's tacit knowledge are central to this study. Several studies (Galan 2023) concur that tacit knowledge loss in

organisations is largely induced by employee turnover given the fact that workers are sources of such intangible assets. The recruitment process plays a crucial role in the acquisition of the talented workers who are the bearers of such knowledge. Jøranli (2018) highlights the importance of recruitment practice in the management of enterprise tacit knowledge, especially when it pertains to searching and sourcing the required competencies and skillsets.

Enterprises in the knowledge-based economy must invest in building organisational-specific capabilities to source and absorb tacit knowledge from rivalry companies if they are to sustain their production and competitive advantage (Grant 1996). Cohen and Levinthal (1990) characterise such enterprise-specific capabilities as knowledge absorptive capacity. Nevertheless, the role of recruitment practices in building organisational knowledge absorptive capacity is often neglected and under-developed in the existing literature on knowledge management and in practice (Jøranli, 2018). It remains unclear as to what the specific roles and contributions of recruitment practices in facilitating knowledge management capability are, especially absorptive capacity in organisations. Mwangi and Oluouch (2022) point out a knowledge gap and lack of existing theoretical and empirical literature showing a strong link between human resource recruitment practices, employee turnover, KM and the organisational benefits of such a linkage. Losing critical knowledge workers through voluntary or involuntary turnover comes with its own serious consequences for the business. High employee turnover rates lead to massive knowledge loss risks, reduced knowledge absorptive capacities and associated recruitment costs. Public enterprises are no exception to this global phenomenon. Extant literature indicates that state-owned enterprises are in a perpetual struggle in terms of sourcing knowledgeable workers due to increased employee turnover and a lack of human resource retention strategies (Kumar 2020). In South Africa, most public entities are facing the phenomenon of enterprise tacit knowledge loss caused mainly by a turnover of their much-needed firm-specific knowledge workers, either through voluntary or involuntary turnover and the non-existence of human resource retention strategies (Phaladi and Ngulube 2022). State-owned entities play a crucial role in developing and driving the South African economy and positioning the country as a developmental state in the globalised knowledge-based economy. Additionally, as a catalyst for economic development, they drive public sector job creation, public infrastructure investment and economies (Netswera 2022). When knowledgeable workers decide to look for employment opportunities elsewhere and they finally leave, they walk away with a wealth of knowledge, expertise and skills, which could prove detrimental to the sustainability of business enterprises. High employee attrition rates in South African SOCs are more than just a human resource management challenge but are also a knowledge management issue as attrition affects the knowledge absorptive and retentive capacities of many state companies.

The study sought to explore HRM recruitment strategies supporting knowledge management (KM) initiatives in South African SOCs; determine the time and cost of replacing knowledge workers; identify KM attributes; assess HRM recruitment effectiveness in sourcing potential workers with the requisite skills and knowledge; and recommend knowledge-driven recruitment strategies to mitigate knowledge loss risks induced by human resources attrition.

2. Literature Review

2.1 Knowledge Management and Organisational Performance

Grant (1996) views the KBVT as a theory of the enterprise and as a philosophy of strategy or concept of competitiveness that prioritises its focus on internal institutional knowledge as a key resource driving the production of goods, products and services in the knowledge-based economy. One of the earlier key KM theories to have emerged in the current knowledge-based economy calls on organisations to invest and pay more specific attention to the management and securing of organisational intangible knowledge assets. KM presents a direct response to managing knowledge resources in the knowledge economy. Knowledge resources are more than just generic resources, but rather firm-specific and valuable resource that warrant proper management (Grant 1996). A study by Mantje, Rambe and Ndofirepi (2023) on South African enterprises confirmed previous research that established that KM has a direct impact on company competitiveness or organisational performance. Therefore, if knowledge resources are not well sourced and managed properly in South African public enterprises, their capability to drive much of the national economic development agenda, public-sector infrastructure investment philosophy and performance is threatened (Netswera 2022). The loss of enterprise knowledge will inherently lead to the loss of their sustainable competitive advantage as key contributors of economic development. Furthermore, what complicates the terrain of knowledge management in South Africa is the fact that KM is under-developed in many public sector organisations (Maphoto and Matlala 2022). However, Phaladi (2021) cautions that the genesis for the effective management of company-specific intangible

knowledge resources lies in the recruitment and sourcing of employees who are sources and drivers of such resources.

2.2 Role of Recruitment Practices in Knowledge Management

Organisational employees (through the theoretical lens of the resource-based view of the firm) and business knowledge resources (through the theoretical lens of KBV) are sources and strategic drivers of competitiveness and superior enterprise performance. Thus, the loss of these crucial tangible and intangible knowledge sources and assets threatens the competitiveness, productivity and sustainability of an organisation and may render companies into serious sustainability and vulnerability risks (Zieba, Durst and Hinteregger 2022). Existant literature suggests that HRM practices such as recruitment processes have an important role to play in sourcing the required human capital through talent acquisition initiatives (Sharif, Naiding and Shah 2022). This line of thinking seems to suggest that recruitment practices have an inevitable inherent role in the management and acquisition of enterprise-specific knowledge assets and sources of such intangible assets. It is common wisdom that the identification and source of human resources (employees) who have the required knowledge, skillsets or competencies is exclusive HRM territory. Nonetheless, a review of the literature on strategic HRM highlights the fact of one of the biggest challenges facing human resource practitioners is identifying, sourcing and deploying organisational members with such attributes (Sokolov and Zavyalova 2020). Such a level of complexity is attributed to the fact that knowledge workers have a distinctive understanding of work and work ethics compared to just any ordinary employee or a hard labourer. This means that conventional recruitment strategies could be rendered irrelevant and unsupportive of KM practices. Researchers and proponents of the RBVT contend that the sourcing and selection of the human resources' competencies from external companies is the terrain of strategic HRM (Dalkir 2020). Such a position remains undisputable. However, arguing from the KBV standpoint, recruitment is more than just the sourcing and acquisition of potential human resources. At the heart of any recruitment strategy is the acquisition of the required organisational intangible knowledge resources such as knowledge, skills and competencies.

2.3 Knowledge Loss in State-Owned Companies

It is important to unpack the complexity on enterprise tacit knowledge loss and its implications for organisational performance, especially as it relates to SOCs. The review of extant literature on knowledge risk management outlines a number of knowledge-related risks facing modern business enterprises, caused by organisational human resource turnover (Galan 2023). Knowledge risks highlighted in the extant literature includes knowledge loss, knowledge gaps, knowledge leakage / knowledge spillovers, knowledge hoarding, knowledge outsourcing and knowledge hiding (Hammoda and Durst, 2022). Arguing from a sustainability perspective, Zieba et al. (2022) posit that these risks, if left unmanaged, will have serious repercussions for sustainability, economic performance and societal impact. Knowledge loss is one of the biggest risks facing many organizations across the globe. In South Africa, knowledge loss is caused mainly by voluntary and involuntary factors. Many SOCs are lagging in knowledge-driven retention strategies (Phaladi and Ngulube 2022). The ageing skilled workforce in technical, scientific and engineering born in the 1950s are retiring en masse. The prevailing circumstances are not unique to South Africa, as it is a phenomenon causing havoc across the globe. Covid-19 has forced many older workers into early retirement before their actual retirement. According to Serenko (2023), the prevailing labour market conditions have led to an era of what is characterised as the Great Resignation in many countries. It has not only led to great resignation, but in the process, the situation has also led to a great knowledge exodus. Phaladi's (2021) study highlights that the prevailing complex fluid labour market means that SOCs are forever in a recruitment drive cycle, with huge financial impacts and productivity risks. State-owned companies are knowledge-intensive enterprises and learning organisations (Benassi and Landoni 2019). As a result, they are continuously acquiring, producing and processing huge quantities of valuable knowledge and are heavily reliant on knowledge to drive a developmental mandate and the economy. The loss of tacit knowledge when employees depart can have negative consequences for organisational performance.

3. Methodology

Given the fact that not much was known about the specific research questions of the study and the specific roles played by recruitment practices in facilitating knowledge absorptive capacities in SOCs in South Africa, the study deployed mixed methods research (MMR), using the exploratory sequential design as the overall research approach to address the research questions. Phaladi (2022) and Creswell and Plano Clark (2018) posit that MMR designs are best suited for exploratory types of studies that explore complex research issues in KM from multiple viewpoints. Research data were extracted from South African state-owned companies. Since the study was an

exploratory sequential MMR design, ethical considerations were heeded in both the qualitative and quantitative research components. Qualitative data were collected through interviews with twenty managers in the HRM departments of nine state companies that were purposively nominated in the first component of the research project, as illustrated in Table 1 below. The qualitative research data were analysed thematically using Atlas.ti analysis software. The qualitative research results informed the development of variables for testing in the quantitative phase of the study. The research results of the qualitative component were then tested with the larger samples in the quantitative phase of the project through the questionnaire instrument. The questionnaire was distributed to 585 randomly selected employees in three public companies that volunteered to partake in the study, with a response rate of 25% (145). The survey questionnaire was circulated using online forms during the 2020 awkward period of the national Coronavirus (COVID-19) hard lockdowns and directives. The questionnaire comprised of the five Likert scale questions, with five different response options ranging from strongly agree to strongly disagree. Quantitative data extracted through the survey instrument were analysed using SAS. The instrument was tested for reliability with a Cronbach alpha of 0.94.

Table 1: Participating SOCs From Which Research Participants Were Drawn

Industry sector	Number of participating SOCs	Number of human resource managers interviewed
Development finance sector	2	7
Water utility sector	1	3
Service sector	2	3
Compliance and regulatory sector	2	4
Research and development sector	2	3
Total	9	20

4. Research Findings

4.1 Qualitative Research Findings

4.1.1 Recruitment processes supporting KM initiatives

All the participants who took part in the interviews concurred that their talent acquisition processes support their SOC in identifying, selecting and appointing potential applicants who possess the required skillsets or competencies. As managers within the HRM establishments, the participants were largely responsible for sourcing a skilled workforce, albeit using different methods in the execution of their recruitment strategies. For instance, four state-owned companies focused only on the technical competencies, whilst the remaining majority focused on both technical and behavioural competencies as part of the talent acquisition practice. Most SOCs deployed competency-based assessments. Competency-based interviewing was developmental in that it allowed human resource managers to identify gaps and address them through individual capacity development initiatives. As such, in addition to the actual recruitment of workers, it also contributed towards their capacity development as well as knowledge development in the knowledge area gaps identified during the recruitment process. It was common knowledge that the talent acquisition process starts with the vacancy being advertised and with job adverts being structured in such a way that they help in finding specific requisite knowledge assets. Concisely, talent acquisition approaches were playing a crucial role in the sourcing and development of employees and intangible knowledge assets.

4.2 Period and Cost Implications Involved in Replacing Critical Knowledge Workers

Regarding the research question: *How long does it take public enterprises to source the critical skills and expertise lost due to employee turnover, and at what cost?* the following emerged:

Eight participants posited that it takes their enterprises between three to six months to find critical skills from the labour market, while another 8 participants showed that it takes them over six months to a year to close the gap caused by employee-induced turnover. In addition, one participant argued that it takes their company 1 to 2 years, and another 2 years or even lengthier periods in special cases, to source and replace critical knowledge workers lost due to turnover. One participant from a state-owned company indicated that it took them more than 2 years to fill a vacant critical position, and they expressed their frustration in the following manner:

> *Two years plus, I must say. Because I am having example of that within my area. I arrived at an XY station in 2014, whereby there was these positions of principal electrical engineer, and principal mechanical engineer. Therefore, we have been having those positions for a long time; I think we closed one position now in February or March 2019. Yes, so we could not attract that skill, and another thing is our market salary scales are not competitive. Some of them we cannot afford (Participant#19, 2019).*

The rarer a skill is, the harder and more costly it becomes because it comes at a huge cost to the company, and some public enterprises end up paying exorbitant amounts of money to source and replace mission-critical scare and skilful knowledge workers, especially in highly technical specialised fields. Staff turnover triggers a number of risks such as enterprise knowledge risks and affects the productivity of public sector companies facing such issues. Furthermore, the participants opined that the cost implications of sourcing and finding the replacement employee with scarce required skills comes at a premium with huge cost implications, in terms of both direct and indirect costs.

4.3 Targeted KM Attributes in the Recruitment Approach

Regarding the KM attributes that participants in the selected public enterprises focused on in the recruitment process and their logic behind that, ten participants in three of the SOCs identified the following KM behavioural competencies:

- knowledge sharing;
- a learning and training mentality and culture;
- succession planning;
- collaboration and networking capabilities;
- an innovation and creativity mindset;
- ability to work effectively within a team environment; and
- coaching and mentoring (willing to act as a mentor or to be coached).

These public enterprises paid particular attention to knowledge-based behavioural competencies as part of the talent sourcing practice. The reasoning behind such a focus was that it supported them in sourcing employees with relevant knowledge-driven competencies and behaviours. Additionally, it helped to focus on developing and nurturing KM behaviours where candidates were found lacking, thus in the process contributing towards the desired enterprise-specific knowledge-sharing culture in those entities. The other nine participants revealed that in one way or other, they do reflect on such knowledge attributes without labelling them as such largely due to their limited understanding of the philosophy and concepts of knowledge management. Some of the interviewees mentioned that KM language is not their language, therefore managing enterprise knowledge was not in their vocabulary. Only one participant of SOC4, in the compliance and regulatory service industry, argued that they did not focus on knowledge-driven attributes at all.

Moreover, participants who paid attention to specific KM-behavioural competencies advanced the following reasons for their focus on such attributes: ensures enterprise cultural fit; secondly, that the new acquired workers will fit into the organisation (emphasis on team fitness); thirdly, longer tenure within public enterprises; fourthly, alignment of the new employees to these KM competencies; fifthly, sustainability of their public enterprises and lastly, to ensure sustained productivity and superior business performance.

4.4 Effectiveness of Recruitment Practices in Attracting Candidates With the Required Knowledge and Skillsets

Pertaining to the research question on the effectiveness of the recruitment processes in sourcing and recruiting workers with the required knowledge, skills and expertise, fifteen out of twenty participants concurred that their recruitment process is effective in identifying and sourcing potential workers with the required relevant knowledge attributes, whilst five responded to the contrary, emphasising the fact that their practices were ineffective. Participants who said that their enterprises were effective in sourcing human resources with the required knowledge and skills attributed their success to internal recruitment.

Six participants in two of the public enterprises credited the high employee retention rate as the reason behind the effectiveness of their talent acquisition practice. Furthermore, their firms' brand-power, competitive compensation benefits, knowledge-driven learning culture and compelling employee value proposition assisted some of the enterprises to retain their talented knowledge workers. In contrast, the other nine participants mentioned that while their recruitment practice is very effective, they were experiencing serious difficulty in retaining their organisational members with mission-critical knowledge and skillsets. These challenges

accelerated employee turnover in those SOCs. This was a serious issue for many of the public enterprises that participated in the project. Five participants revealed that their staff acquisition practices are ineffective, mainly due to a struggle to find the right calibre of candidates at the right salary amount.

5. Quantitative Research Results

HRM departments within state-owned companies play an important role in the recruitment or sourcing of workers with the required knowledge, skills and competencies. The statistical results (as illustrated in Figure 1) posited that 50% of the responses concurred that their recruitment processes or strategies supported the public enterprises in sourcing and attracting candidates with the required knowledge management behaviours such as knowledge-sharing, teamwork, learning, networking abilities or capabilities, etc., while 24% of the responses were of the view that recruitment processes did not support such activities and behaviours. A small share of the participants (26%) was less informed on whether the recruitment processes supported knowledge management activities.

Regarding the research question on whether the sourcing of workers focussed on their potential learning and growth in the public enterprises of the study, a majority of the responses (62%) showed that the sourcing of knowledge workers stressed on their potential to learn and grow in the company, whereas 16% of the responses held contrasting views about this variable, showing that talent acquisition practices did not emphasise the potential to learn and develop or grow in the public enterprises. A minority share of responses (22%) were neutral or less informed about this variable.

Pertaining to the question on whether recruitment or talent acquisition processes focussed on knowledge management attributes such as coaching and mentoring, teamwork, knowledge-sharing, innovation and being a team player, 37% of the responses were of the view that recruitment practices did not stress such attributes. Moreover, 34% of the respondents showed that there was such a deliberate focus on those KM attributes and behaviours. Furthermore, a smaller share (29%) of the responses were neutral or did not express their views on this variable.

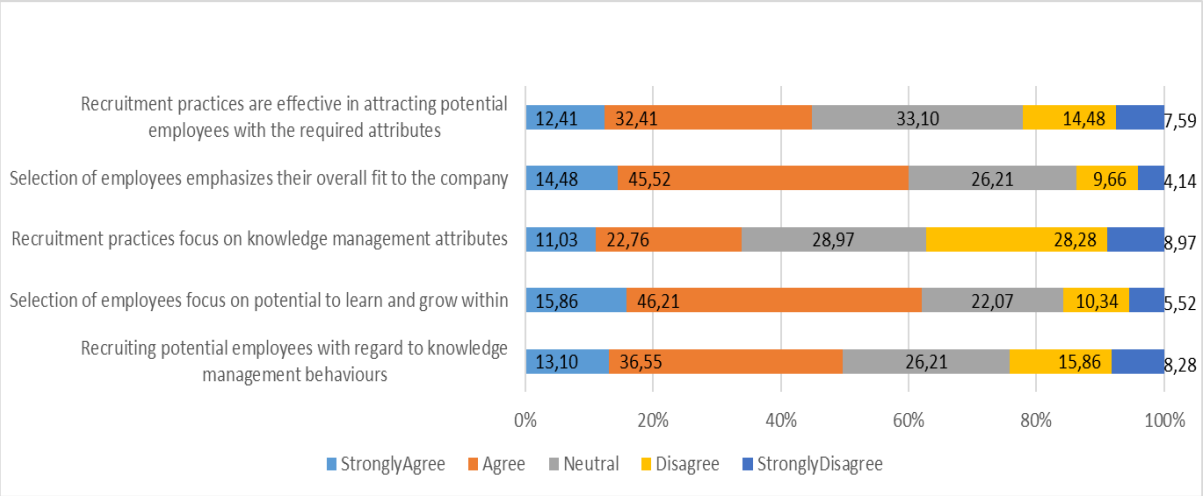


Figure 1: Recruitment Practice Support to KM

The larger share of responses (60%) indicated that the selection or acquisition of workers stressed the overall fit for the enterprise in terms of personality, values, norms and other principles. In contrast, 14% of respondents were of the view that this was not the case whereas 26% of the responses were neutral or did not know whether recruitment practices emphasised overall organisational fit.

Regarding the effectiveness of the talent acquisition or recruitment practices in SOCs in sourcing potential knowledge workers with the much-needed knowledge-driven attributes such as coaching, mentoring, collaboration, networking, teamwork, team player, etc., most of the responses (45%) were in agreement that talent acquisition practices were effective. According to a smaller share of the responses at 22%, the effectiveness of the recruitment practices was a serious problem in attracting or sourcing workers with such knowledge-driven attributes and values or principles. However, it was a worrying observation that a noticeable share of responses at 33% were neutral or did not know if their talent acquisition or recruitment strategies were effective in sourcing potential workers with those KM-driven attributes.

6. Discussion of the Findings

Traditionally, sourcing and attracting company-specific workers and their knowledge and skillsets to ensure the company's sustainable performance and competitiveness (Dalkir 2020) remains the exclusive terrain of the human resource management field. Both the qualitative and quantitative research results revealed a common understanding amongst the participants that recruitment processes supported their public entities in the identification, sourcing and attraction of potential workers who possess much-needed mission-critical knowledge, skills and competencies. However, due to increased human resource mobility, the talent acquisition practices in most of the public companies were in a perpetual struggle to find employees with the required skillsets in mission-critical business areas. The results of the qualitative strand of the study showed that human resource managers were facing a serious challenge in that it took them 6 to 12 months to fill a vacancy in their organisational structures because of employee-induced turnover. In worst cases, it took some SOCs 1 to 2 years to fill a vacant post in mission-critical business areas. The more advanced the employee mobility, the greater the challenges for talent acquisition practices in most of the public enterprises. Moreover, the scarcer the talent is, the costlier it becomes, largely because skillful or talented workers come at a premium. As a result, the public companies had to compete with private entities in the open labour market, with some of them paying higher price tags to attract employees with the required knowledge, skills and competencies. Most of the public companies could not compete with other companies in the labour market due to their salaries not being competitive or market related. The prevailing circumstances are even worse in some of SOCs where there are no concerted strategies to retain their knowledge workers and much-needed knowledge assets. Knowledge management was non-existent in a majority of the South African public companies.

A problem that HR managers in public companies faced was the attraction and retention of workers with mission-critical skillsets. Whenever a valued knowledge worker left the occupation in SOCs, either through voluntary or involuntary turnover (resignation or retirement or death), this created serious issues for the HR establishments in terms of the direct and indirect costs related to such employee turnover (mobility) developments. What made the challenge even worse was that most HRM establishments in SOCs lacked strategies to quantify the impact of losing employees with critical knowledge lost due to voluntary employee turnover. In broad terms, HRM talent acquisition or recruitment practices supported SOCs in the identification and sourcing of knowledge workers with the required knowledge and skillsets. However, the approach and execution of the human resourcing strategy differed from one SOC to another. For example, the qualitative results revealed that in some SOCs, the focus of human resource acquisition was only on the technical competencies and not so much on knowledge-driven behaviours and principles. In a nutshell, knowledge behavioural competencies were not a priority or focus in the recruitment practices in some public companies. The articulation of specific KM behaviours, values and principles in the human resourcing practice was a serious challenge in most of the public enterprises. This research finding was also corroborated by the quantitative evidence because a majority of participants (employees) revealed that their recruitment approaches did not pay attention to knowledge management attributes such as coaching and mentoring, collaboration, innovation, teamwork and knowledge-sharing. Hence, it can be inferred that recruitment practices in most South African SOCs did not display knowledge-driven attributes largely because KM and its vocabulary is still under-developed. In three SOCs out of nine that participated in the qualitative strand of the study, the attraction and sourcing of potential workers emphasised specific KM attributes and behaviours. Those three SOCs were only part of smaller cases whose talent acquisition strategies exhibit knowledge-driven attributes, behaviours and other characteristics. In addition, this was not a common staff acquisition practice in a majority of the public companies. Moreover, the evidence from the qualitative data showed that the three SOCs whose talent acquisition strategies emphasised the importance of certain KM behaviours and attributes were those whose knowledge management strategies and practices were better institutionalized. It can be deduced that the presence of institutionalized KM supported HRM practitioners in those enterprises to develop an understanding of KM attributes and vocabulary.

The data revealed that state-owned companies take pride in being learning and knowledge-driven business enterprises. Similarly, survey evidence also affirmed that the process of sourcing workers focused on their potential to learn and develop in SOCs. The ability to learn, accumulate knowledge and grow goes a long way towards facilitating and developing knowledge absorptive capacities in SOCs. However, a serious challenge lies in the retention of these knowledge workers, which defeats the purpose of such investments in human capital development. SOCs are forever on a recruitment drive. This finding confirms the empirical evidence in the existing body of knowledge which shows that the retention of knowledge workers remains a serious problem once they are sourced and developed (Phaladi and Ngulube 2022; Kumar 2020). Many of the human resource

managers in the qualitative strand of the research project lamented the problem that their SOCs were in a perpetual battle to replace and retain workers with mission-critical knowledge and skillsets. Equally, they rated their talent acquisition practices as being effective in sourcing company-specific knowledge workers, knowledge and competencies. However, being very effective in sourcing knowledge workers but not much successful in retaining them created a strategic contradiction for the SOCs, their human resource management departments and knowledge management capabilities.

7. Limitations and Suggestions for Future Research

This mixed methods research project has some limitations in that the study took place in a limited number of the public companies in South Africa. The COVID-19 lockdown restrictions also proved to be a serious challenge and negatively affected access to the research sites of the study, resulting in limited sampling and response rates. Similar studies in future could address these sampling limitations with larger samples. Moreover, this paper focused only on HRM recruitment practices and how such practices facilitated and developed knowledge absorptive capacities for the effective mitigation of tacit knowledge loss. The project was a cross-sectional enquiry in South African SOCs. For this reason, the findings should be approached with caution in other types of business enterprises. A longitudinal form of study involving similar SOCs and in other areas of the South African economy is also recommended for future research.

8. Conclusion and Recommendations

This study concludes that HRM talent acquisition strategies in public companies develop knowledge absorptive capacity, focusing on recruiting and selecting workers with intangible tacit knowledge assets which increase knowledge acquisition capacity. Staff acquisition and retention practices' effectiveness in managing enterprise knowledge is questionable, as high employee turnover and insufficient strategies for staff retention can create instabilities in the knowledge base and capacities, hindering SOCs' ability to sustain business performance and deliver on their developmental mandates. Most SOCs lack articulation of knowledge management behavioural competencies in talent acquisition, which should prioritize KM attributes and behavioural competencies, including knowledge-sharing behaviours, creativity, innovation, teamwork, coaching and networking abilities. KM remains under-developed in most SOCs and proactive strategies to quantify the impact of losing critical knowledge and skillsets due to employee attrition are imperative because acquiring knowledge assets beyond sourcing and attracting core competencies fosters loyalty and attracts the best knowledge workers in the sector.

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Digital Natives and Their Learning Habits in Acquiring Knowledge

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Abstract: The knowledge provided to students should be presented in an engaging way and using the latest technologies. The world in which society, and especially young people, functions is described as a nanosecond culture, i.e. one in which everything is expected to be available immediately. The recent years have shown that teachers are becoming aware that they need to adjust the educational materials presented and the way they conduct exercises and lectures by expanding their pedagogical and technological skills to accommodate new teaching requirements. The aim of the article is to define what educational needs are desirable and necessary in the process of acquiring knowledge by students and to determine what learning habits young people have. The first part of the article attempts to present some theoretical aspects of learning in the era of digitization. Then, a quantitative study was performed using the Cawi method. The subjects of the study were students of a technical university, both part-time and full-time. A survey was carried out with the participation of 203 student representatives. The study was carried out in the period September - November 2022.

Keywords: Education, Knowledge, Digital approach, Educational needs, Digital native, Learning environment, Higher education

1. Introduction

Education is used to develop passions and skills that enable people to be effective employees and active citizens. However, it should be remembered that currently people often change their professions, they have to be flexible, adapt to new technological changes, and at the same time they are increasingly competing with each other and are willing to take on new educational challenges (Houlden i Veletsians, 2019). Education has changed, it has been digitized. Remote and hybrid induced a change in the way of transferring knowledge. It should be adapted to current trends and requirements as well as the reality surrounding students. The aim of this approach is to create attractive, interesting and motivating lectures and lessons for further learning. Technology and progressive digitization have improved the effectiveness of learning and streamlined the process of acquiring knowledge. According to Mete, Riegel, Kozen and Polka (2017), technology has not only transformed into a powerful tool of everyday life, but also significantly influenced education. Currently, students are considered to be the first generation of the so-called “digital natives” They have grown up with technology all their lives, they know mobile phones, tablets, computers, playstaion and many other electronic devices from birth (Acquah & Katz, 2020).

The recent years have shown that teachers are becoming aware that they need to adjust the educational materials presented and the way they conduct exercises and lectures by expanding their pedagogical and technological skills to accommodate new teaching requirements. Currently, many universities in Poland are developing their e-learning courses more and more, training their staff on how and where to use effective teaching tools to realize the full potential that is required for students to participate willingly and with commitment.

The first part of the article presents the characteristics of a modern student, what he pays attention to when acquiring knowledge and learning. Then, the tool and the test sample were described. The next part consists of research results and conclusions, research limitations and recommendations.

2. Literature Review

Students who were born between 1980 and 1994 are known as “digital natives” (Prensky, 2001; Haytham, 2023). As reported Gallardo-Echenique et.al (2015) from their youth, they grew up with digital communication technologies. As mentioned by Barbuceanu (2020) and Mete et.al (2017) a digital native student is able to communicate, share knowledge and connect in a continuous, 24/7 environment. For them, the most remarkable characteristic was growing up with technology. Digital natives show their preferences for using graphics for communication and are comfortable with multitasking, they prefer to receive instant feedback and seek gratifications (Xie et.al, 2022). According to Porat et al. (2018), the widespread belief is that students, digital natives, who live all their lives in media-rich digital environments and are ubiquitously connected through social networks, naturally develop digital competencies. This is a person who is proficient in Twitter, Facebook, Instagram, SnapChat, podcasts, YouTube, online news, text messaging, instant messaging. He/she knows perfectly well smart phones, iPads, smartwatches and many more. This group is also referred to as the

“iGeneration” or as having “digital DNA” from birth, they are also people brought up in the "nanosecond culture". Taking these factors into account, Howe and Strauss (2003) attributed certain features to the network generation that distinguished them from previous generations. They were described as people with an optimistic approach to the world, who like to cooperate with each other, achieve success in life and do well in the environment of the latest technologies. They are constantly in the digital world, both during study and during leisure time. This enables them to access information quickly and deal with a variety of tasks using technology. They multitask and switch between tasks quickly. They are capable of high-speed tasks. Native digital students prefer to study visually rather than through text, they want an environment that is rich in images. They like information presented in graphics, charts, tables, and images rather than lengthy reading tasks

Education has transformed over the past few decades. Technology breaks up the limitation of time and improves students’ learning autonomy (Liu & Li, 2020; Huang et al., 2020). The challenge posed by the Covid-19 pandemic is the transition from classroom learning to online and hybrid learning with the use of technological solutions Tang, 2021). At the same time, universities had to develop ways to use modern learning methods while ensuring high-quality teaching (Reis et al., 2022). Currently, interactive boards, virtual learning environments, e.g. Moodle, videoconferencing, applications and software, games, tablets and smartphones have started to be used more often in lecture halls (Nikou and Aavakare, 2021). Lecturers started recording podcasts, tutorials, instructional videos, e-books. They began to conduct synchronous lectures and use videoconferencing (Criollo-C et al, 2021). Such tools and such methods are certainly conducive to the positive transfer of knowledge. It can be said that students need such tools, and lecturers need to learn to use such tools.

According to Riegel and Mete (2017), students and lecturers should share knowledge with each other. There is feedback. Students have an enormous amount of knowledge to impart to lecturers, and lecturers have a wealth of knowledge to offer students. Mutual learning can bring many positive effects. This idea of mutual learning holds true for technology (Haytham, 2023, pp. 23-33). The experience of the last two years has shown that technology is conducive to eliminating time and space barriers. It turned out that you can learn asynchronously and synchronously. Opportunities arising from the development of technology in science should be used by adapting to the requirements of current students. Teaching materials supported by photos, graphics, videos should be used. Bearing in mind the current trend of nanoseconds, such solutions are conducive to flexibility and mobility of both students and lecturers.

3. Research Methodology

Based on the discussion above, this study aims to define what educational needs are desirable and necessary in the process of acquiring knowledge by students and to determine what learning habits digital natives have. Following the foregoing discussion, several objectives have been identified. The following research questions were posed: What kind of learning habits do technical college students have? What factors do they pay attention to when learning? Do they prefer group work or independent learning?

The study investigated students' needs for learning habits. This is a pilot study, conducted on a sample of 203 students. It is planned to conduct the survey on a larger research sample, including various departments of technical universities in Poland. The questionnaire was developed by the Center of Modern Technology of the Gdańsk University of Technology. This study adopted an online questionnaire to examine Polish learners’ digital nativity. It consists of two parts. Part one inquired into students’ basic information, such as gender, age, degree and major. Part two inquired into students’ responses to about learning habits. The survey contained 26 closed-ended questions, 1 open-ended question and 4 questions defining users. The participants were informed of the purpose and procedures of the study, and their due rights to quit the study at any time. Generally, participants spent about 10 minutes filling in the questionnaire.

4. Results

The research was carried out in the period September-November 2022 on a sample of 203 people. The characteristics of the survey participants in the research were analyzed based on the results from the metric part of the survey. The current study examined 203 learners’ digital nativity. The research group represented was: 105 women and 93 men, 1 person gave gender: other, 4 people did not answer the question. All the respondents were students of the Częstochowa University of Technology (Poland) from the Faculty of Management, mainly first-cycle studies (99%), i.e. bachelor's or engineering studies, mainly in the field of logistics, engineering logistics as well as finance and accounting. This study adopted an online questionnaire to examine Polish learners’ digital nativity and their intentions to acquiring knowledge.

Figure 1 demonstrated that 203 students from Czestochowa University of Technology successfully completed the online questionnaire.

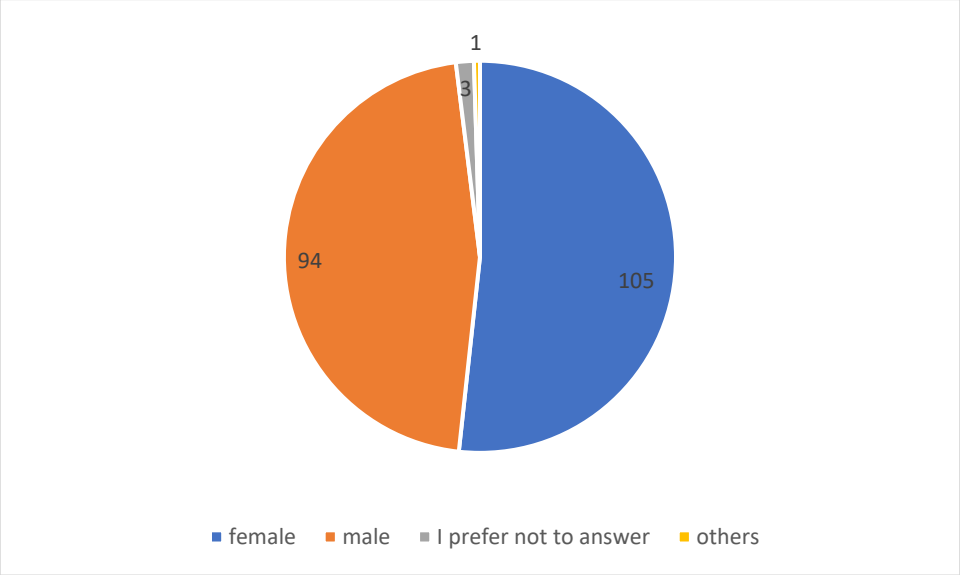


Figure 1: Participants by Gender

According to Figure 2 most respondents (44%) are aged 22 to 24. Another 43% are respondents aged 19-21. The survey was also completed by 4 respondents under the age of 18, 9 respondents aged 30-40 and 1 person over 41 years of age.

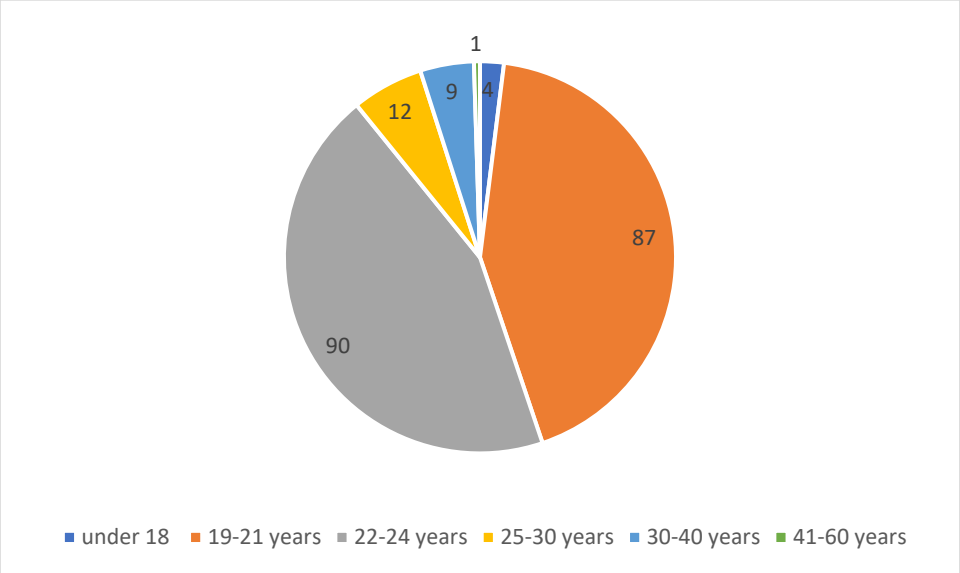


Figure 2: Participants by age

Next, the students' learning habits were analyzed. 59% of respondents indicated that they use free moments while traveling on public transportation or in between classes to study. 80% of respondents are most likely to take study notes on their own, while at the same time they are willing to reach for notes borrowed from friends in the learning process (73%).

There was an even split in the number of responses regarding the use (often or sometimes) of apps to help mobilize oneself and achieve set goals, not only didactic, but also applicable to sports, keeping a diet or learning foreign languages. 51% of respondents use the mentioned apps, while 49% do not use them.

As many as 58% of respondents print out teaching materials provided by lecturers in the form of files (pdf, doc, ppt) for their own use. In response to the question "If I had the option to listen to (e.g., part of) the textbook content, I would use such an option," 90 respondents indicated this answer as "FALSE." As the survey shows, as

many as 70% of the respondents are not systematic in repeating the content/making repetitions of the material for themselves. At the same time declaring (87%) that they would like to be more systematic in learning. As elements that help in learning, students indicated: taking their own notes (174 indications), as well as the possibility of self-check of knowledge on an ongoing basis through review questions or quizzes posted by the lecturer (137 indications). Respondents indicated (197 indications) that learning was helped by materials in which the author or lecturer marked key content in some way (e.g., boxes, bold, symbols). As it turned out, a very important factor supporting learning is the inclusion in textbooks of short summaries of a certain portion of information or learning material. This was the answer marked by 94% of respondents. In response to the question "A variety of materials in terms of form (e.g., podcasts, videos, text, photos) helps me learn," 166 people marked this answer as true. Fewer indications were given to the answer to the question about supporting learning through discussions with other students/colleagues at the university, with 63% declaring such a need. 73% indicated that, given a choice, they were most likely to learn on their own.

Summing up, it can be said that the person from our study is used to receiving information fast, hoping that they could receive rewards or feedbacks as quickly as possible. In terms of communication, he/she is fond of using graphics and data to deliver information.

5. Summary

Analyzing the research results obtained, lecturers and students should focus on mutual learning, and lecturers should adapt their teaching methods to current challenges. It should be remembered that the surveyed students are “digital natives”, who operate in the world of images, sounds and fast content transfers. Knowledge should be imparted in an engaging but varied way to keep students' attention. As you can see, highlights in the text, the use of color, short summaries, and the ability to test their knowledge and acquired skills on an ongoing basis are important to them.

Nowadays there is access to practically everything thanks to technology. At the same time, we can communicate with anyone and create and disseminate fresh knowledge. The development of technology, the era of digitization and the partial shift to distance learning have shown that teachers are becoming aware that they need to adapt the educational materials they present and the way they conduct exercises and lectures, expanding their pedagogical and technological skills to accommodate the new teaching requirements. Today, many universities in Poland are increasingly developing their e-learning courses, training their staff on how and where to use effective teaching tools to take full advantage of the potential that is required of students to participate willingly and enthusiastically in class.

The authors believe that education has been changing in recent years. Mutual teaching and learning is important. There are several opportunities to share knowledge between generations, one can learn from each other. Teachers or university lecturers need to undertake the creation of classes using a variety of technologies, adapt the topics presented to the current requirements of students.

This study had some limitations. Firstly, considering the large population of Polish university students, the sample size was comparatively small, and the results of the study cannot represent all Polish university students. Further studies were suggested to enlarge the sample size. It is planned to conduct this study in other academic units in Poland and compare the results achieved between universities. It is also planned to increase the survey sample. Interestingly, when conducting the survey, many students were eager to discuss their expectations for teaching with modern technologies.

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Remote Work and Human Resources Challenges From the Covid-19 Pandemic Scenario: The Cases of Italy and Portugal

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Abstract: This study presents the preliminary results of a European project (EURECA) being carried out in Italy and Portugal. One of its aims is to understand the role of remote work arising from the recent pandemic. The question that drove this research was: *What is the role of remote work resulting from the emergent changes of the 2019 pandemic scenario in Portuguese and Italian organisations?*. Case studies were used as the methodological approach, and the qualitative and inductive work directed the research, guided by the assumptions of practice-based theory. Thus, interviews were conducted with human resource managers and/or directors of companies/public institutions. So far, the sample comprises 16 organisations. The results show that before the crisis, which lasted about two years, most organisations did not engage in remote work. Afterwards, human resources practices had to adapt to this new reality, and hybrid work (a combination of remote and face-to-face work) is currently present in most of the organisations studied. New challenges are also appearing in this area, including new information systems, career management, and training and performance evaluation, among others. Hence, this new model of work design also brings new challenges to organisations and management. The implications pressing issue are several: practical (for management and organisations); theoretical (new inputs on HR practices, remote working and change management); and methodological (reinforcing the importance of case studies and practice-based theory in a comparative analysis of the Portuguese and Italian contexts). Avenues for further research are also proposed.

Keywords: Remote work, Human resources challenges, Case study, Covid-19 pandemic, Portugal, Italy, EURECA project

1. Introduction and Background

The recent Covid-19 pandemic increased the prevalence of remote work (RW) to an unprecedented global scale, as a new operating dynamic emerged to face the unpredictability of the lockdown. RW has been successfully implemented by organisations and governments around the world. From March 2020, more than 3.5 billion individuals were confined to their homes, leading several million to RW (Bouziri et al., 2020).

On the 4th May, 2023, The World Health Organization (WHO, 2023) officially declared the end of the Covid-19 pandemic, which started on the 11th March, 2020. After only two years of the global lockdown, the resultant practices and challenges of HRM, as well as the working designs and the role of RW, are still not well known. Although there is abundant theory and approaches on the subject matter, studies with practical evidence are scarce and there is still a gap in the knowledge on this subject area. Hence, further studies are needed to demonstrate practical evidence of these emerging issues. As some authors claim (Hamouche, 2021), future research should be directed toward longitudinal analysis to identify the new challenges and opportunities, and further knowledge of the impacts of Covid-19 must be developed and more rapidly disseminated (Vahdat, 2022). The current paper intends to contribute to these gaps and claims.

So, when Covid-19 came to town, human resources practices suffered a shock and had to adapt to the new challenges faced by organizations and their staff. The era of Covid-19 put RW in the spotlight, and research work on the associated problems has been growing. As Jacks (2021, p. 93) notes, 'the COVID-19 pandemic has changed the face of global IT forever and "remote work" is now simply "work". This has quickly become a cultural norm around the world...'

As this is still a recent phenomenon, there remains a deep knowledge gap. The general concern of this paper is to understand the reality for two countries regarding the challenges of RW as a result of this global event. Accordingly, a starting question to guide this research was posed: *What is the role of remote work resulting from the emergent changes from the 2019 pandemic scenario in Portuguese and Italian organisations?.*

From the multiple definitions of this work design, there is a central idea: organisations give their workforce the possibility to carry out work at a distance, remotely and outside their conventional physical spaces, using communication equipment and technologies (Piteira, 2020). However, as the current situation is changing rapidly, so the concept must be updated. Recently, several authors have argued that the Covid-19 pandemic has initiated an important RW transformation, which has started a new debate about its effects on the labour market, the workplace, and on organisational practices, as well as a debate about the potential strategies to address these challenges (Tursunbayeva, Di Lauro and Antonelli, 2022). Arunprasad et al. (2022) underline the literature on RW and pinpoint the factors for managing a remote workforce. The authors made a bibliometric analysis on the research published in Scopus journals, followed by a critical literature analysis. They presented a framework that organisations can use to manage remote workforces, focusing on employee engagement, collaboration and organisational agility. These findings highlight technology orientation, leadership, human resources management practices, external processes and organisational culture as having critical implications for managing the remote workforce.

Thus, the aim of this paper is to contribute knowledge for a better understanding of this new working model, one based on practical observation, using the case method as a research strategy. The present work is part of a European research project (EURECA), currently being conducted by a team of researchers from Italy, Portugal and Spain. This qualitative study comprises data from Italy and Portugal.

2. Design Research, Method and Procedures

According to the previous research question and the selected literature, a set of work propositions were posed in order to guide the data collection and analysis:

P1. The definition and application of RW has changed with the organisational experiences from the pandemic scenario (2020-2022).

Recently, some studies have been produced that discuss RW as an adopted work design caused by the global Covid-19 lockdown (Ozimek, 2020; Piteira, 2020; Wang, Liu, Qian and Parker, 2021; Wontorczyk and Rożnowski, 2022). However, a better comprehension of this is still required.

P2. The organisational experiences during the pandemic scenario (2020-2022) highlighted the advantages and disadvantages of RW.

There is a considerable body of literature on RW design, the relevance of which has been underlined by the Covid-19 pandemic, specifically its advantages and disadvantages (Ferreira, Pereira, Bianchi and Silva, 2021; Piteira, 2020).

P3. As a result of the organisational experiences during the pandemic scenario (2020-2022), use of RW is the predominant trend.

Some literature has been produced on this assumption, and the pandemic scenario has reinforced the challenges of HRM in crises, especially through the focus on RW (Alalmaie, Nanda and Alayan, 2023; Contreras, 2020; Sapo and Spinks, 2002; Vyas, 2022).

P4. The organisational experiences during the pandemic scenario (2020-2022) and the corresponding mandatory RW have posed a new set of challenges to HRM and organisations.

HRM is an attractive area for investigations, particularly given the challenges posed by RW design. Currently, with the identified knowledge gap from the post-pandemic scenario already noted, these challenges are the concern of many different actors, and it has been discussed and listed by some studies (Adekoya, Adisa and Aiyenitaju, 2022; Arunprasad et al., 2022; Sharma, 2022; Tursunbayeva et al., 2022).

Method and procedures

The current work intends to generate knowledge based on practice. With a more complex workplace after the recent Covid-19 pandemic, the present work seeks to check if past explanations and theories still explain the new reality. Therefore, a qualitative methodology was used due the nature of the data, and an inductive approach was taken due to the role of theory and to the researchers' decisions regarding the work process, as suggested by classical authors in the literature (Feldman and Orlikowski, 2011; Miles and Huberman, 1994). This is especially the case with contemporary management; it is increasingly understood to be complex, dynamic, distributed, mobile and transient, and to be so in unprecedented ways. Accordingly, inductive research was conducted starting from empirical observation with minor pre-existing theory. The case-study

method was used in accordance with the recommendations of Yin (1994), using semi-structured interviews as the evidence source in the data-collection (2022/2023 ongoing). The research process followed four phases: (1) definition of the objectives and the empirical field for the purposes of undertaking the quantitative study in the EURECA project and gain an in-depth and comprehensive understanding of the organizational perspective; (2) selection of the empirical field in order to have, in each country (Portugal and Italy), an organization for each category of size, activity sector and nature of the capital/mission; (3) conducting interviews with directors/HR managers; (4) data analysis and interpretation of results, and generation of case studies in order to establish comparisons.

The interviews had a pre-existing script informed by the research goals of the EURECA project, with flexibility to introduce new questions. The interviews were conducted online in the interviewee's native language, were recorded, and lasted about 60 minutes each. The collected data were analysed by country, highlighting the key points of each section, and then compared to find similarities and differences. Qualitative analysis was then carried out on the data following Bardin's (1997) guidelines regarding coding procedures, ensuring quality and fulfilling the criteria for content analysis (completeness, representativeness, homogeneity, pertinence and exclusivity). Consequently, to display and compare the data, co-categorial matrices were generated.

The empirical scenario comprised 16 organisations (7 Italian and 9 Portuguese, see table 1), selected based on criteria previously defined by the EURECA project team (size; product/service; mission and country).

Table 1: Empirical Field

Company description	**Italy**	**Portugal**
Size	Big: 3; SME: 4	Big: 6; SME: 3
Product	Manufacturing: 1; Service: 6	Manufacturing: 1; Service: 8
Mission	Private (n=4); Public (n=3).	Private (n=6); Public (n=3).

3. Findings: The RW by the Cases of Italia and Portugal

Data and findings were structured by the following questions: *How is RW currently understood from the organisational management perspective?*; *Which are its advantages/disadvantages*?; and, *What kind of new challenges are there for HRM?.*

How is RW currently understood from an organisational management perspective?

This study attempted to determine whether RW was a new mode of work that resulted from the crisis generated by the pandemic or whether it was already a common practice in the group of organisations studied. Thus, how RW was used in recent years was investigated, comparing the trends before, during and after the isolation imposed by the Covid-19 pandemic (see table 2).

Table 2: Remote Work Trends in Portuguese and Italian Organisations

Companies	**Before 2020 lockdown**	**Lockdown (2020-2022)**	**After lockdown (2022 onwards)**
Italian Case			
Insiel	Yes, occasional use of telework	Yes	Yes, full remote and hybrid
Regesta	Yes but to a really small extent, aimed at supporting personal needs	Yes	Hybrid work only
Agenzia Entrate FVG	Just rare cases of telework	Yes	Hybrid work, mainly for individual needs

Companies	Before 2020 lockdown	Lockdown (2020-2022)	After lockdown (2022 onwards)
Provincia Autonoma Trento	Yes, occasional use of telework and smart-working	Yes	Hybrid work, consistent with organizational needs
Job Agency	Yes, occasionally, supporting personal needs	Yes	Considerable access to hybrid work
Benetton	Extensive use of remote work from 2017 (both telework and smart-working)	Only in the functions that could be performed remotely	Wide access to hybrid work
Blackship	Born in full remote in 2013	Yes	Totally full remote
Portuguese Case			
AERLIS	No	Yes	Hybrid
AICEP	No	Yes	Hybrid
Auchan Group	Occasionally	Only in the functions that could be performed remotely	Hybrid
El Corte Inglês	No	Only in the functions that...	Hybrid
GELPEIXE	No	Only in the functions that...	Occasionally
Integrity	No	Yes	Hybrid
Yellow Group	Occasionally	Yes	Hybrid
IPDJ	Occasionally	Yes	Hybrid
ISCAL	No	Yes	Presential tendency, RW by exception

The case of Italy shows that before the pandemic, all the organisations had experimented with a form of RW, albeit with different intensity. In most of the cases, it was a mode allowed only to employees in particular conditions (i.e., family requirements, health, distance) and only to a small number of people. Several organisations tested a mode of office-delocalisation to reduce transit from home to a central site. Only one company operated fully remotely, and this did not change during the pandemic or after. The whole Italian sample experienced RW during the pandemic, as all organisations were in lockdown. Before the lockdown, all companies, except the fully-remote one, applied a telework model, and only two of them (one private and one public) navigated a smart-working model before the pandemic. While the need to equip all employees in RW with a laptop and phone represented the most difficult obstacle for public organisations, for private ones the worst problem was managing people. Moreover, those organisations where RW had been applied consistently before the pandemic had less difficulty in managing RW.

In the Portuguese case, just one organisation was technology-based, where RW is more likely. The majority (six organisations) did not apply RW before the lockdown, but three interviewees mentioned it as an occasional practice in necessary situations. All organisations adopted RW, apart from those in manufacturing and retail (which were not in lockdown), and with the exception of functions that could not be performed remotely. Post lockdown (2022 onwards), the tendency has been to adopt a hybrid model. The majority of organisations tend to adopt a system whereby, in necessary situations and in functions where RW is possible, employees have a choice. This is not entirely in remote mode, so as not to lose the connection to the organisation, but rather

with some days present and others spent out of the office. RW was generally adopted by these organisations after the lockdown (2020-2022), which had previously operated almost exclusively on a face-to-face basis. Hence, this hybrid scheme (some days at home and others in the organisation) is the prevailing one for those functions that can be carried out remotely.

Once the use of RW had been characterised, we aimed to find out *How is RW currently understood from an organisational management perspective?*

In the Italian sample, only one company worked fully remotely from the beginning, with the management model being smart-working-oriented in its essence. All employees (25) worked from home and met with customers and colleagues only virtually. For the other organisations, a hybrid model was applied where in employees work some days in the physical office and some days remotely, though with no employee working fully remotely. Each organisation had its own plan in managing how many days were worked remotely *vs* in-office. Several organisations set a minimum number of days required in the office (5 to 9 days per month), others set a maximum number of days required in remote (2 or 3 per week), and only one set a maximum number of days per month (8). In most organisations, especially those in public administration, a fixed number of hours to be available online was defined when people were in remote (2 or 3 to 6 hours), as well as a mandatory disconnection period, in line with Italian law. Generally, the calendar had to be shared with the team leader. The most common approach was to allow people to stay in remote (negotiated between employees and managers), and in only one case was it seen as a new way to manage people, suggesting that RW is seen more as a benefit more for the employee than for the company.

According to the Portuguese data, the concept of RW is linked to autonomy, flexibility, self-management and the use of communication technologies. Hence, the hybrid model is also defined as the possibility of choosing to work some days in the office and others outside it. Following this definition, the mixed model between RW and face-to-face is the trend.

Considering this evidence, P1 was accepted, meaning, “The definition and application of RW has changed with the organisational experiences during the pandemic scenario (2020-2022)”. Similarly, P3 can also be confirmed, meaning that, “As a result of the organisational experiences during the pandemic scenario (2020-2022), use of RW is the predominant trend.”

Which are the main (dis)advantages of RW for organisations?

Notwithstanding the fact that RW has been widely adopted by organisations and it is not possible to go back to a traditional format (face-to-face mode only), the advantages and disadvantages of this mode of work were also questioned.

Italy

More flexibility and a better work-life balance were the two factors mentioned by all the organisations. Remote working permits a large flexibility to choose the timing, the place and the way to manage the job, and also to perceive the need of the other colleagues, i.e., managing a timetable of when to meet and when to work autonomously. Remote work is appreciated mainly for guaranteeing the opportunity to spend more time at home, to manage home tasks and to gain a better work-life balance. It also fulfils the expectations of younger generations for whom work-life balance is a fundamental condition in accepting a new job position. For some organisations, the value of RW also lies in reducing costs, both for employees (travel) and for the company (logistics, electricity...).

The common risks perceived by the organisations were the social isolation of employees and its consequent stress, the difficulty of sharing ideas and values, scarce communication, and the risk of losing organisational commitment and engagement. HR directors were aware that a cultural change is needed to make RW an effective way to manage people in organisations, though the majority of them felt unprepared in this regard.

Italian companies saw RW as a point-of-no-return, and saw the future as being a hybrid formula where employees stay partially remote and partially in-office. Even if RW is seen as a benefit for the individual employee when it is a choice and not a duty, the criticisms are evident and currently without solutions. It is evident that a new culture is needed characterised by less organisational control and more autonomy and self-responsibility, and the results will be seen in the future.

None of the organisation had a specific plan for the career development of remote workers, as this was perceived as a way to discriminate remote workers, and hence they underscored the importance of equal treatment of both categories (remote and in-office).

Portugal

The flexibility of time and place can be a motivating factor for workers. It can help reduce absenteeism, increase resilience and allow for the reorganisation of work processes, making it easier to complete some tasks. It was also pointed out that the time and money saved on travelling and the ability to provide oneself with a more comfortable work environment increased the well-being of workers. Furthermore, organisations can recruit talent from around the world, enabling them to expand and internationalise. Using the right technological tools, work can be more effective and communication can be faster, enabling more meetings to be held with more teams/employees. Accordingly, new HR practices and policies are emerging.

However, some disadvantages were pointed out, namely issues associated with culture, loss of identity and disconnection from the organisation. Remote working increases loneliness and psychosocial risks by decreasing emotional connections, interactions and socialisation with colleagues, sustaining the state in which employees do not know each other. The available forms of communication also contribute to these problems as they are distance-based and provide less possibility for interaction. This may also result in a sense of inequality and less control over the work process. Thus, there should be greater emphasis on making team management and leadership more effective. Legislation has not kept up with this evolution, however, and hence there is a lack of legal frameworks for both RW and hybrid models and their associated problems.

These data strengthen literature that has noted the numerous advantages and disadvantages of RW, leading also to the acceptance of P2. Hence, the empirical evidence is also in line with what is discussed in the theoretical approaches presented above.

What kind of challenges has RW design posed to HRM?

Since 2022 and the easing of quarantine restrictions and the Covid-19 threat, the world of work has changed, bringing new challenges for HRM and pushing this management area to critically reflect on its role in organisations. New policies and new practices are being claimed as necessary, questioning the ability of HRM to provide an effective solution to the new problems brought by the new RW and hybrid work designs.

In Italy, the maintenance of RW after Covid-19 has been carried by employees more than by employers. Several laws have protected the right of employees to have the opportunity to work remotely, and both public and private companies have implemented different modes of work in respect of these laws. However, companies are still coping with the problems brought by this change and HR strategies seem inadequate to solve them. In particular, the choice to not differentiate HR development policies for RW or hybrid work seems to be a choice to not create inequalities through differentiated treatment, and to not make RW/Hybrid work employee feel stigmatised in comparison to their colleagues. The path seems easier for those companies that started out fully remote, or for companies (the minority in this case) where RW is also seen as an opportunity for the company.

In Portugal's case, the HR challenges arising from the new RW design were several. Because of autonomy, flexibility and self-management, many challenges will be posed to HRM, such as career management, recruitment, talent attraction and selection, performance evaluation, training, teamwork, information systems and knowledge management, among others. There is no going back from this new form of work organisation; new practices will have to be thought out and implemented, taking into account several factors: (1) management of different work schedules and workplaces, taking into account the asynchronies generated; (2) leadership and team management in different workplaces; (3) finding more effective forms of communication between people who are far apart, fostering proximity and the relationship between them; (4) working on culture and creating new strategies to foster a sense of belonging to the organisation; (5) updating technological tools that facilitate the two ways of working, as well as the information and knowledge management for organisations; (6) implementing new legislation adapted to the new labour dynamics resulting from RW and hybrid regimes; (7) identifying and resolving the new problems of workers' well-being (physical and psychological); (8) identifying and resolving the new problems associated with the balance between professional and personal life; and, (9) identifying new (and more) possibilities of internationalisation of HR and challenges associated with workforce diversity.

The results of this topic illustrate some of the practical problems that organisations and their human resource managers have been struggling with, which confirms P4, and reinforces the theory underlying this assumption.

4. Findings Discussion

Based on empirical evidence, it was possible to obtain two definitions: one for remote work and one for the hybrid model of work design. These definitions corroborate the latest literature. In parallel, the dimension of the advantages and disadvantages of RW in the post-pandemic scenario was also updated with the presented cases. The trends and prospects of RW were also raised by previous findings, matching the arguments in the current literature. Finally, some implications for HRM in these new configurations of work design were also raised by the two cases, which are reflected in the emerging research of this scientific area. Table 3 summarises the empirical evidence of reported cases and outlines some state-of-the-art theoretical evidence from the literature.

Table 3: Propositions State (P), and Empirical *vs*. Theoretical Evidences of RW from Covid-19 pandemic Scenario

Proposition state (P.)/Empirical Evidences	**Theoretical Evidences**
P1. Accepted *Remote Work: Definition and application* Portugal: It is linked to autonomy, flexibility, self-management and the use of information and communication technologies. Less control of work process. Possibility of employees to choose the place and the time/days to work. New concept of hybrid work design: Fulfilling objectives and goals and work deadlines, therefore the location and time is indifferent. Italy: It is linked to flexibility in choosing time and location, where IT is an essential issue, both as equipment and competences. It is intended mainly as a benefit for the worker than it is for the organisation.	Strategy of making work and labour relations more flexible (Piteira, 2020). The possibility of employees working remotely with the use of IT devices and office equipment "outside the employer's workplace..." (Wontorczyk and Rożnowski, 2022). Mode frequently used in crisis scenarios (Sapo and Spinks, 2002; Contreras, 2020).
P2. Accepted *Organisational (Dis)advantages of RW* Portugal and Italy: Advantages: employee motivation; effectiveness in resource management (less office expenses and logistics, more working time efficiency, etc.); ease in organising tasks and work, wider recruitment; less absenteeism; better quality of work-life/more comfortable work environment. Disadvantages: organisational disengagement; loss of cultural identity; employee isolation; problems with teamwork and leadership; communication barriers; lack of control over work processes.	Advantages: greater organisational and productive flexibility; reduced costs. For HRM: easier recruitment and outsourcing; greater retention and stability of qualified staff. Disadvantages: high initial investment in equipment, weakening the organisational culture; loss of control over work processes. (Greer and Payne, 2014; Dyczkowski, 2012).
P3. Accepted *Trends of RW* Portugal and Italy: Mixed model between RW and face-to-face, such as the trend	Remote work can guarantee a win-win

Proposition state (P.)/Empirical Evidences	**Theoretical Evidences**
is a hybrid work design. The hybrid scheme (some days at home and others in the company), for the functions that can be carried out remotely, is the prevailing one. In Italy, mainly triggered by employee requests and company concession. Italian law is supporting it as a worker's right. Different situation appears for companies initiated as a fully-remote organisations.	situation for employers and employees (Popovici and Popovici, 2020). RW future will to help drive economic growth, in a post-Covid-19 world, with the help of new public policies (Gupta, 2020).
P4. Accepted *RW and HRM/Organisational Challenges* Portugal: HRM policies have to be conceived in this new work scheme. Issues such as new logistics and equipment, hard/soft skills and new competencies, as well as behavioural and social factors are emerging. International HRM will be an emerging strength area of organisations with the challenge of managing workforce diversity. In parallel, the adjustment of the legal framework to this new reality, producing new legal norms/laws. Italy: The legal framework seems not to create large problems for Italian companies, the HR managers asks for a new model to apply where the risks of isolation and the loss of organisational identity can be reduced.	Flexible working preferences, smart working practices (Adekoya et al., 2022). New strategies to leadership, people's physical and mental recovery in the post-pandemic (Sharma, 2022). Changes on the labour market, workplace, and organisational practices, as well as on the strategies related to the ways in which these challenges (Tursunbayeva et al., Di Lauro and Antonelli, 2022). Highlighting the technology orientation, leadership, HRM practices, external processes and organisational culture (Arunprasad et al., 2022; Tursunbayeva et al., Di Lauro and Antonelli, 2022).

In sum, and regarding the research question *What is the role of remote work resulting from the emergent changes of the 2019 pandemic scenario in Portuguese and Italian organisations?*, RW played a critical role. It was a way to save organisations, workers and the economy. As the literature has discussed, RW had only been used in occasional crisis and disaster situations, such as earthquakes and floods. However, with the global health crisis inflicted by Covid-19, the relevance and timeliness of RW as a work-design model has been tested once again. Unlike past disastrous events where organisations returned to normal, this time the working landscape has changed and has drawn into question the most rigid and traditional models of full-time and face-to-face in-office work. As demonstrated in these cases, organisations are gradually adopting mixed-working systems with RW and the hybrid model.

In turn, organisational dynamics and HRM need to adapt to these new realities. The oldest models are becoming obsolete and incapable of dealing with the new problems faced by people in their work context. The main challenges are not only logistical issues and those due to new technological equipment and solutions, but also those of managing teams and people at a distance, the performance of tasks and the sharing of both information and knowledge, as well as behavioural problems related to communication and personal relationships. The practices of attraction, recruitment and selection, the definition of competencies and performance assessment, career management, and training, among others, will have to be thought over and reviewed.

5. Conclusion

The qualitative analysis herein has presented the opportunity to collect data in depth and to understand how the changes due to the lockdown have been disruptive for many types of organisations: public or private, manufacturing or service, small or large, Italian or Portuguese. A common sentiment among these organisations is captured in the idea that "we cannot go back". The world of HRM has changed and organisations are now operating with the awareness that this change brings risks and new needs to HR policies and practices.

Because of the small sample, the results cannot be easily generalised. Specifically for companies that started as fully remote, the situation can be seen as less problematic. Moreover, the present research has explored only the HR managers point of view. Employees' perceptions need to be explored with additional research. Also,

the present study considered only two countries, and it is possible that other countries reacted differently. We have seen, comparing Italy and Portugal, that Italian law seems to be perceived by HR as more effective in promoting RW. While there is more awareness about the importance of work-life balance for young generations, there are still doubts about how to effectively manage people in a hybrid mode. HR managers see these challenges as a big opportunity, though do not yet feel prepared to manage it. A conjunction of scientific research and application is also requested by companies.The implication of RW after the Covid-19 pandemic can be categorized into three areas: practical (for management and organisations); theoretical (new inputs on HR practices, remote working and change management); and methodological (reinforcing the importance of case studies and practice-based theory in a comparative analysis of the Portuguese and Italian contexts).

In theoretical terms, the considerable literature developed in this field has filled most major knowledge gaps. The data reinforced some of these theoretical assumptions by underlining their relevance and timeliness. In methodological terms, qualitative studies are less preferred within the scientific community than studies with large samples and aimed at making generalisations. However, the present study provides knowledge of concrete practical experiences, oriented towards gaining a greater depth of understanding of a recent impactful issue by taking a comprehensive perspective. The case study is thus reaffirmed as a method of inquiry for its importance in building knowledge based on practice and bringing possible new insights not yet discovered in the literature. Two European cases hav been presented, allowing for comparisons and providing practical implications of the study. Since the global pandemic (2020-2022), there has been a lack of knowledge regarding the role of RW and how organizations are managing it. Providing that knowledge is one of the major contributions of this work, which is done by highlighting concrete strategies (and respective problems/anxieties) of organisations from two European countries. These contributions will be useful for several societal agents and professionals (researchers/academia; organisations/managers/HR professionals; economic agents and policy makers).

However, further studies would be desirable in order to investigate more cases (more countries and organisations), make more complex comparisons, and develop an updated body of knowledge. Therefore, quantitative studies and the formulation of new dimensions of the problem are welcome.

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IC Theory and Public Healthcare

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Abstract: The healthcare sector is in crisis worldwide and under pressure from various trends such as digitalization, economic recession, population ageing, and workforce shortfall. This challenges in particular public sector healthcare management's ability to provide services and meet communities' growing expectations. Although the value of healthcare organizations is largely based on intellectual capital (IC), such as the experience and skills of professionals, knowledge available through relationships, codified knowledge, and organizational culture, knowledge-related literature in healthcare management has previously focused more on knowledge management activities than on intangibles and their management. Moreover, the public sector is the least examined area in the IC literature. The literature on this specific aspect – IC in public healthcare – has so far focused largely on identifying different aspects of IC rather than recognizing its value in action. To contribute to this knowledge gap, this article studies the role of intellectual capital in public sector healthcare management to elaborate on this critical component of organizational survival, renewal, and performance. This study aims to elucidate what this topical context requires of the application of IC theory and how it can advance the theoretical approach. Based on a literature review and preliminary empirical data gathered through thematic interviews with knowledge management professionals in a public healthcare organization in the throes of major healthcare reform, this article draws on the importance of intellectual capital in the public healthcare sector.

Keywords: Intellectual capital,Healthcare management, Public sector, Reform

1. Introduction

Healthcare is a highly knowledge-intensive industry as, according to Miles (1995), its economic activities are intended to result in the creation, accumulation, or dissemination of knowledge, which is a source of value creation (Grant, 1996) and of support for decision-making. The volume of healthcare data has led knowledge-related development to focus on reports, patient information systems, business intelligence, and data lakes. Although these measurable and technical dimensions of knowledge as a form of data and systems are important and form the basis of information and knowledge, there is a need to re-evaluate the role of intellectual capital in healthcare.

As is typical for all post-industrial knowledge-based economies, the predominant characteristic of healthcare is continuous and quick change. The healthcare sector is in crisis worldwide and under pressure from several different trends such as digitalization, economic recession, population ageing, and workforce shortfall (e.g., Liu et al., 2017). This challenges in particular public sector healthcare management's ability to provide services and meet the users' growing expectations. In Finland, public healthcare services are undergoing a major reform, in which the responsibility for organizing these essential public services has been transferred from the municipalities to larger wellbeing services counties mainly based on the regional division. The reform aims to improve the availability and quality of basic public services throughout the sparsely populated welfare country of Finland. In addition to the ongoing reform, public healthcare in Finland is facing the abovementioned global challenges of population ageing, lack of skilled labour, and rising costs of healthcare. Taken together, all these change factors challenge us to improve the effectiveness of services and find solutions from both intangibles and economics.

Although the value of healthcare organizations is largely based on intellectual capital (IC), such as the experience and skills of professionals, knowledge available through relationships, codified knowledge, and organizational culture (e.g. Grant, 1996; Evans, Brown & Baker, 2015), the knowledge-related literature in healthcare management so far has focused more on knowledge management activities than on intangibles and their management (e.g. Paoloni et al., 2020). Moreover, the public sector is the least examined area in the IC literature (e.g. Dumay, Guthrie & Rooney, 2015; Guthrie & Dumay, 2015). The sparse literature on this specific context – IC in public healthcare – has mostly focused on identifying various aspects of IC (e.g. Dumay et al., 2020) rather than recognizing its value in action.

To reduce this knowledge gap, this article studies the role of intellectual capital in healthcare management to elaborate on this critical component of organizational survival, renewal, and performance. This study aims to elucidate what this topical context requires of the application of IC theory and how it can advance the

theoretical approach. Based on a literature review and empirical data gathered through thematic interviews with knowledge management professionals in a public healthcare organization in the throes of a major healthcare reform in Finland, this article addresses on the importance of intellectual capital in the public healthcare sector. The contribution brings together two disciplines, intellectual capital management and health management, and presents preliminary findings of the interviews. The research questions are:

(*1) In what context is intellectual capital examined in healthcare management?*

(2) What further research avenues can be identified in this specific context?

The rest of the paper is organized as follows. The next section reviews the literature on IC by briefly presenting the concept and construct of IC and the recent research on IC in healthcare management. In section three, the critical areas of IC management in public HC will be discussed. Section four makes some concluding remarks.

2. Theoretical Background – IC in Healthcare

Intellectual capital is conceptualized as a combination of knowledge and competencies that can act as a sustainable competitive advantage for an organization (Roos et al., 1997; Stewart, 1997). Most of the value of healthcare organizations is made up of intangibles such as the knowledge, experience, and skills of the professionals and leaders; knowledge available through networks of internal and external relationships and institutional and codified knowledge stored in databases, organizational culture, and procedures (e.g. Evans, Brown & Baker, 2015). These intangibles are typically categorized as human capital (HC), relational capital (RC), and structural capital (SC) having separate constructs but also a strong interdependence constituting IC. All the constructs of IC help to ensure the success of the organization (Stewart, 1997). This paper examines IC in terms of its traditional three-dimensional categorization - human capital, relational capital, and structural capital.

Although it is stated that the modern knowledge economy organization's value is largely based on IC, especially in the service sector (e.g. Edvinsson & Malone, 1997; Grant, 1996; Sveiby, 1997) the literature on the role of knowledge in general in the healthcare context has focused on knowledge management, information management, and business intelligence (to name a few), with less attention paid to IC. Also, Paoloni et al. (2020) found in their systematic literature review concentrating specifically on IC in the healthcare context that most of the contributions still focused merely on KM activities rather than on IC itself. When IC was in focus, the contributions to structural capital were numerous but rare regarding relational and especially human capital (Paoloni et al., 2020). This is remarkable given the striking importance of human capital in the form of skilled, qualified, and experienced professionals. Evans & Baker (2015) conclude in their review that the utilization of an IC framework for healthcare organizations is relatively new, and thus the literature on IC in healthcare is growing but not advanced, and only limited organizations manage their IC systematically and strategically (Evans & Baker, 2015). Overall, the literature contemplates IC and healthcare from vastly different points of view (Paoloni et al., 2020).

We scrutinized the literature on intellectual capital in healthcare management to find out in which contexts the role of IC has been examined in healthcare organizations. As our interest is in the management of healthcare organizations (following the theoretical background of strategic management) we excluded medical literature and other healthcare industries (e.g., pharmaceuticals and research). Conceptual articles and literature reviews were likewise excluded. The literature examined was from the private, public, and non-profit sectors. A remarkable feature was the considerable number of Italian studies.

The role of IC in healthcare has been examined from vastly different points of view: The role of IC in the performance of healthcare organizations (e.g. Alfiero, Brescia & Bert, 2021; Pflugfelder & Ng, 2022), the role of IC in the sustainable development of healthcare (e.g. Cavicchi & Vagnoni, 2017), IC in digitalization (e.g. Ratia, 2018), the role of IC in innovations (e.g. Kucharska, 2021), the reporting of IC in healthcare (e.g. Dameri & Ferrando, 2021; Nicolò et al., 2023), and IC in the COVID crisis (Paoloni, M. et al., 2022). Specific to the healthcare context is the middle-range theory of Nursing Intellectual Capital (NIC), which consists of human capital and structural capital but does not include relational capital. The role of NIC has been studied, for example, in relation to cross-cultural competence (Lin, 2015) and patient outcomes (Covell & Sidani, 2013). Considering the current shortage of healthcare professionals (e.g. Liu et al., 2017) NIC would be a valuable construct for further research.

The fundamental importance and multidimensionality of the health sector justifies various approaches. Performance in healthcare is expressed by a multitude of indicators (e.g. effectiveness, productivity, quality of services, employee satisfaction, availability of services etc.) and examined from several different points of view

in the articles reviewed. In private sector studies, the emphasis was more on economic factors (e.g. Tiwari, 2022; Pflugfelder & Ng, 2022; Peng, Pike & Roos, 2007). By contrast, studies on public sector performance provided richer views on performance. Performance was expressed, for example, in terms of employee satisfaction (Torre et al., 2020), patient satisfaction (Fiano et al., 2022) or level of assistance (Alfiero, Brescia & Brett, 2021). In summary, intellectual capital and its components play a pivotal role in performance in diverse ways (e.g. Fiano et al., 2022; Tiwari, 2022; Pflugfelder & Ng, 2022; Torre et al., 2020).

Sustainability in healthcare is also a multifaceted phenomenon (Jameton & McGuire, 2002), including social, environmental, and financial aspects. The role of IC and its components (human capital, relational capital, and structural capital) in sustainable development of healthcare has been studied with growing interest especially in the public sector (e.g. Cavicchi & Vagnoni, 2017; Cavicchi, 2017). Also, Al Issa et al. (2022) examined the role of green intellectual capital (GIC) dimensions in sustainable healthcare in public and private organizations. A case study has been carried out in Italy using Integrated Reporting to disclose the level of intellectual capital in a non-profit healthcare organization (Dameri & Ferrando, 2021). Dameri & Ferrando utilized the International Integrated Reporting Framework (IIRF) (Abhayawansa et al., 2019), which broadens the reporting to considering six types of capitals— financial, manufactured, intellectual, human, social, relational, and natural— and considers IC and its components as sources of value (Cheng et al., 2014). Integrated reporting may enable integrated management and better disclosure of IC to meet various stakeholders' expectations (Dameri & Ferrando, 2021).

Kucharska (2022) examined how tacit knowledge influences intellectual capital and innovativeness. The public and private healthcare sectors were compared, and the findings were that public healthcare organizations are less innovative than private ones due to more externally determined IC components than in the private sector. A few articles examined intellectual capital in relation to digitalization from quite varied aspects. Ratia (2018) studied how exploiting business intelligence (BI) tools and IC can create value in the private healthcare sector. Schiavone et al. (2021) analysed the role of intellectual capital in driving the construction of a measurement system of a digitalized health network. Paoloni, P. et al. (2022) explored in the context of remote care services how IC (specifically relational capital) and knowledge-sharing can contribute to the achievement of sustainable development in non-profit health systems.

One article examined the topical COVID-19 pandemic and the role of relational capital in overcoming the crisis in Italian public and private hospitals (Paoloni, M. et al., 2022). The study confirmed the essential role of intangibles, namely relational capital, during periods of uncertainty.

Overall, the literature is still quite sparse and diverse as pointed out in earlier reviews. However, the recent research published after the literature reviews of IC in healthcare by Paoloni et al. (2020) and Evans, Brown & Baker (2015) contribute to the topics reflecting growing pluralism and a wider societal view. This is even more prominent in studies of public sector healthcare compared to those on the private sector, reflecting the growing demands for transparency, sustainability and participation by society and citizens.

3. Critical Areas of IC Management in Public Healthcare

The literature on the public sector is one of the least examined in IC literature (e.g., Dumay, Guthrie, and Puntillo, 2015; Guthrie & Dumay, 2015) even though the public sector contributes a considerable proportion of GDP in most economies (e.g. Dumay, Guthrie & Farneti, 2010). The use of IC in practice in the public sector has been scant and only few articles have explored IC in the public sector. Based on the reviewed literature the critical areas of IC management in public healthcare relate to the following questions: 1) how to define performance, 2) how sustainability is considered, and 3) how the role of intellectual capital and its components are changing while the operating environment changes with accelerating pace. Since little research has been done on this topic in the public HC context, the specificities of the context should be considered.

Kianto & Cabrilo (2022) highlighted earlier the need for the reconceptualization of intellectual capital theory. While their proposals were largely based on findings from private sector organizations, our research complements these findings with the public sector view. Public sector-specific features were found especially when examining the role of IC in sustainable development (e.g. Cavicchi & Vagnoni, 2017), and the role of IC in performance. In public sector research, performance was manifested in numerous ways, and the role of IC studied in relation to patient satisfaction (Fiano et al., 2020), employee satisfaction (Torre, Tommasetti & Maione, 2020) and level of assistance (Alfiero, Brescia & Bert, 2021), reflecting the growing importance of participation, transparency, and effectiveness.

Digital competence was proposed as a newly emerging feature of human capital (Kianto & Cabrilo, 2022), including abilities, skills, and attitudes enabling work in the digital era (Murawski & Bick, 2017). While digitalization is also a major driver of change in healthcare, it is quite surprising that in our review the research relating to the role of IC in digitalization remained quite minor. This may reflect the hectic pace of eHealth evolution in practice, which exceeds the speed of the scientific research process but may in the near future lead to a rise in the research on digital competence. It is also possible that digitalization blurs the boundaries of the intellectual capital components by transforming human capital into structural capital at an increasing pace. One striking example is the rapid rise of artificial intelligence (AI) and its applications (e.g. Biswas, 2023).

Kianto and Cabrilo (2022) also proposed that gig work and other contingent work should be acknowledged as an important aspect of human capital. Gig-workers are not common in the public healthcare sector, but it is a well-known phenomenon in Finland that a significant part of the administrative development work of public healthcare organizations is done by external specialists (e.g., consultants, hired project managers etc.). Moreover, the share of temporary agency nurses and doctors is remarkable. These observations support the need for further analysis of the implication of external or short-term workforce on organizational culture, trust, and organizational structure, as Kianto & Cabrilo (2022) stated.

An open and entrepreneurial culture was proposed as an important facet of structural capital (Kianto & Cabrilo, 2022) supporting, e.g., collective intelligence. Traditionally the public sector has not been seen as an open and entrepreneurial work environment but rather as a fairly hierarchical and rigid place to work (e.g. Parker & Bradley, 2000). Our preliminary results from interviews support the importance of an open and entrepreneurial work environment (also) in public sector health care:

> *"I think we have a very open atmosphere at that point. There are no things that could not be talked about and [we have] an unwritten agreement that if you sometimes feel that something did not go as it should have gone, you can trust that it will be raised right away. […] we have invested in team building in the early stages […] systematically […] keeping up a continuous dialogue."*

> *"[Organization culture,] that's what it's all about. […] How people want to take responsibility. […] want to learn new things. […] I think that it should be nice to be at work. If you come to work for your salary [only], then it's not the kind of culture with which our unit can succeed. […] we need to be a kind of place that people want to stay."*

> *"[…] competition [for employees] is fierce, so in that sense, too, culture [is important] and success in it is a really important factor […]. In a way, we could have a pretty high threshold for leaving us, [people staying] because of internal motivation."*

Moreover, our preliminary results from the interviews highlight the growing importance of relational capital in the form of relationships and networks in the public healthcare organizations due to complexity and importance of healthcare sector:

> *"[…] the existence of [our department] is based on cooperation, we cannot [...] act alone."*

> *"Well, this is really, really strongly about networks. Like cooperation, and now especially the building of cooperation."*

> *"Relatively good contacts […] through the different backgrounds […]. […] here in the organization, with different parties, so that we can get involved and participate in whatever we need to […]. So that's where [our] strengths are especially."*

> *"It is important that we have good contacts to governmental bodies."*

These observations further encourage us to reconsider the theory and concept of IC in the public health care sector regarding human capital, relational capital, and structural capital.

4. Concluding Remarks

A well-functioning healthcare system is vital both socially and for individuals. Public healthcare ensures equality and well-being and thus contributes to preventing the emergence of differences in well-being. The Finnish healthcare reform aims at better performance of the healthcare systems in the ever-changing environment.

The acknowledged model in modern complex change underlines the wide involvement of organizational actors and empowering the organizational culture (e.g., Hendry, 1996). We need to further increase the

understanding of the role of intellectual capital in the public healthcare context to ensure the embracing, recognizing, and managing of intangibles.

In our perspective, IC should not be narrowly understood as stable and undynamic assets or stocks of knowledge embedded in individuals, relations, or organizations. Instead, we should raise our eyes to IC as a vital driving and dynamic force (Singh & Rao, 2016) and broaden the view beyond the organizational boundaries to see how managing IC could help healthcare, associated ecosystems, and future societies in current and forthcoming transformations. More research is needed to identify the specificities of the public sector regarding IC.

We continue to examine this topical issue through a literature review and interviews with healthcare management professionals constantly renewing the healthcare in the midst of public reform.

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Data-Driven Approach in Knowledge-Based Smart City Management

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Abstract: The concept of smart city management is based on the implementation and use of advanced technologies, such as wireless sensors, intelligent vehicles, mobile networks, and data storage technologies. It involves integrating various information and communication technology solutions to efficiently manage a city's resources. Cities are investing in data-driven smart technologies to enhance performance and efficiency, thereby generating a large amount of data. Finding innovative ways to use this data helps improve city management and urban development. A data-driven city utilizes datafication to optimize its operations, functions, services, strategies, and policies. Datafication involves transforming various aspects of urban life into computerized data and extracting value from this information. This transformation is dependent on controlling the storage, management, processing, and analysis of the data, as well as utilizing the extracted knowledge to develop useful smart city solutions. Access to real-time data and information enables the provision of effective services that improve productivity, leading to environmental, social, and economic benefits. Both current and future smart cities have the potential to generate vast amounts of real-time data due to complex physical infrastructure and data-driven applications supported by social networks. This paper investigates how the emerging data-driven smart city is practiced and justified in terms of its innovative applied solutions. The aim of the paper is to explore the general conditions for implementing advanced data-driven technologies for smart city management, using knowledge from literature analysis and case studies. To understand this new urban phenomenon, a descriptive case study is used as a qualitative research methodology to examine and compare the possibilities of implementing data-driven approaches in knowledge-based smart city management. Seventeen case studies that use data-driven applications in real-world settings were identified from secondary sources and evaluated based on smart city indicators and related data-driven applications. Smart Cities were selected based on their rankings in the Digital Cities Index 2022, the Smart City Index 2022, and the IESE Cities in Motion Index 2022.

Keywords: Smart city, Data-driven applications, Smart applications, Knowledge-based smart city management, Datafication, Data-driven smart cities

1. Introduction

The development of technology provides opportunities to build smart cities. In the current understanding of the concept of a smart city, there is a focus on knowledge management because smart cities have the potential to generate large amounts of data. The management of this data creates opportunities for improving smart city solutions. Peng, Nunes, and Zheng (2017) defined a smart city as a city that utilizes advanced technologies such as wireless sensors, smart meters, intelligent vehicles, smartphones, mobile networks, or data storage technologies.

The concept of a Smart City aims to utilize modern technologies, particularly information technologies, to enhance the quality of life and support urban development. The idea of constructing data-driven smart cities is becoming a reality due to recent advancements in urban development practices and technological solutions. The data-driven city represents one of the newest and future manifestations of smart cities. Cities are investing in data-driven smart technologies to enhance performance and efficiency, as well as generate a significant amount of data.

The literature does not pay much attention to the organizational and managerial solutions during the transition from a classic city to a smart city, therefore the paper try to explore the potential of the data-driven applications in knowledge-based managing of urban development.

The motivation for this study is to identify the core dimensions of the emerging data-driven smart city and to use the outcome to analyze, investigate, and develop guidance for data-driven smart cities of the future in terms of its technological components.

The aim of this paper is to investigate the general conditions necessary for implementing advanced data-driven technologies for smart city management. This will be accomplished by analyzing literature and case studies. A descriptive case study methodology is adopted to examine and compare the possibilities of implementing data-driven approaches in knowledge-based smart city management, in order to gain a better understanding of this new urban phenomenon.

This study investigates the practices and justifications behind the development and implementation of innovative applied solutions in the emerging data-driven smart city. In order to achieve the aim of this paper, two research questions were defined:

RQ1. How are the selected data-driven application for Smart City management currently used in the world's best practice?

RQ2. How is it appropriate to implement data-driven approach for Smart City management in general?

The structure of the paper is as follows: After this introduction, the next section presents the research methodology in detail. Then, the selected smart city solutions connected with data-driven applications are presented in the form of a case study. Finally, the research findings are outlined and discussed, implications are explored, limitations and future research are described.

2. Theoretical Background

Cities have the potential to generate vast amounts of real-time data due to complex physical infrastructure and social networks that are supported by data-driven applications. Due to the accessibility of real-time data, individuals and communities are increasingly presented with opportunities to engage in a variety of issues and processes that concern their lives (Bakıcı et al., 2013; Anthony, 2022). Knowing the identified challenges and the expected increase in the number of urban residents around the world, there is an increasing need for new and innovative ways to manage the complexity of urban life. The importance of smart cities derives from the future projections of a growing urban population (Pašalić, Ćukušić, and Jadrić, 2021).

Researchers identified four components of a smart city: industry, education, participation, and technical infrastructure. This list has been expanded and consists six main components (Giffinger and Gudrun, 2010). These components are smart economy, smart mobility, smart environment, smart people, smart living, and smart governance (Woetzel et al., 2018) :

- Smart mobility - data-driven applications are used to offer and monitor complex multi-modality systems of transportation to achieve sustainable transport systems that are efficient. Smart parking and smart traffic management techniques that are used to coordinate and integrate different transportation modes are part of smart mobility applications (Kaluarachchi , 2022; Cai, Hong and Xiong, 2022).
- Smart economy - innovation and productivity are employed to adapt to the market and workers' needs to enhance new resilient global business models for competing both locally and globally. Entrepreneurial innovation hubs where start-ups and business incubators are encouraged also belong in smart economy context. Public and private initiatives that foster the development of new smart projects are an essential part in setting up a comprehensive smart city economic ecosystem. When private sector-initiated innovations spring up, regulating, assembling key actors, offering subsidies, or changing procurement decisions are some of the ways governments can contribute (Mora et al., 2017)
- Smart governance can be achieved when citizens and other stakeholders are part of operations in cities, contributing to planning, supporting key decisions, and making processes with the help of smart platforms and applications. The aim is to attain synergies through collaboration and improve public services and the transparency of institutions to promote sustainable communities. Technology helps policy makers to engage, survey, and obtain stakeholder opinions on a range of matters and to incorporate public feedback when improving systems, processes, and policies. To be successful, new initiatives need to be transparent and accountable, engaging citizens from the inception of the project (Ruhlandt, 2018).
- Smart environment -sensors and other innovative monitoring systems can be used to collect data from utility services and networks including energy, air, water, and waste management to provide a more efficient service, conserve energy, and improve the life of citizens while achieving environment sustainability. Big Data can help in the coordination of wind and solar energy with traditional energy sources. Smart sensor data can be processed to find out whether a renewable energy source operates correctly. They can also assist in reducing pollution and promoting biodiversity. The availability of data and new analytical algorithms provide the ability to forecast and obtain a better idea of the impact that climate and environmental changes may have on human health. With this knowledge, the potential natural disasters can be more accurately identified, and cities can become better equipped

with warning systems to prevent the harmful impact of environmental factors on citizen's health and well-being (Marsal-Llacuna 2016; Anthony, 2020; Polese et al., 2021; Kaluarachchi 2021).

- Smart living- when public services and facilities are well managed through the use of new technologies and data-driven solutions, it becomes possible to create a secure, accessible, and healthy lifestyle, thus realizing the concept of smart living. Smart systems can enhance call centers, assist first responders at emergency scenes, and improve field operations during emergency responses. Response time plays a crucial role in emergency situations, so these services need to be integrated with traffic system controls, vehicle recognition applications, and speed management. Smart living also aims to promote better health and provide improved long-term medical treatments and applications that assist in preventing, treating, and monitoring various conditions (Geekiyanage et al., 2020).
- Smart people - data-driven smart applications that result in inclusive communities, provide educational opportunities, promote digital literacy, and grant access to digital platforms all contribute to the development of smart cities. This includes neighborhoods with free Wi-Fi, utility services powered by renewable energy, and new housing equipped with intelligent systems. However, the concept of smart cities also raises questions about equity and the need to ensure that all citizens have online access and are digitally literate, as many data-driven applications require smartphones or smart devices. Aging populations can particularly benefit from these types of applications, as they can be remotely monitored to detect and treat health issues early on and prevent hospitalizations, allowing seniors to live independently. When implementing the criteria for smart cities, it is important to consider the specific requirements of each neighborhood and community in order to promote digital culture and foster participation (Rathore et al., 2016).

The data-driven city is a city that implements datafication for enhancing and optimizing its operations, functions, services, strategies, and policies. Broadly, datafication refers to the collective tools, processes, methods, techniques, and technologies used to transform a city to a data-driven enterprise (Crawford and Schultz, 2014; Osman, Elragal and Ståhlbröst, 2022). The intensification of datafication is manifested in the radical expansion in the volume, range, variety, and granularity of the data generated about urban environments and citizens, with the aim to quantify the different aspects of urbanity in the modern city. In a modern data-oriented urban landscape, a city's performance is measured, assessed, and enhanced based on the ability of having control over the storage, management, processing, and analysis of the urban data, as well as on the knowledge extracted from these data in the form of applied urban intelligence. Tackling the challenges of sustainability and mitigating the negative effects of urbanization are among the key concerns of the datafication of the modern city (Bibri et al., 2020; Wu et al., 2022).

Smart cities include sensor networks and the connection of intelligent appliances to the internet, which is essential to remotely monitor their treatment such as power usage monitoring to improve the electricity usage, lighting, and air conditioning management. To achieve this aim, sensors can be extended at various locations to gather and analyze data for utilization improvements (Talari et al., 2017). Sensor services can be employed in projects regarding the monitoring of cyclists, vehicles, and parking lots. This data can feed into service applications that utilize an IoT substructure to simplify operations in air, noise pollution control, the movement of cars, as well as surveillance and supervision systems. A city with robust communication networks can rapidly and safely transmit the data collected by smart devices and other sensors. Open data platforms are another aspect of the data driven technology base and create large volumes of data that can become useful when built into smart applications. In most of these applications, data and connectivity are key in achieving efficient operations (Botta et al., 2016; Bokolo, 2022).

As cities are routinely embedded with all kinds of ICT forms, including infrastructure, platforms, systems, devices, sensors and actuators, and networks, the volume of data generated about them is growing exponentially and diversifying, providing rich, various streams of information about urban environments and citizens (Wang and Zhou, 2023). This data enables the real-time analysis of different urban systems and interconnects data across different urban domains to provide detailed views of the relationships between different forms of data that can be utilized for advancing the various aspects of smart city management.

3. Research Methodology

The research methodology used in this study is qualitative, and data and information were obtained from secondary sources. A case-study approach was employed to examine the role of data-driven smart city solutions in managing urban development. Many publications attempt to conceptualize and define the

elements and application domains that make up smart cities, often through case studies or comparative case study analysis. However, it is argued that there is a need for research on effective strategies for cities to become smarter. The purpose of this paper is to investigate the general conditions necessary for implementing advanced data-driven technologies for smart city management, based on insights gained from literature analysis and case studies. To accomplish this, a small sample of data-driven solutions implemented in various smart cities was selected, in order to study their impact on urban development and smart city indicators.

Data and information about data-driven smart city initiatives have been collected from secondary sources. The presented case studies were explored through desk research using online resources, such as the web pages of smart city initiatives. Scientific articles and studies that formed the basis for the literature analysis were searched for in relevant databases like Web of Science and Scopus. The strategy for finding relevant articles involved searching for articles based on selected keywords (smart city, data-driven applications, smart city management, datafication) and removing duplicate articles.

Smart Cities were selected based on their rankings in the Digital Cities Index 2022, the Smart City Index 2022, and the IESE Cities in Motion Index 2022. The table below (Table 1) presents the top results from these rankings.

Table 1: Leaders of Ranking Smart Cities according to world indices (Smart City Index 2022 Ranking, IESE Cities in Motion Index 2022, Digital Cities Index 2022)

Ranking	Index		
	Digital Cities Index 2022	**Smart City Index 2022**	**IESE Cities in Motion Index 2022**
1	Copenhagen	Amsterdam	London
2	Amsterdam	Barcelona	New York
3	Beijing	Berlin	Paris
4	London	Brisbane	Tokyo
5	Seoul	Brussels	Berlin
6	New York	Busan	Washington
7	Sydney	Chicago	Singapore

The Smart City Index, Digital Cities Index and the IESE Index were selected on the basis of temporal and thematic relevance, as they reflect the current results in several indicators, which are the priority indicators of city's technological development.

Descriptive case study research here involves describing, analyzing, and interpreting the current nature, composition, and processes of data-driven smart cities. The focus is on the current conditions and how these cities behave in terms of what has been achieved, specifically in the form of data-driven smart city solutions.

4. Results and Discussion

This section presents data obtained through secondary analysis of best practice strategies from selected smart cities, including comparison and key findings. A sample of 17 case studies that use data-driven applications deployed in real-world settings were identified from secondary sources and evaluated based on smart city indicators and related data-driven applications. The results are presented in Table 2.

Table 2: Data-Driven Smart City Applications Categorized According to the Smart City Indicators

City	Data Driven Applications	Smart city indicators
Copenhagen	Citizen participation, fast broadband and mobile connections, smart energy incubators and energy labs, smart transport systems, and open data platforms	Smart governance Smart environment Smart mobility Smart economy Smart people Smart living

City	Data Driven Applications	Smart city indicators
Amsterdam	Citizen participation, smart lighting controls for energy efficiency and saving, improved safety, traffic reduction, digital platforms for citizens, open databases, opportunities for smart entrepreneurs	Smart governance Smart environment Smart mobility Smart people Smart living
London	Citizen participation, green and smart technology application in transport and parking, pollution and congestion control, innovation in entrepreneurship, digital platforms for citizens, and open databases	Smart governance Smart environment Smart mobility Smart economy Smart people Smart living
Barcelona	Combined information, communication and green technologies, smart water efficiency, smart public transportation, participatory democracy, open databases, and opportunities for smart entrepreneurs.	Smart governance Smart environment Smart mobility Smart economy Smart people Smart living
New York	Digital tools to share information to overcome crime, innovation in entrepreneurship opportunities, open Wi-Fi, infrastructure management system, online transportation control system, and open data initiative: "Making city data open"	Smart environment Smart mobility Smart economy Smart people Smart living
Beijing	Intelligent urban infrastructure, sharing data and public services for healthcare and education among cities, and digital platforms	Smart mobility Smart people Smart living
Berlin	Mobile remote health monitoring, smart metering, smart transport systems, services to assist and support entrepreneurship, and open data platforms	Smart environment Smart mobility Smart economy Smart people Smart living
Paris	Smart applications for lighting, road circulation, waste management, and environment monitoring, extensive public Wi-Fi network, online transportation control system, and open databases	Smart environment Smart mobility Smart people Smart living
Brisbane	Smart infrastructure, economic growth and environment sustainability, community involvement in urban city decisions, and services to assist and support entrepreneurship	Smart governance Smart environment Smart mobility Smart economy Smart people Smart living
Tokyo	Energy efficiency, digital connectedness, waste	Smart environment

City	Data Driven Applications	Smart city indicators
	management, fully automated buildings, smart street lighting and meters, intelligent urban infrastructure, digital platforms, and smart mobility management	Smart mobility Smart people Smart living
Seoul	Energy efficiency, business productivity, healthcare and public sector services, services to assist and support entrepreneurship, intelligent transport systems	Smart environment Smart mobility Smart economy Smart people Smart living
Brussels	Energy efficiency through smart sensors, smart mobility systems, real-time transportation information, waste management, and environmental monitoring.	Smart environment Smart mobility
Busan	Cloud infrastructure connecting shared applications, geographic information and intelligent transportation, digital platforms, and open data systems	Smart mobility Smart economy Smart people Smart living
Washington	Citizen participation, open data and open government, IT cloud, equitable justice delivery system, online communities, smart grid, and digital evidence management	Smart governance Smart environment Smart mobility Smart economy Smart people Smart living
Sydney	Smart lighting system that utilizes sensors, smart waste management system that uses data analytics, open data platform, intelligent transportation system, and public services for healthcare and education	Smart environment Smart mobility Smart people Smart living
Chicago	Digital government portal with language support, open data and open government, IT cloud, online communities, smart grid, and digital evidence management	Smart governance Smart environment Smart mobility Smart economy Smart people Smart living
Singapore	Energy efficiency, intelligent transportation system, healthcare and public sector services, environment monitoring system, services to assist and support entrepreneurship and business productivity	Smart environment Smart mobility Smart economy Smart people Smart living

The results illustrate that the majority of smart cities use data-driven applications in all categories to improve operations and achieve efficiency. Smart mobility, smart living, smart environments, and smart economy criteria are implemented quite commonly, while smart governance criteria are relatively new to be implemented.

Smart mobility and transport concepts have been implemented in cities for some time and cover a wide range of criteria. Data-driven applications systems that provide smart transportation systems management were employed in all surveyed cities. A variety of data-driven traffic control systems have been implemented for

the efficient performance of city services and include interactive notifications of parking availability and distribution, bike and car sharing, digital public transit payment, predictive maintenance of transportation infrastructure, real-time public transit information, and road navigation. These applications support agent-based simulations of transport systems and many encounters they can face so that complex systems that incorporate and respond to a multitude of entities, including the shortest routes, minimal waiting times, and diversions aware from traffic congestions, can provide the optimum traffic solutions.

Smart economies support entrepreneurship and a culture of innovation, and 11 cities in the sample were implementing data-driven smart economic concepts embracing an open approach to support innovation and providing opportunities for entrepreneurs. An emerging trend is also to initiate innovation hubs. Smart economy examples present in the sample are public-private partnerships that bring together municipal agencies, educational institutions, non-profit agencies, private-sector companies, and start-ups that put people at the center and use technology to unite the city.

In data driven smart cities, Big Data and analytics help utilities providers to gain operational efficiencies in smart environments. Organizations and citizens consider how to maximize the use of resources while preserving them, and 15 case study examples were utilizing smart environment techniques.

Data-driven application systems that provide digital platforms and promote digital literacy in citizens to engage in digital services come under smart people city services, and 16 examples were identified in the case study sample. Many government departments and authorities have added new digital infrastructure, new roles, and personnel to support digital services to promote people using smart networks. Establishing data science teams and analytic units distributed in all sections of the government to support these services are essential in this effort.

City governance can be influenced by technology and by changing the relationship between the local authorities and citizens. In the case study examples, 7 cities were using smart governance systems. With the aid of data-driven digital platforms, citizens can engage in dialogue with local authority officials and agencies via interactive mobile apps and social media platforms.

From the surveyed cities, 16 cities were implementing criteria listed under smart living. While improving security and health, data-driven technologies can improve the quality of life by facilitating engagement in culture and arts and include online information sharing, ticketing, and reservations. In the sample, smart security measures implemented include real-time crime mapping that utilizes data and statistical analysis to highlight potential conflict areas and patterns and predictive policing that could anticipate crime to prevent incidents before they occur. Other measures present included promoting culture and leisure activities and health and security monitoring by smart systems.

The study results illustrate that smart people, smart living, and smart governance criteria are integrated and play an important role as smart mobility, smart environments, and smart economy. Smart mobility is the most widely implemented technological, whilst smart governance, a relatively new phenomenon. This demonstrates that even though some cities have not received highly technical infrastructures, they are still opening to new, transparent, and participatory governance approaches where citizens play a key role.

The study results suggest difference in the smart city indicators with regards to their implementation. The development of smart people, smart living, and smart governance concepts illustrate that the current new wave of smart cities is realizing the importance of human and social capital in future cities. These shifting paradigms give insights to policy makers, urban planners, and designers in prioritizing resources and implementing future city strategies. Access to real-time data can result in digital literacy and digital culture that improve public participation, online deliberation systems, and societies of urban futures. Data-driven smart cities are also places where entrepreneurs can innovate, and technology can contribute to improve the quality of life, security, protection of nature, and the way forward for future cities.

Access to real-time data and information can provide effective services that improve productivity, resulting in environmental, social, and economic benefits. It also assists in the decision-making process and provides opportunities for community engagement and participation by improving digital literacy and culture.

5. Conclusion

Cities today generate and act as huge repositories of information and real-time data. When collected and systematically organized, this data can be stored, shared, and applied to provide new ways of services and applications that can influence lifestyles. This capability of cities to collect data via sensors and other smart

devices are resulting in large data bases that are difficult to manage and use. Real-time data can be utilized to improve connectivity, information sharing, and performance, resulting in data driven cities and societies. There is a global movement to open up public data and make it more accessible to application innovation, to create novel mobile apps and services, and promote the transparency of governments.

Current trends in smart cities include intelligent, data-driven technology and its applications that can facilitate citizen participation and support decision making and policy formulation. Hence, novel ways of governing that engage stakeholders are emerging and are capable of collecting ideas, anticipating trends, as well as planning and evaluating policy, all in collaboration with citizens.

There has been significant progress in the utilization of data-driven applications to perform and oversee various urban functions in recent years. These smart applications, driven by data, enable improved governance and operational implementation by enhancing public participation. They can facilitate innovation, promote information sharing, and engage communities to enhance the city's overall performance. In order to fully leverage the potential of data-driven applications, cities need to integrate them into their existing data strategies, while also addressing new challenges and continuously refining their processes. By embracing data-driven applications, future cities can benefit greatly in terms of achieving performance efficiencies, mitigating the impact of climate change, and enhancing the quality of life for their citizens.

Big Data can promote innovations and create new paradigms. The importance of being digitally literal, being connected to online services, and having access to real-time data has been further exacerbated where many essential activities are carried out remotely via digital online methods.

However, it is clear that the selection of several case studies is a limitation of this research. It is therefore important to explore the potential of data-driven smart city solutions in urban development and city management in more detail by considering more cases. Nonetheless, the analysis of best practices in selected case studies the smart city model for the city can provide useful insights and practical guidelines.

The study was based only on a qualitative approach, so the results are restricted to understanding, explaining, and demonstrating of how the selected smart city dimensions can be integrated into the effective knowledge-based urban development management.

At the same time, the paper launches the opportunity for future research on the smart city concept more targeted on issues related to smart governance and active involvement of citizens in smart initiatives.

Moreover, as this study has demonstrated that applied technological solutions already exist across the selected cities, it would be extremely useful to conduct a wider and more varied comparison involving more other cities with a view to revealing more general trends in data-driven smart city management.

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Academic Development Through Course Enhancements: Becoming Reflective Practitioners

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Abstract: Working in Communities of Practice (CoP) when developing student support in courses, may also have an impact on the academic learning. In CoP's scholars can meet up to discuss, solve issues and develop new solutions. It is an arena for reflection on action, retrospective reflection and for meta-learning. In this paper we will present how two lecturers have co-developed knowledge through knowledge sharing, discussions and projects with students. The two lecturers have different background regarding education teaches within the same main area; organizational theory and development, and Knowledge Management. By sharing tacit and explicit knowledge when co-developing support for students learning, their own reflections support our learning process. Through reflection before action when developing the initiatives that we want to test out on students, reflecting in action when we deploy the initiatives, reflect on action when we evaluate the initiatives and reflect retrospectively together longer after deploying the initiative, we learn and develop not only as academics but also as reflective practitioners. This is also what we want for our students. Through several years we have developed the courses in the study programme of Knowledge Management at the Inland Norway University of Applied Sciences, Norway. The development has exclusively been to support students learning outcome and work relevance of the different courses. The latest initiative is about video-feedback and how this can support the students enhanced learning outcome. We are investigating what the students claim will provide them with yet another tool for learning and that will improve their academic skills. Through the process of working with this project and utilizing our knowledge of the different ways of reflection, knowledge sharing, cooperation and collaboration, we have learned from the project and our process. Hence, our meta-learning may also benefit our students as we as reflective practitioners can help our students become reflective practitioners, too.

Keywords: Reflective practitioner, Knowledge sharing, SECI-model, Meta-learning, Situated learning

1. Introduction

Organizations are affected by a number of different issues, both internal and external. An important feature of development is that many organizations to a larger extent need to relate and adapt to demands and expectations from their surroundings and respond to them. There are for example several ways of providing products to a market. From providing a finished product to the market production has sometimes adapted to the markets by inviting the public to co-produce products. It is not uncommon to work in ecosystems developing services and products without knowing the full extent of what the economic benefits will be. There are different ways to stay relevant in a market, but many organizations use experimenting and learning as a way of adaption which presupposes the organization to be structured regarding capturing and utilize the knowledge acquired. Academic organizations need to work systematically and targeted building internal competencies, which may require an internal process of awareness over time regarding being in tune with the requirements from the surroundings rather than jumping on passing fads.

In order to stay relevant, on top of the competition and up to date one needs to develop the product to meet the market. Our business is academia and our products are our courses and study programmes. We thus need to be up to date regarding supporting the students learning outcome. This means that we need to be agile about every feature of the education. The curriculum has to be up to date, the way it is being taught needs to be accordingly, and the assignments and exams even need to be supporting the students learning process. Having already supplied the curriculum, utilized student active learning methods, such as "flipped classroom", and student involvement in the development of assignments and exams, the "only" piece left was the feedback on the assignments.

From previous investigations we knew that students appreciate feedback and supervision (Haave, Hole and Vold, 2016) Since the Knowledge Management (KM) study programme does not have a separate major assignment (like a bachelor thesis or similar) the feedback must be on the assignments provided during the courses. Hence, this was what we embarked on; providing the students with video feedback in order to make the feedback personal and as a support for the further learning process.

The way to do this was also to develop ourselves as academics and academic practitioners. We needed to utilize Knowledge Management theories in order to develop and adapt.

We are three authors to this paper, where two of us are also the informants and lecturers in the different courses. Hence, we are doing research in our own organization and on our own work practices.

Our research question would thus be:

How can we utilize the meta-learning from the research to become better practitioners?

In order to aid this process, we needed some sub-questions to operationalize our quest to become reflective practitioners. The first sub-question would be:

What KM theories will be important for our development?

The second sub-question should be concerning how this could be developed into a model for meta-learning in order to secure that even future research on future developments can be managed:

- How to develop a model for meta-learning from developments and adherent research?

The reason why we highlight this as a topic, is that very little time is allocated for reflective work amongst lecturers at our university, just as it is often little or no time for reflections for learning in organizations in general (Raelin, 2002). Here we show the development undertaken as a result of a reflective process.

In the following we will present the case in more detail before we suggest the theoretical foundation that will enlighten our study. We will then discuss the methodological choices and challenges before we discuss our findings and conclude.

1.1 The Case

The study programme in question is the Knowledge Management Study programme consisting of four courses; two in the autumn and two in the spring.

Table 1: Overview of Courses in the Knowledge Management Study Programme

Autumn	Spring
Learning Organizations 7,5 ECTS	Knowledge Management 7,5 ECTS
Service Management 7,5 ECTS	Quality Management 7,5 ECTS

The development has always been on staying relevant regarding the curriculum, as well as continuously developing student active methods. The latest development through the last two semesters have been to refine how the students themselves are enabled to develop assignments and video recorded feedback on these assignments in order to enhance the learning outcome.

In the autumn the research amongst the students were about facilitating for their improved understanding of the curriculum for supporting their skills regarding transforming their knowledge into assignments, and also to provide the students video feedback on their assignments in the Learning Organization course, and "ordinary" written feedback in the Service Management course.

Learning more about the facilitation process and how to provide better video feedback, was taken a step further for the Knowledge Management course. The research is still ongoing, as is the meta-learning from the case.

2. Theoretical Foundation

First of all, we need to explore how to become reflective practitioners. Donald Schön explained about how to utilize reflection for learning purposes (Schön, 1984, 1987). It is about gaining new insights of not only practices but also oneself through and by experiencing. Reflection is central in Schön's works. He strongly promotes to reflect "in action" and "on action". Reflection in action is about reflecting as one is actively experimenting. Reflection on action is about reflecting retrospectively on an action in order to learn from the situation and to see what could be changed for future situations (Boud, Keogh and Walker, 2013). Much similar to the military's "hot washup" or After Action Review (Morrison and Meliza, 1999; Keiser and Arthur Jr, 2021), it is about evaluating and learning from the experience. Often in organizations, one does not take the time to reflect (Raelin, 2002). Hence, some opportunities of learning from experiencing are lost.

Since we are "learning by doing" and learning by experiencing, we also need to turn to the experiential learning theorist that was heavily influenced by the American pragmatist John Dewey; David A. Kolb. Kolb (2014) proposed the experiential learning cycle where one have an concrete experience that one reflects upon, then draw the perceptions into abstract concepts of the experience and feeds preparing new active experimentation. This cyclic way of learning from experiencing supports a constructivist learning approach.

Working together with a common interest may also resemble working as a Community of Practice (Lave and Wenger, 1991). Being able to draw on each other's experiences and knowledge as well as practicing situated learning provide the learners (here: the lecturers) with a knowledge sharing opportunity. Reflecting in and on action when working on facilitating for the students to understand not only the curriculum, but also be able to utilize the curriculum to develop assignments, either made up or from their own organizations, is important for our learning process so that we are able to improve our efforts. The reflections we do as a CoP provide us with a broader perspective than if we were to reflect on our own. The most important regarding CoP's are the relations that may be considered the "glue" combining the people. A CoP require a psychological safety (Edmondson, 2019) to ensure that the issues addressed are important to solve. Regarding teams it is easier to talk about issues that one agree on (Hjertø, 2013), but to obtain progression one have to address issues that are challenging, but then it is important that there is a culture that support this. In a CoP it is important to promote engagement that foster learning and provide for incrementalism. Guidance, dialogue and compromises are important for work in CoP's, which in turn require a culture based on psychological safety and that contribute towards more underlying and challenging aspects are brought forward in the CoP's.

Having been lecturers for nearly two decades, there are things that we do that would be categorized as *tacit knowledge*. In order to share this knowledge, the SECI-model (Nonaka, 1994; Nonaka and Takeuchi, 1995) may prove useful. The SECI-model was first described by Nonaka (1994) and put to a greater organizational use by Nonaka and Takeuchi in their seminal work "The Knowledge-Creating Company" (Nonaka and Takeuchi, 1995). Tacit knowledge as described by Polanyi (2009) is knowledge that is not possible to verbalize as it is generally knowledge that you develop by experiencing. However, Nonaka and Takeuchi suggested a model that transforms tacit knowledge to explicit knowledge through socialization and externalization. By socializing with others, it is possible to externalize the knowledge and thus transfer it to others who have to combine the knowledge with their previous knowledge. Then this knowledge needs to be "practiced" in order for it to be internalized and thus become the tacit knowledge of the receiver of the knowledge.

There are several approaches regarding learning organizations. One of the features of a learning organization is that they share knowledge (Filstad, 2007; Senge, 2014). The SECI-model describes how one can share tacit knowledge in organizations (Nonaka, 1994; Nonaka and Takeuchi, 1995). In short it describes how tacit knowledge can develop and be shared in the workplace through four phases and the process is circular rather than linear.

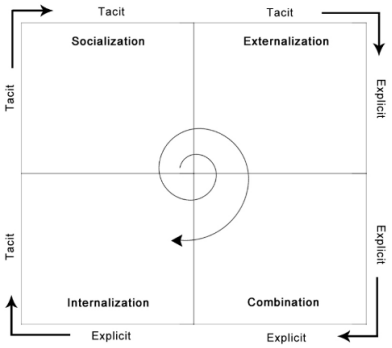


Figure 1: The SECI-Model (Nonaka&Takeuchi, 1995)

Regarding socialization, it is possible to learn via other ways than language alone. For example, one may look and learn, and even imitate what others do. Socialization is also when one work together and share each other's experiences. Apprenticeship is an example of master and apprentice working together learning by observation and practicing what is observed.

Externalizing is about verbalizing the tacit knowledge, and about telling stories to new and other workers. Explicit knowledge will however never bring out all the aspects of tacit knowledge.

Combination is about combining explicit knowledge with new explicit knowledge. For example, one may have learned about how to organize routine descriptions in order to develop this in one's own organization, or one may have learned about how to perform certain services, but different situations require different handling.

Internalization is about transforming explicit to tacit knowledge and becomes an integral part of the individual's knowledge repository.

Preferably, it is to be a continuous process in the organization (Sarpong, Maclean and Alexander, 2013). The micro politics in the organization together with the culture and the mindset of the organization are important features regarding becoming a learning organization.

Bloom's taxonomy has been used to assess students learning (Eber and Parker, 2007). The taxonomy has been developed from the original *knowledge, comprehension, application, analysis, synthesis and evaluation* and describe how this step by step increases from knowledge to higher order learning. Knowledge being the basis for the learning is increasingly important in the age of digital technology as we have "everything" at hand and only a google search away. However, without remembering the knowledge, the rest of the pyramid "collapses" as it is important that the students have obtained the basic knowledge.

Agarwal (2019) discusses how far one can move the students up in the pyramid. Agarwal also points out that learning isolated facts is not enough to create an understanding, but facts and higher order questions better support the students way up the pyramid (Agarwal, 2019). Agarwal has tested different types of quizzes, but drawing on these experiences, the facilitation may thus be both knowledge based and supported with higher order questions in order to push the students into higher order learning.

Adams (2015) point out that the change in the original taxonomy adds a "new dimension across all six cognitive processes" (p. 153). Adams claim that there are four types of knowledge that may be encompassed by the learning activities: *factual, conceptual, procedural and metacognitive* (Adams, 2015, p. 153). Also, she claims that it is important that students are able to execute "critical thinking and evaluative judgements" and it seems that learning objectives are at a lower level (Adams, 2015, p. 153).

3. Methodology

In this paper we have utilized our own experiences, hence we are our own respondents and has thus performed an autoethnographic study (Chang, 2016). We have all told our own stories and collected and compared the outcomes and learning. Our aim is to learn from our experiences and develop as practitioners.

Also, our experiences are from our own organization (Coghlan, 2019). We thus need to be aware of our own biases and prior experiences and how this will affect our interpretations. As we are three researchers, we have sought also to discuss our findings from different viewpoints to avoid making our own social construction of reality (Berger and Luckmann, 1966).

Based on findings from investigations amongst the students and our observations in the classroom we reflected together after each seminar as well as interviewing the students and using surveys to understand how the students perceived our approaches. This mixed methods approach (Tashakkori and Creswell, 2007; Creswell and Creswell, 2017) is not described in further detail here as it is our process as researchers that is presented in this paper.

Our observations are though, that the students need to learn the theory in order to understand it and reflect upon it tying it to their own work experiences. Then they are also able to solve assignments. Then next step is to combine the knowledge it to their own work life experiences and based on this, co-develop assignments that resonate with their needs for relevance. This co-development and solving of assignments may then in turn form a "test bed" for how they can apply the new knowledge at their workplace.

Based on our observations and our own reflections, we are then able to develop our own understanding and learning process through testing and reflective discussions.

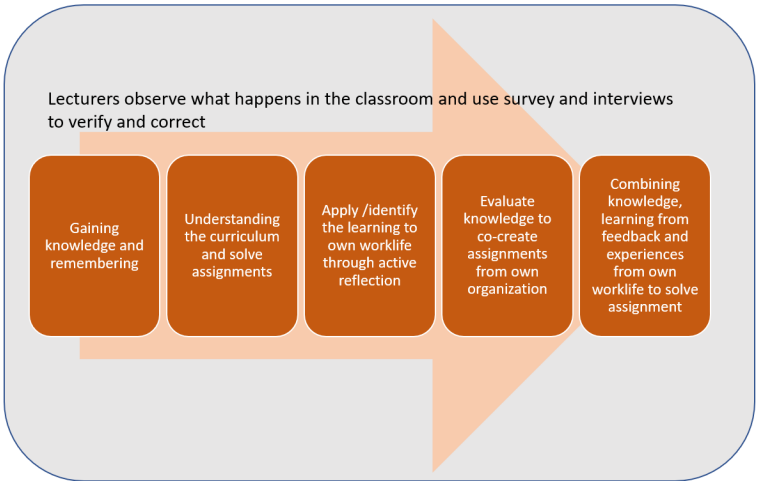


Figure 2: Data-Collection on Student's Feedback

3.1 Developing the Process

Taking Bloom's taxonomy as a point of departure, we can describe our way to becoming reflective practitioners. We firstly had to recognize that in order to develop skills for "translating" curriculum into assignments the students also needed to know the curriculum well enough to not only remember, but also understand and apply the knowledge. Which is basically a level one may expect from a lecturer that teaches a new curriculum for the first time. This means that we as lecturer facilitating for this need to be at a higher level, indeed we need to not only be able to analyse, but also evaluate the students' ideas and co-create the assignments with them. Hence, we needed also to read up on what video feedback was and potential benefits. The facilitation of co-developing assignments starts in the autumn semester, but it takes time to make the students understand the importance and benefit of developing their own assignments as well as developing their skills and abilities to co-create assignments. We needed to test how video feedback could support developing these skills and we thus applied this in the autumn semester, investigated how the students perceived it and how they felt it added to their learning outcome. This information was analysed, along with the reflections we had conducted prior to and during the recording. The outcome of this, along with more literature on video feedback, we ploughed into developing new experiences. Again reflecting, before and during the refined ways of providing the video feedback gave us more material for evaluating the value of this for any potential enhanced learning outcome. This again was investigated to see how the students perceived this refined video feedback and how well they were able to transform the feedback into further developed skills for co-creating assignments from their own workplaces. Our development and meta-learning can be summed up in the following figure (figure 3):

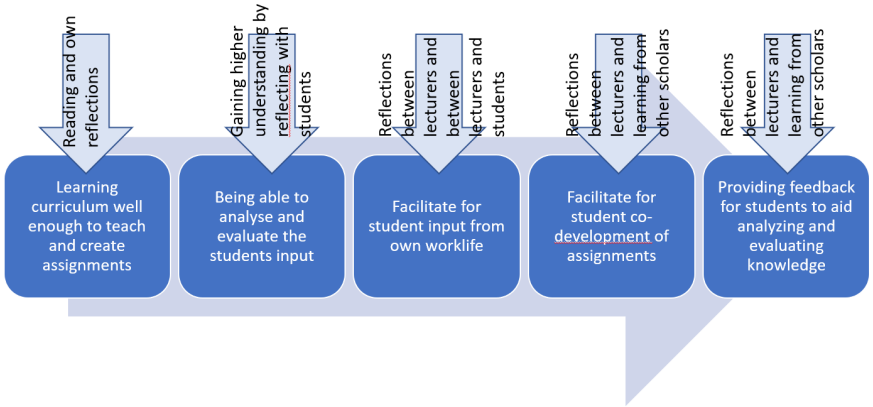


Figure 3: Teacher's Reflections Feeding Development of Course and own Development

Here we show how we have used reflection processes to form the development process to enhance the learning for the students.

4. Findings and Discussion

By Socializing and Externalizing our findings we have been able to combine what we have learned and by working with it we Internalize the knowledge. In some ways we work as a team where we are equal members and learn from each other, much like what Senge describes (Senge, 2006). Other times we are more a CoP where one of us have deeper knowledge, and maybe even more tacit knowledge than the other and share with the group. Even when we recognize using the SECI-model we resemble a CoP rather than a team as we have different backgrounds and different approaches to lecturing.

We have through several years developed the study program and have almost rigorously followed Kolb's experiential learning cycle (Kolb, 2014). By reflecting in and on action and reflecting together not only as in "after action review" (Morrison and Meliza, 1999; Keiser and Arthur Jr, 2021), but also retrospective reflection (Schön, 1984, 1987). These reflections have made it possible to achieve the level of competence we have needed in order to bring the students to a higher level of learning. By offering different types of learning material, stressing that the basic knowledge is important and following up with higher order questions to trigger and develop their skills of combining and applying their knowledge and even analyse and evaluate on the basis of their video feedback how to better master not only to create their assignments, but to solve them in a way that allows them to analyse and evaluate as well.

The process can be described as a step-stone trajectory that even the students have to follow, only a step behind:

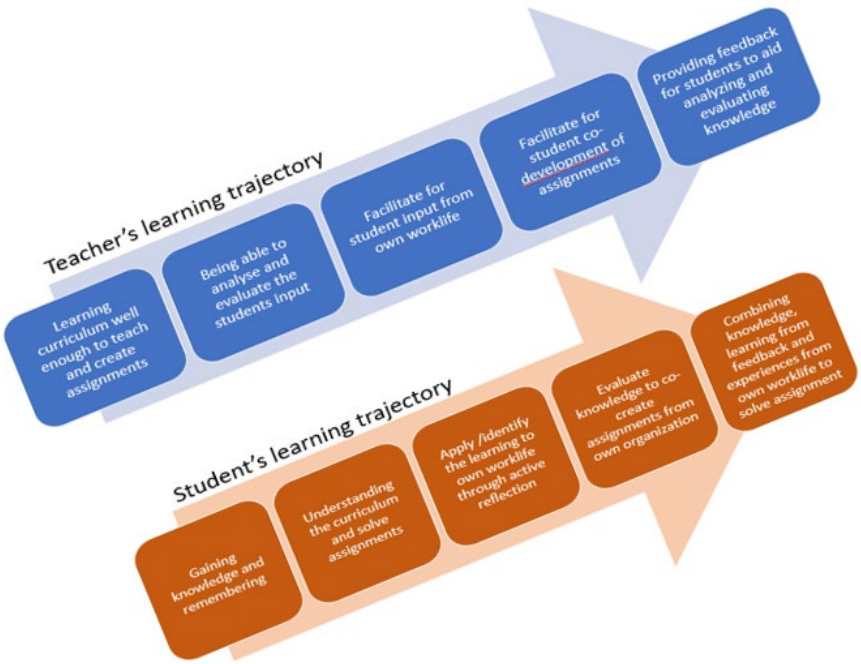


Figure 4: Teacher's and Student's Learning Trajectories to Become Reflective Practitioners

The trajectories show how the lecturers/teachers can facilitate for higher learning and for students to become reflective practitioners. It is, however, imperative that the lecturers/teachers themselves are able to become, and develop, as reflective practitioners in order to be able to facilitate for the students learning.

What we have not been able to do, is to follow our students back into their organizations to see if they were then able to combine the learning with what they encounter in their workday. We can, however, establish that they are able to co-develop assignments and they show high level of critical thinking and understanding in their submissions.

5. Conclusion

In this paper, we have elaborated on using KM theories to develop both lecturers and students as reflective practitioners in order to facilitate for higher learning in an academic setting. In order to co-develop assignments with students, it is important to have gained a higher level of learning and an understanding of the curriculum to be able to evaluate, correct and comment on the students input to their assignments. This is equally important

in order to be able to provide the students with feedback on their assignments that will further the ambition of promoting and achieving higher learning. This require becoming reflective practitioners as this is about a development as a lecturer from understanding the curriculum to being able to co-create assignments with students and providing feedback on a higher level.

5.1 Future Research

We are in the process of investigating how our students are able to utilize their knowledge back in their organizations. We will seek to establish if it is possible to tie any utilization to the facilitation provided during their study, such as co-developing assignments and video feedback. This will aid us in the future process of developing the study, and us as reflective practitioners.

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Knowledge Dissemination of Sustainable Product Development

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Abstract: Current environmental regulations and customer expectations force manufacturing companies to develop new products considering ecological, social, and economic issues. At present, product sustainability, time-to-market, and profit are equally important factors in the new product development process. Consequently, product design should embrace issues related to sustainability in the entire product life cycle. These issues refer to manufacturing processes, product use, and the post-use phase, including product reuse, remanufacturing, recycling or disposal. Product design considering these issues is called sustainable design or eco-design. The product development process aims to create a new product that can be a modification of existing products or be completely new for a company and market. Innovations are widely used as a key component for addressing sustainable development concerns. The role of product design and innovation in the quest for sustainability has received considerable attention among researchers and businesses in recent years. This research is a novel bibliometric analysis of sustainable product development, product design, and product innovation in the last 30 years, from 1993 to 2022. The results of data analysis embrace trends regarding the yearly number of publications devoted to sustainable product development, sustainable product design, and sustainable product innovation. Moreover, the collected publications were classified into subject areas, source titles, and source type. The bibliometric analysis reveals the most popular journals to knowledge dissemination of sustainable product development, sustainable design, and sustainable innovation. The results show that the increase of publications devoted to sustainable product design and sustainable product innovation is particularly strong in the last 5 years. Moreover, the number of publications related to sustainable product design is over ten times larger than related to sustainable product innovation.

Keywords: New product development, Product design, Product innovation, Sustainability

1. Introduction

Nowadays, customers are more and more aware of a need of protecting the environment, and the concept of sustainable development. As a result, companies are interested in improving sustainability performance of their products and business processes, including product development, manufacturing, and transportation. Companies are trying to fulfil customer expectations through developing a framework for incorporating sustainable-oriented changes at the product design stage, and measuring the level of sustainability performance. A number of studies dedicated to sustainable products is constantly increasing in the last years. The goal of this research is the comparison of knowledge dissemination in the aspect of sustainable product development, product design, and product innovation.

New product development includes a few stages related to idea generation, concept screening, feasibility analysis, product design, prototype tests, and commercialization. Product design seems to be a crucial factor from the perspective of incorporating sustainable-oriented changes into a product. The concept of sustainability should refer to the complete product life cycle, from new product development through manufacturing, packaging, and transportation, up to its disposal or recycling. Many authors indicate the importance of sustainable-oriented design thinking (Ceschin and Gaziulusoy, 2019; Mihelcic and Zimmerman, 2021; Shapira et al, 2017; Soomro et al, 2021). In recent years, sustainable manufacturing is often linked with the closed-loop and the circular economy concept (Jawahir and Bradley, 2016; Sartal et al, 2020). In this paradigm, product sustainability is expanded from the 3R principles (reduce, reuse, and recycle) to the 6R methodology (3R principles plus recover, redesign, and remanufacture). As a result, the design process should consider issues related not only to manufacturing and using a product, but also issues related to its utilization by consumers, ultimate reuse, recycling, remanufacturing, and even disposal. Consumer behaviours in the aspect of hoarding, throwing away, and sustainable product disposal are presented in (Sarigollu et al, 2021).

Ceschin and Gaziulusoy (2019) described sustainability transitions in product design from green design to design for increasing sustainable behaviour. They proposed a multi-level framework of design for sustainability from material/component level, through product level, to socio-technical system level. Mihelcic and Zimmerman (2021) presented the importance of design and innovation in advancing sustainability and frameworks for sustainable design. Their principles of green engineering refer, for example, to separation and purification operations as a component of the design framework, and design that bases on renewable and readily available inputs throughout the product life cycle. In turn, design thinking in the context of creating innovation is considered in (Adams et al, 2016; Cillo et al, 2019; Nakata and Hwang, 2020). Advantages of design thinking in the aspect of eco-products within the automotive industry are presented in (Relich, 2014).

Additionally, there were carried out investigations within identifying relationships between eco-innovation and product success (Díaz-García et al, 2015; Relich, 2015; Hermundsdottir and Aspelund, 2021).

Tello and Yoon (2008) defined sustainable innovation as the development of new products, processes, services and technologies that contribute to the development and well-being of human needs and institutions while respecting the words' natural resources and regenerative capacity. As drivers of sustainable innovations, they indicate government regulations, social activism, technology advance, customer demand, supply chain, and corporate social responsibility initiative. In turn, Bos-Brouwers (2010) defined sustainable innovations as the renewal or improvement of products, services, technological or organisational processes that deliver not only an economical performance, but also an improved environmental and social performance, both in the short and long term. Varadarajan (2017) presented types of sustainable product innovations that can include reduction of resource use (e.g., product miniaturisation), elimination of resource use (e.g., ecologically harmful ingredient elimination), and substitution of resource use (e.g., product digitalisation, biodegradable packaging materials). There was also discussed a model of sustainable innovations, and its implications for theory, research, and practice. A typology of innovations for sustainable development was discussed in (Silvestre and Ţîrcă, 2019). There were divided innovations into four groups: traditional, social, green, and sustainable innovations, which strongly emphasise both environmental and social concerns.

This study is concerned with investigating knowledge dissemination in the aspect of sustainability related to product development, product design, and product innovation. The literature review has revealed that the majority or scientific works refer to knowledge transfer towards improving performance of innovations. A knowledge transfer framework for supporting small and medium-sized enterprises in developing sustainable innovation was presented in (Adams and Comber, 2013). Moreover, knowledge transfer between green thinking, lean thinking, and product development was descripted in (Oliveira et al, 2018). It is noteworthy that there was some research on knowledge discovery in the context of identifying critical success factors in new product development (Lane and Flagg 2010; De Medeiros et al, 2014; Relich and Bzdyra 2015). Thomé et al (2016) presented a longitudinal review for sustainable new product development in years 1993–2015. However, there is the lack of research strictly devoted to the presentation of current knowledge dissemination from the perspective of sustainability within product development, product design, and product innovation. This was a motivation to investigate knowledge dissemination in the mentioned areas.

The paper is organised in the following parts: Section 2 presents materials and methods, including description of keywords for the database search in the aspect of sustainable product development, product design, and product innovation. Section 3 presents the results of data analysis and discussion, whereas Section 4 – conclusion and further research.

2. Materials and Methods

Gathering data for this research was based on the functionality of advanced search in Scopus. In May 2023, the Scopus database includes over 44,000 journals, book series, conference proceedings, books, etc. These publications are provided by the main publishers such as Elsevier, Emerald, Springer, Taylor and Francis. The search used two criteria regarding years and keywords that are sought in titles, abstracts, and keywords of publications.

The main goal of this study aims to investigate knowledge dissemination of sustainable products in the last 30 years, from 1993 to 2022. The publications from the first months of year 2023 were omitted in research to ensure the year-to-year comparison of the results. The aspect of sustainable products was divided into three areas: product development, product design, and product innovation. The additional goal of this study is to compare knowledge dissemination among these three areas. Product development is the broader concept than product design that is only one of activities in the NPD process. However, product design is the key factor in this process, incorporating the concept of sustainability into products. Product development is also the broader concept than product innovation, because not each new product is an innovation. In fact, the majority of new products are modifications of past or existing products, and they can be only new for a company.

The aspect of sustainability within product development, product design, and product innovation was sought through keywords related to environment, ecology, and the triple bottom line concept. There were performed four analyses, separately for product development, product design, product innovation, and together for these three areas. Pseudo-codes related to keywords for these four analyses were presented below.

The search of publications for the 1st analysis:

TITLE-ABS-KEY ((*"product development"*) AND (*"sustainab* development"* OR *"environment*"* OR *"ecolog*"* OR *"triple bottom line"*)) AND PUBYEAR > *1992* AND (EXCLUDE (PUBYEAR , *2023*))

The search of publications for the 2nd analysis:

TITLE-ABS-KEY ((*"product design"*) AND (*"sustainab* development"* OR *"environment*"* OR *"ecolog*"* OR *"triple bottom line"*)) AND PUBYEAR > *1992* AND (EXCLUDE (PUBYEAR , *2023*))

The search of publications for the 3rd analysis:

TITLE-ABS-KEY ((*"product innovation"*) AND (*"sustainab* development"* OR *"environment*"* OR *"ecolog*"* OR *"triple bottom line"*)) AND PUBYEAR > *1992* AND (EXCLUDE (PUBYEAR , *2023*))

The search of publications for the 4th analysis:

TITLE-ABS-KEY ((*"product development"* OR *"product design"* OR *"product innovation"*) AND (*"sustainab* development"* OR *"environment*"* OR *"ecolog*"* OR *"triple bottom line"*)) AND PUBYEAR > *1992* AND (EXCLUDE (PUBYEAR , *2023*))

Data analysis refers to the number of publications in years 1993–2022, main subject areas, and main source titles. Moreover, there is investigated the number of publications in the aspect of their source type (journal, books, etc.). The results of research embrace the comparison of sustainability within areas regarding product development, product design, and product innovation. The aim of data analysis is the presentation of research interests in publishing scientific works dedicated to the mentioned areas of sustainability. This presentation can be considered in the aspect of knowledge dissemination among researchers, and it is the first step towards future research regarding customer expectations for sustainable products, and corporate social responsibility within developing and manufacturing more sustainable products.

3. Results and Discussion

This study is concerned with investigating knowledge dissemination of sustainable product issues within three areas related to product development, product design, and product innovation. Moreover, data analysis also includes the results for merging all of these three areas. Hence, data analysis consists of four parts that are presented below in subsequent subsections.

3.1 Sustainable Product Development

The results of data analysis refer to the number of publications in the last 30 years, source of publication, and subject area. Figure 1 presents the number of publications devoted to sustainable product development in years 1993-2022. There were 13,386 publications in the considered period.

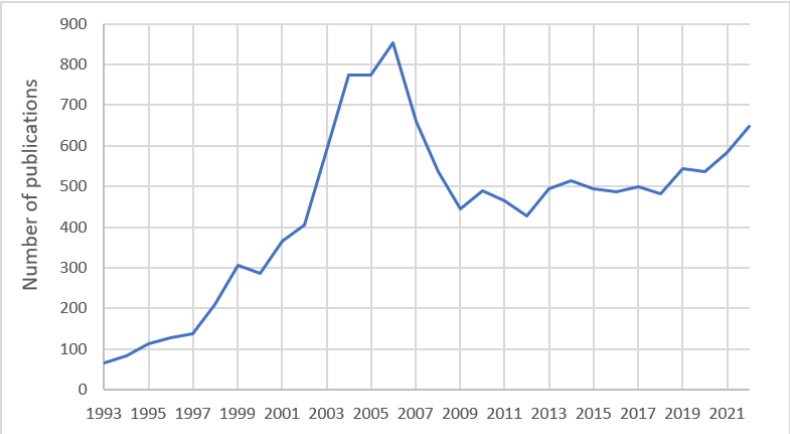


Figure 1: Number of Publications Devoted to Sustainable Product Development

The number of publications had the significant increase from 1993 to 2004, reaching the largest level in years 2004–2006. In years 2009–2018, the trend was rather constant, whereas from 2019 the number of publications is increasing.

Figure 2 illustrates the number of publications relating to various subject areas. The majority of publications are related to journals addressed to engineering, computer science, and business, management and accounting. It is noteworthy that a single publication can be classified to a few subject areas.

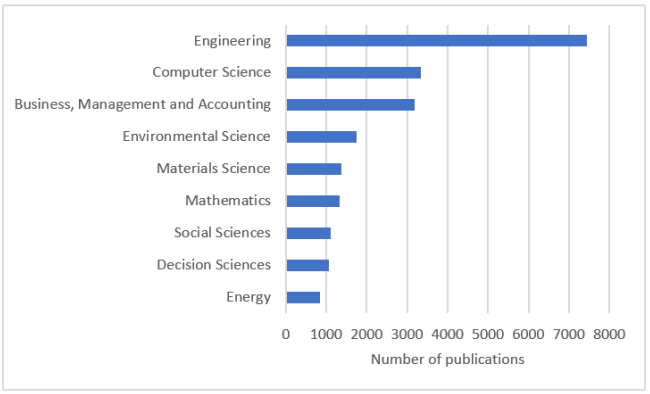


Figure 2: Number of Publications Relating to Different Subject Areas

Figure 3 illustrates the number of publications relating to the source title (i.e., the name of journal, book series, proceedings), in which scientific works were published. The source titles presented in Figure 3 refer to about 9% of all publications.

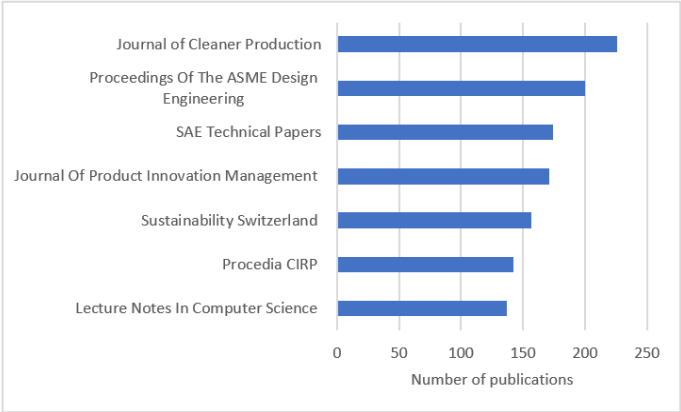


Figure 3: Number of Publications Relating to the Source Titles

3.2 Sustainable Product Design

Figure 4 presents the number of publications devoted to sustainable product design in years 1993–2022. In this period, there were 19,231 publications, so more than publications dedicated to sustainable product development.

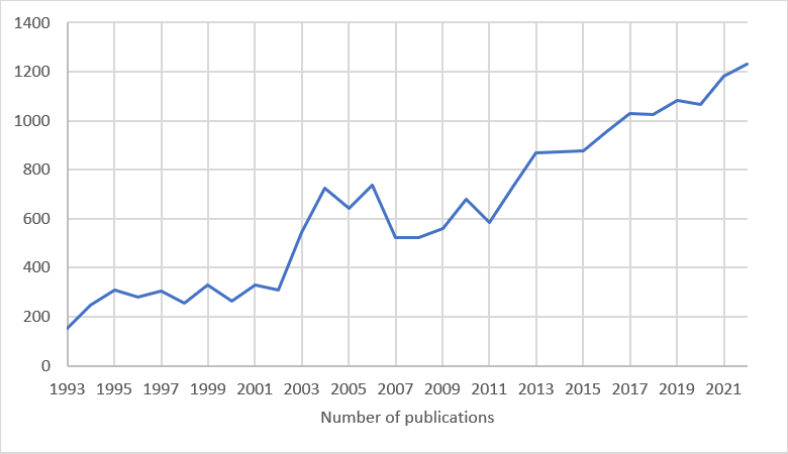


Figure 4: Number of Publications Devoted to Sustainable Product Design

The number of publications had the significant increase in years 2003–2004, and from year 2015. There were above 1,200 publications devoted to sustainable product design in 2022.

Figure 5 illustrates the number of publications relating to various subject areas. The majority of publications are related to journals addressed to engineering and computer science.

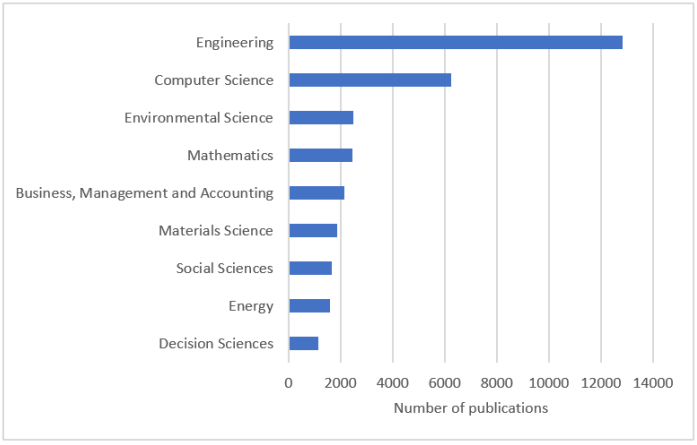


Figure 5: Number of Publications Relating to Different Subject Areas

Figure 6 illustrates the number of publications relating to the source titles that were most often chosen by researchers. The source titles presented in Figure 6 refer to about 11% of all publications.

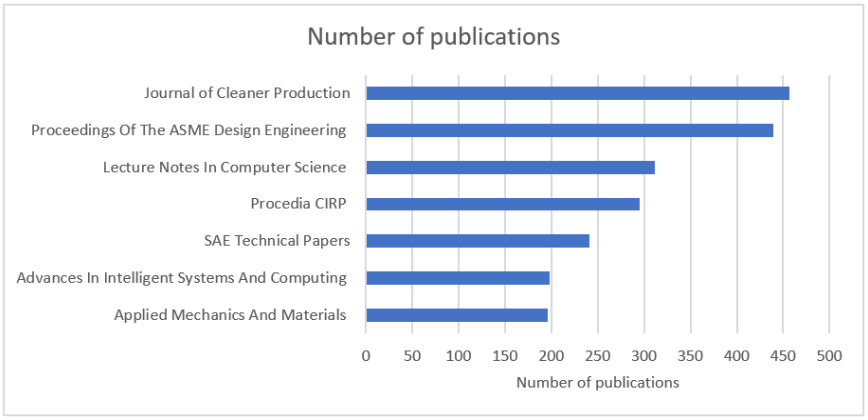


Figure 6: Number of Publications Relating to the Source Titles

3.3 Sustainable Product Innovation

Figure 7 presents the number of publications devoted to sustainable product innovations in years 1993–2022. There were 1,689 publications in the considered period, with the largest number of publications in 2022.

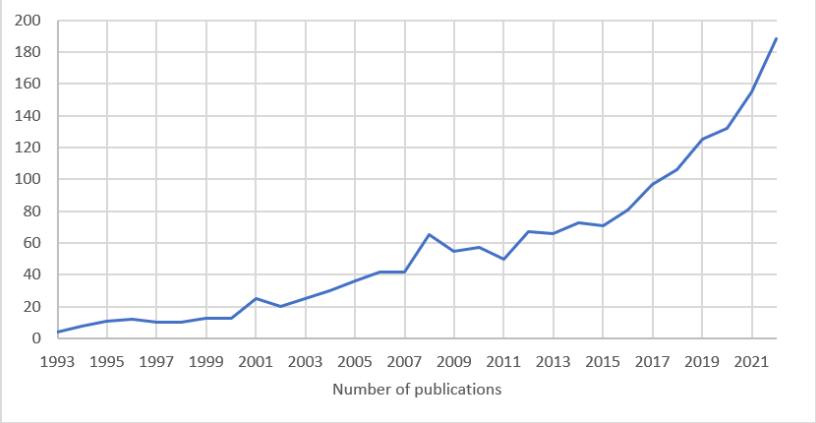


Figure 7: Number of Publications Devoted to Sustainable Product Innovations

The number of publications had rather the constant growth from 1993 to 2007, whereas the observable increase is from year 2016. The trend was rather constant in years 2008–2015.

Figure 8 illustrates the number of publications relating to various subject areas. The majority of publications are related to subject area of business, management and accounting. This subject area is different compared to the results obtained for product development and product design.

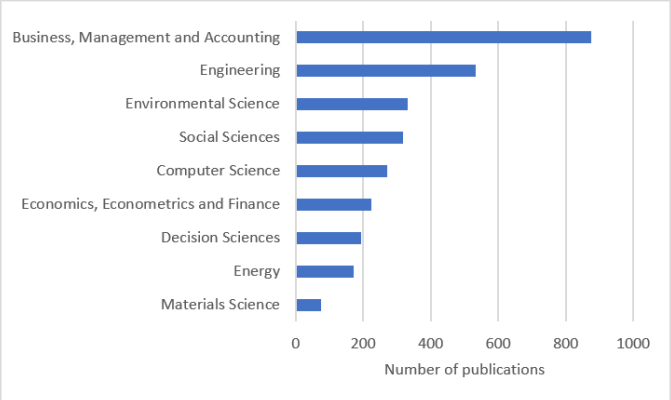


Figure 8: Number of Publications Relating to Different Subject Areas

Figure 9 illustrates the number of publications relating to the source titles that were most often chosen by researchers. The source titles presented in Figure 9 refer to about 15% of all publications.

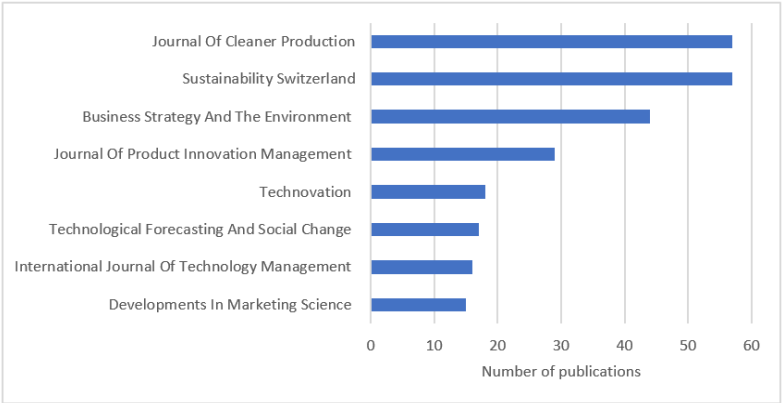


Figure 9: Number of Publications Relating to the Source Titles

3.4 Sustainable Product Development, Design, and Innovation

Figure 10 presents the number of publications devoted to sustainable product development, design, and innovations in years 1993–2022. There were 30,725 publications in the considered period, with the largest number of publications in 2022.

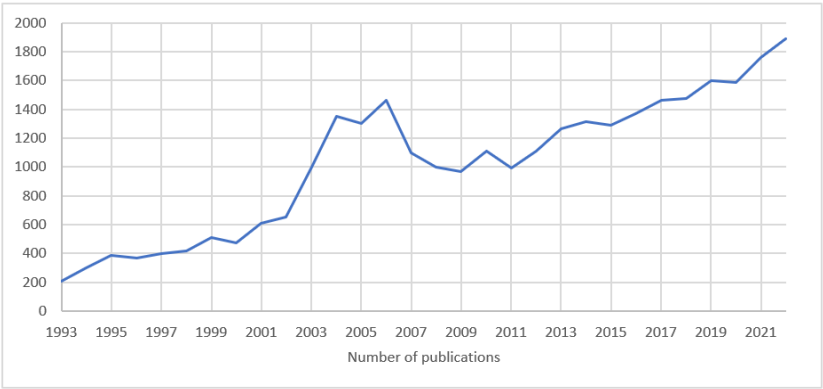


Figure 10: Number of Publications Devoted to Sustainable Products

The number of publications had rather the constant growth from 1993 to 2002 and from 2012 to 2022. The significant increase was in years 2003–2004, whereas the trend was rather constant in years 2007–2011.

Figure 11 illustrates the number of publications relating to various subject areas. The majority of publications are related to subject areas such as engineering, computer science, and business, management and accounting. This configuration is the same as for the results obtained for sustainable product development.

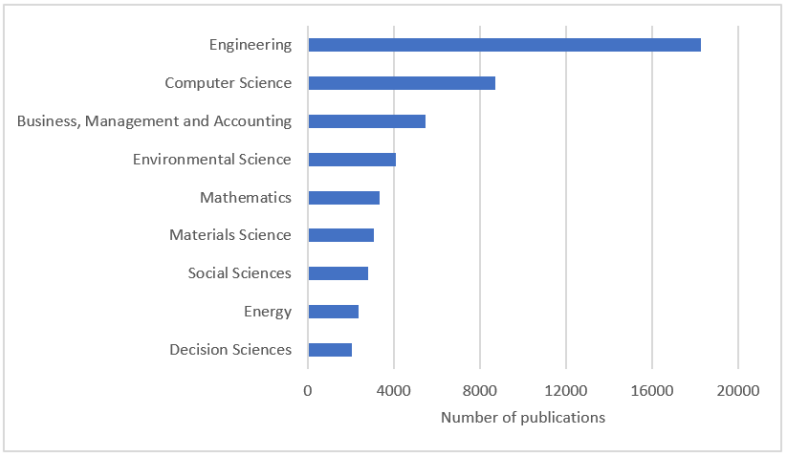


Figure 11: Number of Publications Relating to Different Subject Areas

Figure 12 illustrates the number of publications relating to the source titles, in which scientific works were published. The source titles presented in Figure 12 refer to about 34% of all publications.

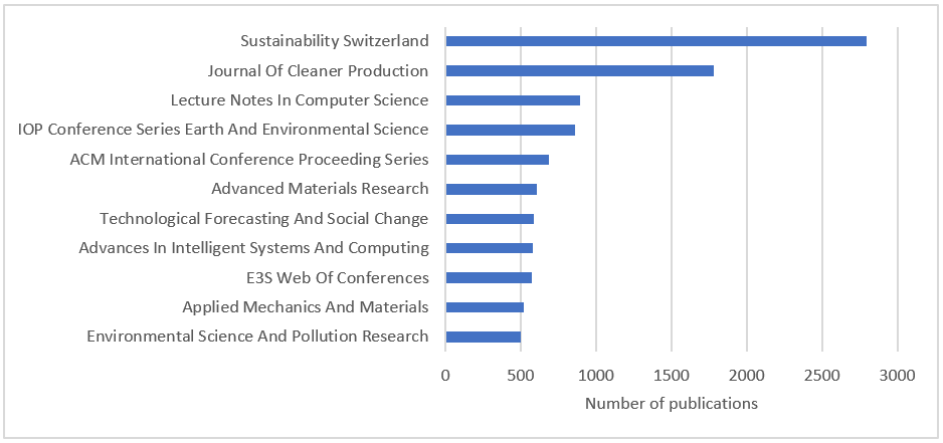


Figure 12: Number of Publications Relating to the Source Titles

Figure 13 illustrates the number of publications relating to the source type, among which the overwhelming part consists of journals and conference proceedings.

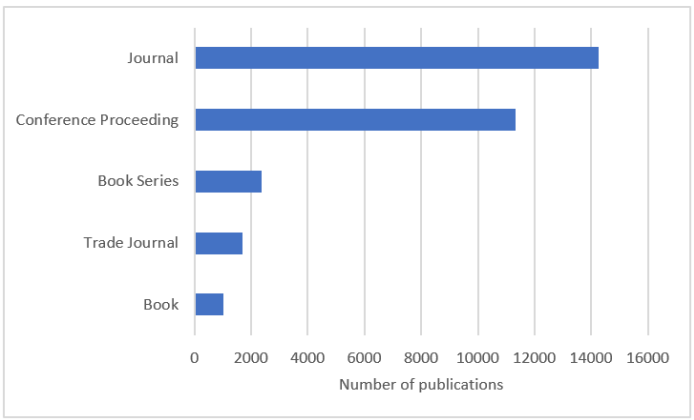


Figure 13: Number of Publications Relating to the Source Type

The results obtained in this study illustrate the continuous increase of publications devoted to sustainable product development. These results are similar to the results presented by Thomé et al (2016) for sustainable new product development in years 1993–2015. They divided publications into two periods for years 1990–2009 and 2010–2015, and investigated, among other things, the number of publications, citations, and h-index for thematic clusters such as life cycle assessment, design, innovation, and human. In period 1990–2009, they also distinguished thematic clusters related to standards and innovation, whereas in period 2010–2015 clusters for supply chains, sustainable products, product life cycle, and renewable resources. Their results of data analysis referred to the general concept of design and innovation (including not only the product aspect, but also economic growth and social aspects), whereas the results presented in this study are strictly related to product design and product innovation.

A review of sustainability management research, including themes of innovations, industrial ecology, and social-ecological systems, in years 1990–2015 was showed in (Williams et al, 2017). A longitudinal review of business innovation and sustainable development in period 2010–2019 was also presented in (Maier et al, 2020). There were investigated the number of publications from general topics related to innovation and sustainability, up to topics strictly related to business innovation and sustainable development. Science category was there limited to business, management, and economics. Data analysis includes most cited papers, authors, and journals, in which articles were published. The growth of publications related to sustainable innovation was also presented in (Hermundsdottir and Aspelund, 2021). This study referred to publications from 2005 to 2020, and it presented a systematic analysis of the key terms related to sustainable innovation and its impact on competitiveness. Similar to data analysis presented in this research, their results also show the increase of publications devoted to innovation and sustainability in recent years.

A bibliographic analysis of green product innovation in years 1991–2013 was presented in (Dangelico, 2016). In turn, sustainable product development in the context of eco-innovation was investigated in (Gbededo et al, 2018). There was proposed an eco-innovation approach, which includes the aspect of eco-design and circular economy minimising the use of materials, energy, toxicity, and waste. A literature review contains data from 2006 to 2015, and refers to sustainable product development and sustainability assessment techniques. Moreover, there was examined sustainable manufacturing methodologies and approaches. They also considered a collected set of publications in the aspect of economic, environmental, and social dimensions. Contrary to their approach, this study considers all publication together within the triple bottom line.

A systematic review of sustainable design methods and tools was presented in (Faludi et al, 2020). They investigated the needs and values of industry regarding sustainable design, improvements in sustainable design methods and tools, and ways to integrate sustainable design more effectively into industry. The improvements in sustainable design methods and tools referred to issues regarding business integration and communication support. In turn, integration into industry was related, among other things, to knowledge dissemination within best practices for scaling industry self-training on sustainable design methods and tools. Moreover, Ahmad et al (2018) presented a literature review of tools and case studies for sustainable product design in years 2007–2017. Based on the criteria of sustainability dimensions, they proposed a generic classification scheme to enhance the understanding of the mentioned tools in manufacturing companies. In this study, knowledge dissemination is also addressed to manufacturing companies within areas related to sustainable product development, including product design and product innovations.

The results of data analysis indicate that knowledge management in the aspect of sustainable product development was in years 1993–2022 presented in 377 papers, in the aspect of product design in 305, and in the aspect of product innovations in 49 scientific works. Issues related to knowledge management in the aspect of product development and product design were mainly published in subject area referring to engineering. In turn, issues related to knowledge management in the aspect of product innovations were mainly published in subject area referring to business, management, and accounting.

Knowledge management in the sustainability related issues refers mainly to the aspect of sustainable development of a manufacturing company and product innovation. Abbas and Sağsan (2019) investigated the impact of knowledge management on green innovation and corporate sustainable development. They used structural equation modelling to determine to what extent knowledge creation, acquisition, sharing and application affect green technology innovation and green management innovation, as well as environment, social, and economic aspects of sustainability. Rabal-Conesa et al (2022) investigated the relationship between organizational agility and the successful development of new green products. The results of this study indicate the impact of external knowledge on the success of eco-innovation. Moreover, internal environmental

knowledge positively affects the success of sustainable products. In turn, Estrada et al (2016) presented the results of a significant positive impact of competitor collaboration on product innovation performance only when internal knowledge sharing and formal knowledge protection mechanisms are incorporated in manufacturing companies.

4. Conclusion

Sustainable product development has become a significant research area in recent years. Sustainable products should include all three dimensions of sustainability (environment, society and economy) throughout their complete life cycle, from material extraction, manufacturing, product packaging and transportation, use, up to recycling or product disposal. The majority of the sustainability-related issues is decided at the product design stage. As a result, this stage is a key factor in drifting business strategy towards achieving sustainability in manufacturing companies. Designing sustainable products should ensure lowest negative environmental impacts, and providing economic and social benefits to the stakeholders. The interest of researchers, businesses, and policy-makers for sustainable development, sustainable design, and sustainable innovations is increasing in recent years. Practitioners need approaches for their businesses for reducing material and energy consumption, and improving the level of eco-friendly materials and packaging. These approaches can facilitate developing sustainable innovations that aim to increase competitive advantage not only through the growth of sales and market share, but also through non-financial values related to the improvement of product quality, customer satisfaction, and ultimately, business reputation and image.

The presented study is a novel bibliometric analysis of sustainable product development, product design, and product innovation in the last 30 years, from 1993 to 2022. The results of data analysis reveal the trends in publishing scientific works devoted to sustainable product development, sustainable design and product innovations, as well as the most popular sources for knowledge dissemination. The results also show differences in the growth of publications for sustainable product design and product innovation in recent years. This research is a preliminary study for further research regarding the development of business models for sustainable innovations dedicated to the Industry 4.0 environment. Moreover, future research will be referred to investigation of the impact of knowledge management on the improvement of product innovation in sustainability related aspects.

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The Role of a Manager in Managing Information in the Remote Work of Generation Z Employees

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Abstract: The increasing significance of information as an economic resource and a component of competitiveness results in that it has become essential for the smooth functioning and development of modern organisations. Possessing information provides a competitive advantage, which is why information is regarded as a strategic resource of an organisation, which supports various processes including: decision-making, employee communication, and knowledge management. For people from Generation Z, representing the youngest workers on the labour market, the availability of information constitutes a significant attribute of quality of life, as well as quality of work. The significance of information and the resulting information management takes on particular importance in a remote work system. The aim of this paper is to present the views of employees from Generation Z concerning the significance of information and the role of the superior in managing information in a remote work system. The research results presented in this paper are part of a nationwide quantitative study of workers from the youngest generation on the labour market. The study was carried out in December 2022 on a representative sample of Polish Generation Z employees who had experience of remote work. In order to learn the opinions of the young workers concerning the analysed issues, a survey was prepared and the questionnaire technique based on a five-point Likert scale was used. The results of the conducted research indicate that young people from generation Z positively assess the impact of remote working on both the speed of information exchange and the ability to understand the provided information, as well as assess its veracity. They were most appreciative of the speed of information transfer in remote working, and more doubtful about the reliability of the obtained information. In contrast, respondents assessed the amount of information flowing to employees working remotely in a negative manner. As can be seen from the obtained data, respondents appreciate the role of the manager in exchanging information in remote work, especially young employees with short experience in this form of work. Whereas, those with longer experience of remote working and working in micro organisations obtained information mainly from colleagues. However, it should be emphasized that despite the positive assessment of information sharing in remote working and the role played by the supervisor, the interviewed Generation Z employees indicated primarily that they would like to work stationary or in a hybrid manner in the future.

Keywords: Information, Remote work, Generation Z, Information management

1. Introduction

The information society reflects the most important feature of social and economic change, i.e. the processes of creating and collecting information. The modern world bases on information and thus, a modern company must be able to take advantage and manage it properly. Information constitutes an opportunity to use the resources and knowledge of employees, to learn more about the market and the needs of the customer, and therefore to improve the company's operations, strengthen its position, and increase its competitiveness.

The issues of information management are presented as a core management function within an organisation, whose role is to acquire, store, and deliver proper information, to the right people, at the right time. Effective information management has an impact on the quality of work not only of managers but, through them, of all employees in the organisation. Employers whose employees work remotely often face the problem of how to support their subordinates in the area of information management in the broadest sense.

The aim of this paper is to present the views of Generation Z representatives concerning the significance of information and the role of the manager in shaping information exchange, as an essential element of information management, in remote work. The empirical part of the study is based on the results of a survey carried out in December 2022 among young people who are representatives of Generation Z. The survey included a randomly selected representative sample of 387 Generation Z employees residing in Poland and working remotely. In terms of the conducted study, the following main research problem was posed: How do Generation Z employees perceive the impact of remote working on information exchange and the role of the manager in shaping information exchange as an important element of information management? In the process of developing the study results, non-parametric tests were used to assess the significance of differences in the analysed variables: the Mann-Whitney U test and the Kruskal-Wallis ANOVA test.

The paper presents a cognitively important topic, because knowing the preferences and expectations of young people from generation Z regarding the significance of information in remote working and the role of a manager in information management enables the effective management of these employees.

2. Theoretical Background

The term information comes from the Latin *informatio* and means "representation, explanation, notification". However, the scientific definition of this concept, despite its great importance, poses many difficulties for researchers. Among the many definitions functioning in the source literature concerning the subject in the context of the analysed issues, it is worth noting the general concept of information as a factor that increases our knowledge of the reality around us (Eaton and Bawden 1991, pp 156-165; Meadow et al., 2000, p. 35). Data and messages become information when they make it easier for a given recipient to solve a particular problem or reduce the state of uncertainty. Information that can be considered useful should not only be clear for the recipient, accurate and precise, but also include reliable sources of acquisition. Furthermore, in addition to being operative and up-to-date, they must relate to future periods without losing their link to the present. It is believed that information being a strategic resource of an enterprise not only enables communication between employees and management - coordinating individual and group activities, and works in favour of establishing relations with the environment, but also enriches individual knowledge and supports the process of change. The value of information depends on its timeliness, quality, and quantity, as well as its links to actionable tasks. The scope, content and form of the information provided in the company depend on the position and its place in the organisational structure. Individual levels of management have different information needs. Different information is needed for decision-making at the operational level and other ones at the strategic level (Septer 2013, p. 49).

Information management includes the processes and systems used to collect, store, and organize data, as well as the strategies and policies used to ensure the effective use of that data (Oluic-Vukovic 2001, pp 54-61). Its purpose is to ensure that the right information is available to the right people at the right time in order to facilitate decision-making and support the smooth functioning of an organisation. Information management in a company consists in developing and applying an appropriate pattern of behaviour, which constitutes a system of interrelationships between the information acquired, its analysis, the made decision, the given instruction, the action taken and its control (Choo 2002, p. 26). The significance of access to information in organisations continues to grow. On the one hand, completeness of information is important, and on the other hand, avoiding information overload (Bouthillier and Shearer 2002). Thus, proper information management has an impact on the quality of work not only of managers but, through them, of all employees in a given organisation. More and more often attention is being paid to the fact that focusing on the technological plane in the process of information management is insufficient, because its effectiveness is significantly influenced by the organisational factor and above all by the people involved (Gourlay 2000; Albrychiewicz-Słocińska 2022, pp 19-27).

Information constitutes a highly significant part of personal and professional life for representatives of the youngest generation on the labour market. Generation Z (also referred to as the Internet generation or multitasking generation) is most often defined as people born after 1995 (although some researchers include people born after 1990, and another approach includes people born in 2000 and later). Unlike the previous Generation Y, which was gradually entering the digital world, this generation has already grown up in the world of modern technology. Representatives of Generation Z are people who find it easy to work on several tasks at the same time as a result of wide access to information and social networks (Duffy et al., 2018; Dolot 2018, pp 44-50; Singh and Dangmei 2016, pp 1-5). Managing Generation Z employees poses many challenges, as these young people want to know and have an impact on what is happening in the organisation they work for, and they also want to know that their work is meaningful. Meeting these expectations is particularly difficult in the remote working situation, which, through the crisis caused by the Covid 19 pandemic, is increasingly functioning on today's labour market alongside the hybrid and onsite form of working (Stankeviciute and Kunskaja 2022, pp 221-235).

Many of the features of Generation Z representatives indicate that, for them, remote working is a suitable form of performing professional tasks. It means working with the use of means of direct communication at a distance, carried out completely or partly at a location indicated by the employee and agreed with the employer, including the employee's home address. The employer provides the remote worker not only with the necessary materials and working tools, including technical equipment, but also with the necessary training and technical assistance.

Among the organisational advantages of remote working, the main one is the reduction of operating costs, because the employer does not invest in renting office space and organizing workstations. In addition, an increase in organisational flexibility and a decrease in employee absenteeism are indicated. Employing remote

workers may also constitute the only opportunity for an employer to hire professionals who live far from the company's headquarters. Whereas, the biggest advantage of remote working mentioned by employees consists in the convenience of performing it from home and saving time and money on travelling to the employer's premises. Remote work also works in favour of employing workers with disabilities living in locations far from industrial centers, as well as workers caring for children or other dependent persons. The employee also benefits from flexible working hours agreed with the employer (Sanchez et al., 2021, pp 67-100; Pyöriä 2011, pp 386-399). Apart from these unquestionable advantages, this form of work also includes some drawbacks. Having limited contact with colleagues and supervisors, remote workers are less likely to integrate, support each other, share experiences and current insights. This situation can reduce opportunities for knowledge exchange and limit professional development.

The presented features of Generation Z workers and the specificities of remote working point to the difficulties that can arise in managing these young workers performing this form of work (Sandoval-Reyes, Idrovo-Carlier and Duque-Oliva 2021, pp 1-12; Boyer O'Leary, Wilson and Matiu 2014; Hamilton 2002). This situation can constitute a major challenge for management in various areas of operation, including information management.

3. Methodology

The research results presented in this paper are part of a quantitative survey study entitled: "Managerial aspects of remote work management". The study was carried out in December 2022 among young people working remotely, representing Generation Z. The presented excerpt from the survey results concerns the respondents' views on the impact of remote work on information sharing and the role of the manager in shaping information sharing as a significant element of information management in remote working.

The study was carried out with the use of quantitative research methods which take advantage of the survey technique. Generation Z representatives whose professional experience covered at least the year 2022 were surveyed. Due to the lack of statistical data concerning the number of people aged 15-34 performing remote work in Poland, people who are professionally active and represent the relevant age category were selected. Based on the 2021 Statistical Yearbook, the size of the working population in Poland, in the age range of interest to the researchers, was set at 4,802,000 people. For the population estimated in this way, the study sample size was set at 384 people with the following statistical assumptions: fraction size 0.5; confidence level 95%; maximum error 5%.

The study was carried out by Fieldstat sp. z o.o., a specialized market research agency, using quantitative research methods, CATI (Computer Assisted Telephone Interview - 50% of respondents) and CAWI (Computer-Assisted Web Interview - 50% of respondents). Ultimately, 387 correctly completed questionnaires were obtained. It should be mentioned that redundant questionnaires do not disrupt the planned structure of the study group.

The used research tool consisted in a standardized questionnaire consisting of 57 closed statements and 7 questions concerning the socio-demographic characteristics of the respondents and their workplace variables. The issues related to remote work were divided in the questionnaire into several areas relating to: knowledge, information and learning, as well as communication, teamwork, work organization, motivation, employee relations and work-life balance. Several questions have been prepared for each research area. A Likert scale (the so-called Likert scaling technique) was used for the responses. The used research tool (questionnaire) was original and was prepared by a research team consisting of staff from the Department of Applied Sociology and Human Resource Management, Faculty of Management, Częstochowa University of Technology.

In terms of the conducted study, the following main research problem was posed: How do Generation Z employees perceive the impact of remote working on information exchange and the role of the manager in shaping information exchange as an important element of information management? The study also posed a number of specific problem questions:

How do Generation Z employees perceive the various aspects of information exchange in remote working, including: speed of information exchange, understanding information, assessment of information validity, and amount of information received?

Does remote working encourage Generation Z employees to seek information among colleagues?

How do Generation Z employees perceive the manager's role in shaping information sharing as an important part of information management in remote working?

A total of 387 people participated in the study, including 163 (42.12%) women and 224 (57.88%) men. The Generation Z employees participating in the study varied in terms of age. The least numerous were the youngest 76 (19.64%), between the ages of 15 and 24. The following age categories were represented by: 141 (36.43%) of people between 25 and 29 years of age, and 170 (43.93%) of people between 30 and 34 years of age. Employees with various levels of remote working experience took part in the survey. The majority of respondents - 296 people (76.49%) - worked in executive positions. The remaining respondents - 91 people (23.51%) were employed in managerial positions. Taking into consideration the size of the organisation where the respondents performed their remote work, micro organisations (with 1-9 employees) dominated with 182 (47.03%) indications, followed by small organisations (with 10 to 49 employees) with 86 (22.22%) indications, large organisations (more than 250 employees) with 64 (16.54%) indications, and medium organisations (50 to 249 employees) with 55 (14.21%) indications. Respondents also represented organisations that varied in terms of industry. Furthermore, respondents declared that in the future they would like to work: in a stationary mode (54.26% of indications), in a hybrid mode (28.17% of indications), and remotely (17.57% of indications).

STATISTICA software was used in the process of compiling the research results. Non-parametric tests were used to assess the significance of differences in analysed variables: Mann-Whitney U test (UMW), Kruskal-Wallis ANOVA test (AKW). Four questionnaire validity procedures have been used: content (Rossiter 2008), face, construct and nomological (Czakon 2014) ones. The scale reliability was validated using Cronbach's alpha that is a measure of internal consistency (α =,970019).For the analysis of the survey results, a number of statistical hypotheses were adopted regarding the existence of significant differences in the respondents' statements due to their socio-demographic characteristics and workplace variables. It was assumed that H0 constitutes the hypothesis concerning no differences due to the grouping variable, while H1 is an alternative hypothesis about the occurrence of such differences. These hypotheses were verified with the use of the aforementioned statistical tests allowing to reject the null hypothesis concerning no significant differences and accept the alternative hypothesis about the existence of differences in respondents' answers with regard to the individual independent variables. The study presents the relationships verified with statistical tests, authorizing to draw conclusions on the regularities in the studied group.

4. Results of the Research and Discussion

A number of indicators related to the analysed issue were selected from the total material extracted from the research survey. They present the respondents' views on the impact of remote working on information sharing among employees and the role of a manager in shaping information exchange as an important element of information management. An element directly related to the addressed research issue consisted in questions concerning the impact of remote working on: speed, understanding, and evaluation of the veracity of provided information and also the amount of information provided.

As can be seen from the obtained data, Generation Z employees participating in the survey were mostly (62.53%) of the opinion that remote working enables a fast exchange of information. Only 21.71% of respondents had a different opinion on this issue, and only 15.76% did not provide a clear answer. Furthermore, more than half of the respondents (55.30%) indicated that working remotely works in favour of understanding the provided information. Only 17.31% of respondents were of the opposite opinion and 27.39% answered this question with "neither agree nor disagree". Respondents also had a positive opinion on the impact of remote working on assessing the veracity of information, although in this case their opinions were less unanimous. 46.77% of respondents felt that remote working made it easier to assess the veracity of information, but 27.39% were of the opposite opinion, and as many as 29.72% did not provide a clear answer. Significantly, when asked if remote working leads to information overload, the majority (38.24%) were critical of this issue - pointing to extensive mounts of received information. However, it should be noted that 34.37% of respondents had the opposite opinion and 27.39% did not provide a clear answer (for a detailed summary of the respondents' answers regarding the impact of remote working on information exchange, see Table 1).

The conducted statistical analysis revealed that respondents' opinions concerning the impact of remote working on the ability to quickly exchange information varied according to their experience of remote working (the results of the Kruskal-Wallis test $p = 0.0011$, with an assumed significance level of $\alpha = 0.05$ indicate rejecting the verified null hypothesis). Practice in performing this form of work also differentiated the indications of respondents concerning the impact of remote working on their understanding of the provided information (AKW test $p = 0.0003$, $\alpha = 0.05$) and assessing the veracity of information (AKW test $p = 0.0018$, $\alpha = 0.05$). Respondents who had been working remotely for 1 to 3 years were relatively more likely (72.29%) to agree with the statement that working remotely allows for a quick exchange of information than those with

other work experience. Those working remotely for the shortest period of time, up to six months, were the least likely to share this opinion (48.21%). However, it was characteristic that those working remotely for the shortest period of time were also the least likely to agree with the statements that working remotely facilitates understanding the provided information (39.28%) and makes it easier to assess the veracity of the information (31.25%).

Table 1: Percentages of answers in the Field of Remote Work

Remote work	strongly disagree	mostly disagree	neither agree nor disagree	mostly agree	strongly agree
enables quick exchange of information	6.72%	14.99%	15.76%	46.77%	15.76%
helps to understand the provided information	6.46%	10.85%	27.39%	40.31%	14.99%
facilitates the assessment of the veracity of information	5.42%	18.09%	29.72%	31.78%	14.99%
leads to information overload	7.24%	27.13%	27.39%	30.23%	8.01%
makes most of the information go through the manager	1.29%	15.76%	25.58%	32.82%	24.55%
encourages to seek information among co-workers	5.68%	21.71%	29.72%	36.43%	6.46%

Source: Own study.

The results of the Kruskal-Wallis test also indicate that the assessment of the respondents concerning: the impact of remote working on the ability to exchange information quickly, understanding the provided information, and assessing the veracity of the information - varied according to the form of preferred future work (AKW test $p = 0.0000$, $\alpha = 0.05$). Those respondents who would like to work remotely in the future were most likely to agree with the statements that working remotely provides the opportunity to exchange information quickly (75%), works in favour of understanding information (70.59%), and makes it easier to assess the veracity of information (64.71%).

Additionally, statistical tests revealed that the respondents' opinions regarding the impact of remote working on: the ability to quickly exchange information (AKW test $p = 0.0323$, $\alpha = 0.05$) and understanding the provided information (AKW test $p = 0.002$, $\alpha = 0.05$) varied according to the size of the organisation where they were employed. Survey participants who worked in large organisations were relatively more likely (67.19%) than respondents employed in micro (63.19%), small (61.63%), and medium (56.36%) enterprises to indicate the ability to exchange information quickly when working remotely. Similarly, respondents employed in large organisations were relatively more likely (62.5%) than respondents employed in micro (58.24%), medium (50.91%), and small (46.51%) enterprises to believe that remote working was conducive to understanding the information provided.

Due to the assumed aim of the research and the related research questions, in the conducted survey, respondents were asked to respond to statements regarding the role of a manager and colleagues in shaping information exchange in remote working. As can be seen from the received data, a predominant part of survey participants (57.37%) was of the opinion that performing remote work results in the majority of information going through a manager. Although, it should be emphasized that one in four respondents (24.55%) completely agreed with such a statement and 32.82% of respondents rather agreed. Only 17.05% of respondents had a different opinion on this issue, and 25.58% did not provide a clear answer (Table 1).

The results of the statistical analysis indicate that the opinions of respondents regarding the role of a manager in information exchange in remote working varied according to their work experience in remote working (AKW test $p = 0.0019$, $\alpha = 0.05$) and their position in the workplace (UMW test $p = 0.0080$, $\alpha = 0.05$).

Respondents who worked remotely for the shortest period of time - up to 6 months - were relatively more likely (64.28%) to agree with the statement that most information in remote working goes through a manager than those working for more than 3 years (58.06%) and those working for 6 to 12 months (55.9%), as well as those working for 1 to 3 years (50.6%). What's important is the fact that this opinion was far more frequently

expressed by respondents working in executive positions (60.48%) than those in managerial positions (47.25%).

In the context of the manager's role in managing information in remote working, the results of the question concerning obtaining information from colleagues are interesting. As can be seen from the received responses, 42.89% of respondents said that remote working encourages people to seek information among colleagues. An opposite opinion was held by 27.39% of respondents, and as many as 29.72% did not provide a clear answer (Table 1).

The results of the statistical analysis indicate that respondents' opinions regarding the impact of remote working on seeking information among colleagues varied by their: gender (Mann-Whitney U test $p = 0.0492$, $\alpha = 0.05$), experience in remote work (AKW test $p = 0.0053$, $\alpha = 0.05$), as well as the size of the organisation employing them (AKW test $p = 0$, $\alpha = 0.05$). Male respondents were relatively more likely (45.98%) than females (38.65%) to believe that remote work was conducive to obtaining information from colleagues. People with the longest experience of working remotely were relatively more likely (54.84%) to share this opinion than those working in this form for 1 to 3 years (51.81%) and people working for 6 to 12 months (41.61%), as well as those working remotely for the shortest time (34.82%). Verifying the significance of differences also shows that respondents working in micro organisations (55.5%) were relatively more likely to agree with this statement than those employed in large (37.51%), medium, and small companies (29.09%, 29.07% respectively).

The presented results of the survey have not been compared with others, because in the literature on the subject no studies on the opinions of remote employees from the Z Generation on the analyzed topic were found.

Continuing in the future, the research topic presented in the article should be expanded with qualitative research. Such research makes it possible to reach a deeper understanding of the needs and expectations of employees from the Z Generation who perform remote work. Particularly intriguing in terms of research is answer to the question of why the respondents, positively evaluated many aspects of remote work, want to work stationary or in a hybrid form in the future.

5. Conclusions

Information acquired from young Generation Z workers who had experience of remote working allowed for some interesting insights relating to the analysed issue.

The research results indicate that respondents perceived the impact of remote working on both the speed of information exchange and the ability to understand the information provided and to assess its veracity in a positive manner. However, it should be emphasized that they mostly appreciated the speed of information transfer in remote working, while they were more doubtful about the reliability of the information they were obtaining. These results confirm the fact that the information technologies used in remote working provide opportunities for almost immediate contact with all members of the organisation - something that is often difficult or even impossible in a stationary working situation. However, the deprivation of face-to-face communication (characteristic of remote working) and the related reduction in informal relationships and lack of non-verbal communication means that it can be difficult to assess the veracity of the provided information.

A following observation shows that people working remotely for the shortest period of time - up to 6 months - were the least likely to agree with the statements that remote work provides the opportunity to quickly exchange information, promotes understanding the provided information and makes it easier to assess its veracity. This situation means that more extensive experience of working remotely has an impact on positively perceiving communication in this form of work - which is probably related to the skills acquired over time by remote workers.

Furthermore, the obtained data signals that the participants of the survey working in large companies, relatively more often than respondents employed in other companies, emphasized the benefits of remote working in terms of fast and convenient information exchange. Respondents' opinions may result from the specifics of working in large organisations, where direct contacts are limited to the circle of closest colleagues and relationships with other members of the organisation are often similar to remote working.

In reference to the positive opinions of respondents concerning the impact of remote working on information exchange, the negative assessment of the amount of information flowing to employees working remotely is particularly noteworthy. Pointing to an excessive amount of received information, the respondents highlighted

the disadvantage of remote working in terms of information overload. In this context, the role of a manager should boil down to coordinating the information provided to individual subordinates so that they can focus on carrying out their duties effectively, without the need to waste time selecting information and without having to worry about missing out on the important information in too many incoming messages.

Another interesting observation concerns the role of a manager in the exchange of information in remote working. As can be seen from the obtained data, a predominant proportion of respondents indicated that in remote working most of the information goes through the manager and one in four completely agreed with this statement. Significantly, this opinion was far more often expressed by respondents who had worked remotely for the shortest period of time and those in executive positions. Therefore, young Generation Z employees with short experience of working remotely were more likely to ask their supervisor for information.

Significantly fewer respondents, in relation to those exposing the manager's role in information exchange, stated that remote working was conducive to gaining information from colleagues. This opinion was more often shared by those with the longest experience in working remotely and those working in micro organisations. This observation means that a smaller number of people with whom the respondents worked and a longer time in remote functioning works in favour of forming employee relationships, allowing for freedom to obtain information from colleagues.

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Towards Sustainable Rural Communities

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Abstract: The future of rural communities relies on managing knowledge transfer and sharing in order to advance towards sustainable rural development. Investing in knowledge sources and management helps rural organisations to drive social growth, fostering cohesive and socially open rural communities. Rural communities may address a knowledge-driven pathway for sustainable rural development. Rural actors and stakeholders contribute to shaping wealthy rural communities by employing the potential of knowledge management, transfer and sharing. Regulatory frameworks support collaboration within rural communities that benefit of knowledge management issues and practices.

Keywords: Rural development, Rural communities, Knowledge sharing and transfer, European rural policies

1. Introduction

Rural communities identify the needs of the community, taking into account local traditions, cultural values, integrating broader societal objectives in planning and managing initiatives for sustainable rural development (Robinson, 2008). As social systems, communities enable individuals, groups, and organisations as actors that communicate and share resources, improving their life and meeting their interests collectively (Fesenmaier and Contractor, 2001). Managing knowledge supports community development. Knowledge is a driver of value within rural economies. Rural development relies on driving collaborative frameworks and managing knowledge transfer and sharing in order to drive social and economic growth of rural communities (Mardsen *et al.*, 2001).

Knowledge management views the firm as a social community or knowledge system capable of generating information (Sporleder and Peterson, 2003). Social capital and networks play a critical role in supporting knowledge transfer. Managing efficiently knowledge transfer relies on organisations capable of managing and building social capital proactively (Inkpen and Tsang, 2005), driving and managing effectively knowledge transfer (Argote and Ingram, 2000; Argote *et al.*, 2000). Knowledge is dynamic and dependent on social relationships that contribute to its creation, sharing, and use (Ipe, 2003). Communities act as gate-keepers to explicit and implicit knowledge that the core group of stakeholders contribute to create and share (Wiltshier and Edwards, 2013). Collective action helps support healthy and effective rural development, mobilising local actors to develop knowledge sources and practices for value creation processes (Meinzen-Dick, DiGregorio and McCarthy, 2004). Cooperation, interaction and social exchange contribute to shaping and forming collective knowledge (Hecker, 2012). Wealthy rural development relies on encouraging the sharing of knowledge within rural communities and agriculture (Girard, 2015).

Knowledge-driven co-production systems support multi-actor collaboration within rural communities (Vincent and Feola, 2020), and drive sustainability-oriented rural innovation (Testa *et al.*, 2022) for wealthy rural communities and revitalization (Yin, Chen and Li, 2002).

Sustainable rural communities rely on knowledge sharing practices and culture as drivers of social inclusion and innovation. While several studies investigate the role of knowledge management within rural areas and other studies focus on the perspectives for rural development, few studies interrelate the knowledge and rural development management as enablers of sustainable growth within rural communities. The research question refers to understand how rural actors and organisations contribute to shaping wealthy rural communities. The motivation of the study comes from considering that no much research concerns how to drive rural growth for wealthy rural communities.

The aim of the study is to elucidate how rural actors and stakeholders contribute to shaping sustainable rural communities by employing the potential of knowledge management, transfer and sharing, relying on regulatory frameworks and guidelines in order to drive rural development. Knowledge management issues and practices support the interaction and enable rural actors to strengthen collaborative efforts. Regulatory frameworks and guidelines help facilitate knowledge sharing and transfer, and drive social and economic exchanges among rural actors and stakeholders. This interplay supports some pathways leading to achieving sustainable rural development and healthy communities. The study is conceptual and relies on analysis and review of literature on the relationships between innovation and knowledge sharing as a means for sustainable rural community development.

The paper is structured as follows. The introduction elucidates the aims and motivations of the study. In the second paragraph the theoretical background is presented. Understanding the role of knowledge transfer and sharing within and across organisations and the pathway to sustainable rural development are elucidated. In the third paragraph methodological section is presented. In the fourth paragraph the relationship between knowledge management and policies for rural development is presented. The analysis of studies that elucidate the role of knowledge management as a driver to support knowledge exchange and drive collaboration within healthy development of rural communities is elucidated. European framework, guidelines and regulations contribute to modernising and improving agrifood and rural development. Finally, discussion and conclusions are outlined.

2. Theoretical Framework and Background

2.1 Understanding the Role of Knowledge Sharing and Transfer Within and Across Organisations

Investing in knowledge sharing and transfer helps to support social capital and social interaction as drivers for promoting community development (Fesenmaier and Contractor, 2001). Knowledge helps for sustainable communities and agrifood systems (Feenstra, 1997). Knowledge supports both innovation and social and economic growth within communities. Knowledge is a critical organisational resource for competitive advantages (Davenport and Prusak, 1998). Knowledge is a core resource for successful organisations that contribute to social value creation within communities. Investing in knowledge management nurtures knowledge sharing culture among the actors involved in creating new knowledge. Investing in knowledge assets helps to drive value creation processes, restoring the value of social relationships, and developing knowledge capital of communities and collective intelligence within social systems. Investing in knowledge supports the organisations to develop social growth and social capital, and fosters cohesive and socially open communities. The knowledge created by communities develops within social ecosystems, enabling organisations to evolve in a sustainable way, fostering social capital, for building strong economic, social and environmental ecosystems. Collaboration is recognised as a key element to foster the responsibility of each actor in the cooperative framework and to achieve social, economic and environmental objectives. Knowledge transfer contributes to competitive advantages. Successful organisations are able to drive and manage effective knowledge transfer. Effective organisations transferring knowledge internally are more successful than those lack knowledge management and transfer. Knowledge transfer refers to the process through which one unit is affected by the experience of another one within organisations (Argote and Ingram, 2000). Social capital and networks play a critical role in supporting knowledge transfer. Managing efficiently knowledge transfer relies on organisations managing and building social capital proactively (Inkpen and Tsang, 2005). While knowledge transfer relates to the «movement of knowledge between different units, divisions, or organizations», and «involves both the sharing of knowledge by the knowledge source and the acquisition and application of knowledge by the recipient» the «knowledge sharing refers to the provision of task information and know-how to help others and to collaborate with others to solve problems, develop new ideas» (Wang and Noe, p. 117).

2.2 Towards Sustainable Rural Development

Creating value in rural areas relies on promoting social and economic value creation within rural communities. Sustainable development of rural communities relies on enhancing rural resources as capital assets that contribute to wealthy local communities by providing opportunities to improve the quality of rural environment (Garrod, Wornell and Youell, 2008). The pathway leading to sustainable rural development relies on open and socially proactive rural communities. Akgün, Baycan and Nijkamp (2015) have defined the sustainable rural development as the call of maintaining sustainability and continuity of rural areas while exploiting their opportunities in the global scene. Sustainable agricultural practices contribute to shaping healthy and sustainable rural development and societies (Mardsen *et al.*, 2001). Rural resources enable rural and agrifood organisations to entrepreneur initiatives and to drive economic and social growth within rural communities. Investing for enhancing rural resources helps to drive rural development as paradigm leading to wealthy rural communities and driving value creation. Rural development is emerging as a new paradigm that places the agriculture at the interface between actual and potential rural and no rural activities for constructing viable rural livelihoods (Ellis and Biggs, 2001). Agricultural activity can also shape the landscape, providing environmental benefits in terms of land conservation, sustainable management of renewable natural resources, preservation of biodiversity and contribution to the socio-economic viability of rural areas (Oecd, 2001). Rural areas and resources contribute to sustainable and smart growth, and provide an added value and potential for creativity and innovation (Commission, 2017). In the post-industrial stage of rurality there is an integration between economic and social activities within the territory. The preservation of the environment, the security and quality

of food are becoming the main priorities of policy agenda. Rurality becomes as a synonym of diversity in terms of landscape, historical and heritage asset, tradition and values related to agriculture, and natural asset (Sotte 2008).

3. Methodological Section

The study relies on qualitative and archival data drawn by both analysis and review of literature that aims at investigating the relationship between agrifood and rural sector and knowledge management practices, and the documents related to European policies with regards to rural development and agricultural sector. The European frameworks and guidelines governing the design of rural development and defining policies for agriculture are presented and analysed. The aim of documentation's analysis is to elucidate how regulations and guidelines contribute to improving social and economic activities that concern rural development, fostering knowledge sharing and exchange, leading the actors to identifying new opportunities for rural value creation. The study aims at introducing a proposal for rethinking the development of rural communities. At this stage of research as exploratory study and analysis, no systematic literature review was no set. In particular, with regards to literature analysis, the selected contributions are interpreted in a narrative synthesis in order to elucidate new perspectives and advance theoretical frameworks on emerging issues (Denyer and Tranfield, 2006; Dixon-Woods, Agarwall, Young, Jones and Sutton, 2004).

4. Knowledge Management Between the Development of Rural Communities and the European Policies for Rural Development

4.1 The Role of Knowledge Management Within Rural Communities

Knowledge management practices and issues help for building wealthy rural communities. Knowledge management views the firm as a social community or knowledge system capable of generating information in the agricultural context (Sporleder and Peterson, 2003). The sustainability of communities and enterprises relies on encouraging knowledge sharing between stakeholders to increase effective measures for social and economic growth in agriculture and rural areas (Girard, 2015) by following a knowledge management view and developing knowledge sharing and knowledge transfer in order to support the building of partnerships within rural communities (Wiltshier and Edwards, 2013). Managing knowledge in the agricultural systems helps to facilitate a continuous exchange of knowledge generation processes, localised practices, collective needs, and research results across farmers, development experts, scientists, citizens, and policy makers. Knowledge is enabling a networked innovation as a multi-sided process that relies on driving knowledge creation, transformation and distribution that involve a wide variety of diverse and several actors that contribute to value creation within rural communities (Abdirahman *et al.*, 2014). Knowledge is becoming a driver of the land development, supporting the pathway for sustainable development (Maizza, Fait, Scorrano and Iazzi, 2019). The future of sustainable rural development relies on driving the interaction among actors that are dealing with knowledge-based practices that involve the combination of different kinds of knowledge, leading to shaping knowledge-driven rural communities (Buckmaier and Tovey, 2008). Governing agrifood systems and rural development and communities towards sustainability relies on managing, sharing and transferring knowledge as a critical resource for driving healthy and safe rural and agrifood ecosystems. Developing knowledge issues and practices within rural and agrifood ecosystems helps to support social and community innovation, leading to effective rural development and communities coherently with sustainable development. Introducing knowledge management practices helps rural actors to work collaboratively and contribute to innovation that helps to facilitate the itinerary of agrifood systems and communities towards sustainability (Brun *et al.*, 2021) leading to alliances that open to democratising knowledge access and utilization. In particular, driving knowledge sharing supports for innovation enabling cooperative frameworks and collaborative efforts towards value creation within rural communities (Gardezabal *et al.*, 2021). Managing and sharing knowledge helps communities to drive rural innovation, enabling the participant actors to create new technical, managerial and institutional knowledge. Sustainable rural development relies on structural, relational, and cognitive dimensions of social capital with regards to the ability of firms to engage with networked stakeholders in bottom-up knowledge sharing for innovation (Go, Trunfio and Della Lucia, 2013). Ammirato *et al.* (2021) have stated that «the agri-food sector is characterized by a constellation of heterogeneous actors sharing values, culture and infrastructures that have the potential and the will to cooperate in order to pursue the general long-term objectives of territory development and competitiveness» (p. 3). Collaboration is emerging as a driver of rural actors taking the responsibility to achieve social, economic and environmental objectives. Collaboration helps rural firms and several stakeholders to contribute to value creation processes within rural ecosystems.

4.2 The European Framework as an Enabler of Rural Development and Knowledge Sharing Practices

European policies contribute to facilitating interaction, economic and social exchanges among rural actors, supporting the development of knowledge sharing practices. As centres of renewable energy production, European rural areas contribute to driving biodiversity preservation and protecting environmental resources (Commission of the European Communities, 1988). Following the Cork Declaration (1996) rural policies support rural communities to preserve and improve the quality of rural environment, valorising natural resources, biodiversity and cultural identity coherently with a multi-disciplinary and multi-sector approach.

Recently, the European rural development planning was emerging as a priority to drive social and economic growth of rural communities (Commission of the European Communities, 1996). According to the article 4 of the EU Regulation No 1305/2013 for the European Union rural development policy (2014-2020) three long-term overarching strategic objectives were identified and translated into six priorities for rural development: a) fostering the competitiveness of agriculture; b) ensuring the sustainable management of natural resources, and climate action; c) achieving a balanced territorial development of rural economies and communities including the creation and maintenance of employment. In particular, the role of knowledge transfer and innovation is an important asset to modernise rural areas and communities: fostering knowledge transfer and innovation in agriculture, forestry and rural areas; fostering innovation, cooperation and the development of the knowledge base in rural areas; strengthening the links between agriculture, food production and forestry, research and innovation for improved environmental management; fostering lifelong learning and vocational training in the agricultural and forestry sectors; enhancing the viability/competitiveness of all types of agriculture, and promoting innovative farm technologies and sustainable forest management: by improving the economic performance of all farms and facilitating farm restructuring and modernization, increasing market participation and orientation as agricultural diversification; by facilitating the entry of skilled farmers and generational renewal; promoting food chain organisation and risk management in agriculture by improving competitiveness of agrifood and rural systems; restoring, preserving and enhancing ecosystems related to agriculture and forestry by enhancing biodiversity and improving water management and soil management, preventing soil erosion; promoting resource efficiency and supporting the shift toward a low-carbon and climate-resilient economy in the agriculture, food and forestry sectors.

The Cork 2.0 Declaration (2016) supports innovation within European rural areas by: promoting both rural prosperity relying on the identity and dynamism of rural areas; fostering diversification, entrepreneurship and employment for wealthy and resilient rural communities and farms; strengthening rural value chains by promoting policies that open to emerging business opportunities for agriculture and forestry, and rural enterprises related to circular and green economies; investing in rural viability and vitality, promoting rural quality of life and meeting the aspiration of rural youth, strengthening and aligning the development of rural and urban areas.

The Common agricultural policy (CAP) refers to bringing together food, the environment and the countryside. The CAP is a partnership between society and agriculture that ensures a stable supply of food, safeguards farmers' income, protects the environment and keeps rural areas vibrant. The CAP 2023-2027 focuses on a new way of working. It is a modernised policy, with a strong emphasis on results and performances. It focuses on ten specific objectives, linked to common EU goals for social, environmental, and economic sustainability in agriculture and rural areas. The CAP 2023-27 is built around ten key objectives, and focuses on social, environmental and economic goals: to increase competitiveness and contribute to food value; support initiatives and actions for managing climate change; to provide environmental care; to preserve landscapes and biodiversity; to support generational renewal; to drive vibrant rural areas; to protect food and health quality; to foster knowledge and innovation; to ensure a fair income for farmers. These objectives are the basis upon which EU countries designed their CAP Strategic Plans.

5. Discussion and Conclusions

The study aims at identifying the role of knowledge management practices in terms of knowledge transfer and sharing as drivers of sustainable rural development and communities. Driving rural development and enabling communities to achieve conditions of sustainable and wealthy development relies on fostering and managing knowledge sharing practices. Investing in knowledge sharing and transfer helps to drive collective knowledge as a driver for shaping sustainable rural communities within agrifood systems. Sustainable rural development relies on strengthening collaboration within rural communities through knowledge sharing practices. The future of rural development and communities relies on managing knowledge transfer and sharing for shaping effective rural communities and organisations that contribute to value creation within rural ecosystems and open to

wealthy and sustainable rural communities, driving social and cohesive rural growth. Promoting knowledge sharing within rural and economic ecosystems helps to support sustainable, social and economic growth. Rural development policies contribute to designing sustainable rural ecosystems and communities by enhancing knowledge management practices and issues for innovation and wealthy rural communities. Investing in initiatives and actions that implement knowledge sharing and transfer practices enable rural enterprises and organisations to interiorise a culture of sustainability.

With regards to policy aspects, European institutions encourage all the rural stakeholders and actors to promote rural development as a key strategy for sustainability. Designing policies for sustainable rural development helps to revitalise rural economies and communities by creating and consolidating new linkages between agriculture and society, bridging rural and urban realities. European regulations and guidelines contribute to strategic and organisational changes by encouraging the rural actors to adopt and construct business models that support the to design of sustainable and cohesive rural communities. Promoting sustainable rural development and encouraging a culture of sustainability in agriculture and rural areas relies on strengthening initiatives that empower rural actors to engage in knowledge transfer and sharing practices.

Driving the future of social, economic and ecological frameworks for human and non-human life depends on changing the trajectories of dominant agrifood systems, shaping rural ecosystems that contribute to sustainable rural development and communities. There are some organisational, managerial and social implications of the study. Firstly, developing knowledge sharing practices helps to enhance the construction of collaborative spaces within agrifood and rural systems, and asks for identifying coherent frameworks for cooperative design. Secondly, promoting sustainable rural development and communities relies on training specific managerial capabilities and skills. Thirdly, developing knowledge sharing practices helps to drive social innovation and inclusion issues within rural communities building social ties and cohesion among the actors involved in value creation process. There are some limitations. The study aims at introducing a new proposal for driving economic and social growth of rural communities and agrifood systems. Sustainable rural communities drive social and economic development relying on knowledge management practices and issues. This study does not propose a systematic literature review. There are no case studies. The study is exploratory and investigates new perspectives for rethinking rural community development. Further research perspectives imply to investigate how farms in agriculture are developing hybrid pathways to designing structures and business models for healthy and sustainable value creation processes in rural areas and communities.

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Intellectual Capital and the Perception About Self

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Abstract: The value of a company is not only measured by the value of its shares in the financial market, but also by its influence in the media and by how it impacts people's lives. Therefore, you have the value of that brand, its name, and its owner. Although this value speaks very loudly in a society, capitalist or not, there is another value that is not measurable and has a high impact on the external value of a company. It is the value that a company has for its employees and aggregate workers. This is a value that can be measured in the evasion of its staff. However, there is still one more value. Having valuable employees is not a gift; it's an achievement. Getting employees who work for years in the company and have high performance, engagement, and motivation, is more than professionalism. It's affection. And work with affection is not a characteristic of all people. This employee-company relationship requires commitment from both parties. A company, like a tree, is more than it appears to be. Likewise, a person is also more than appears to be. In this context, this article aims to address these intricacies of business-employee relationships, so that self-perception is the basis of a lasting and healthy relationship. The methodology of this work, in addition to long bibliographical research, is research that addresses several issues related to this context and the results are surprising. Thus, more so than professional development, it is necessary to invest in a high-value asset: awareness of yourself. Searching for your value within yourself is a great journey, which must be carefully instigated, in order to promote evolution and well-being within the company. More than professionals, people of character and commitment are needed, and these are also characteristics that must be sought in its employees. This is so the company has a long and healthy life, and the employee feels motivated to grow as a person and as a professional.

Keywords: Intellectual capital, Affection company, Professionalism and self-awareness, Intrinsic quality, Character and evolution, Intrinsic professionalism

1. Introduction

A company is more than meets the eye. A good physical facility: something pleasing to the eye is of great importance. Something that fills the employee's eyes and heart, a place he feels proud to go to work in the morning. A concierge and a reception that makes you want to go to work well dressed. A place that, at the end of the afternoon, he is proud to leave and desires for someone to see him leaving there. Yes, it may not seem like it, but it exists. The pride of working somewhere. Clean, clear, organized environment. An efficient, pleasant entry-exit system and a corridor or garden that leads you to the final working environment that you like. A coffee space that is pleasant and informative. Coffee talks can be technical, informative, and solve many work problems. Clean and tidy bathrooms. Clean and organized kitchen and dining room and a balanced, varied, and nutritious menu. A human resources environment with pleasant staff and a system that allows flexibility in special situations that the employee faces but is simultaneously efficient in regulating rules and procedures that the employee and third parties must follow (Alkmin, 2022). Remembering that the value of a company is its book value added to its intellectual capital value. Book value is related to physical capital and monetary capital. Thus, the location of the company has its value here. The value of the building, the price per square meter, the city, in short, all the effort in location, building design, decoration, is found here. It is visible and it is tangible. The size of the building, the type of building, its location, and what that building holds inside, whether it's jewellery, cars, electronic components, or clothing, is part of its physical capital. Monetary capital, measured in figures, whether by the amount in cash or shares or even by the value of its shares on the stock exchange, is a direct and tangible measure of value. In addition to its visible heritage, however, there is the invisible heritage, but of undeniable existence (Bond *et al*., 2000; Kayo and Famá, 2003; Berzkalnea and Zelgalve, 2013).

Like a tree, according to the analogy of Edvinsson and Malone (1997), the health of a company begins with its foundations, with the land where it is planted, which is the environment in which it operates. And that goes through the place where the company is installed. Therefore, a company will only be prosperous if it is located properly. Its roots will only develop if they are in the proper soil, as acidic soils burn the developing roots. Thus, companies located in inappropriate locations do not prosper. There are also suitable customers for that company, that is, the market/product segment to be reached must be studied. Customers must be studied, in order to know their taste, preferences and needs, so that they can be served in the best way. Customer feedback,

if utilised in a healthy way, will be part of your fertilizer that will nourish your company, as well as your payment. Not forgetting that bad, demanding, and non-paying customers spoil the company's soil and consume its nutrition. Wrong partnerships and dubious suppliers, also interpreted as parasites and humidity, contribute to fungus undermining the strength of companies. The innovations necessary for products and processes, in order to improve the cost/benefit/quality ratio, contribute as the necessary fertilizer for the trunk to become stronger and the branches to reach new heights.

The value of a company can be calculated by the value of its shares and their quantity in the financial market. Even if you have to subtract the value of debts, taxes, depreciation and amortization, what would be the value of your company if all your employees resigned at the same time? Scary situation? Perhaps. However, this hypothetical situation serves to realize that a company has an added value inherent to the people who make up its staff. And that many times you don't stop to think. In the same way that many people only think about the leaves that fall on the sidewalks and blame the trees, without looking at the engineering work that composes them, in the same way, many times, the people who compose the functional framework are not observed from the point of view of the knowledge engineering work they carry, but only as a registration number, which can be dispensed with (Edvinsson and Malone, 1997; Sullivan, 1998).

However, this organizational culture that “no one is irreplaceable” has meant that companies are always starting over and not being able to take off in their success, as expected. The greatest intellectual capital of a company is still what is in a person's brain, even if that company is composed only by its owner. Even if all laptops and clouds are lost, still, a person's brain is capable of recreating this company. However, the opposite is not true. People carry with them ideas, motivations, dreams, aspirations, neurolinguistics, and neuroscience that changes and creates new synapses with each experience, no matter how small. A new smell, new colours, a new dawn, a new perception, and that's it, here comes an innovation, a new product, a refining process. And so on (Edvinsson and Sullivan, 1996; Edvinsson and Malone, 1997; Sullivan, 1998).

As with the company analogy, it is also possible to analyse a person or company employee, like a tree (figure 1). Their way of dressing, way of speaking, of doing their day-to-day tasks, and the way they interact with the team, is what is visible and is what is easy to evaluate. But behind this image, there is the work of an entire brain, and why not say, the entire body, which acts and reacts to situations, praise, criticism (constructive or not) and management. In his invisible form, there is the way he assimilated his childhood experiences, his day-to-day internal life, the experiences of his previous job, what he studied at school, the languages he speaks. All this and much more, works as fertilizer or as parasites, within you, supplying or stealing energy from your being. However, this is a human being, it is the human capital and the greatest intellectual capital of a company, which lives and pulsates with new ideas, new solutions, or unfortunately, new problems. This perception is very important. When the intellectual capital starts to give problems in a company, there is a need to look for the parasites, for the missing nutrients, for the place where that person is “planted”. That perception, that analysis, is an art of management. It's something profound, not just theoretical. For this, it is necessary that the perception of the self-first occurs (Fineman, 1997; Luthans and Youssef, 2004; Nobre and Valentini, 2019).

This self-perception starts with the entrepreneur. It is important that he knows himself and that he has the notion of how important it is that both he and his employees are well situated within the company. There is nothing worse than discovering that your employee is there, lost, without knowing why he came to work that day. It's frustrating. A businessman who knows himself well will be better able to hire the right people to be with him and help him manage his company, complementing the qualities he lacks, as if they were extensions of his arms; strengthening his own qualities and as if they were extensions of his legs; making him reach farther. This makes him have a complete team, a team that complements each other and not a team of gaps and friction generation (Gallois, Callan and Palmer, 1992; Luthans and Youssef, 2004; Meireles and Camargo, 2014; Valença, 2020).

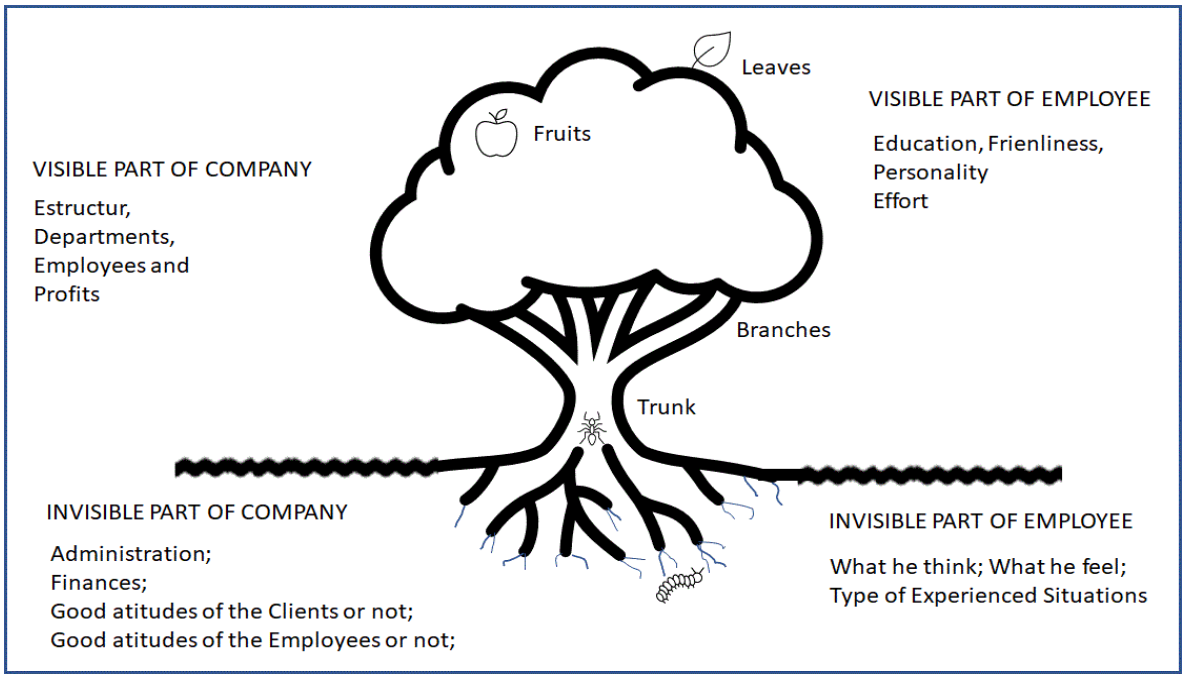


Figure 1: Tree of the Comparison Between Company and Employee

2. Motivation

The motivation for this work came from the observation carried out in the classroom about the most frequent complaints of students who attend classes, and several "*brain storms*" in relation to motivation, appreciation and perspectives as employees and in relation to companies for the who work or have worked.

3. Methodology.

The methodology for this work was divided into three stages, the first being a bibliographical research carried out using the following descriptors: "intellectual capital", "intellectual value", "human capital", "organizational climate", "business affectivity", “company affection”. The research was carried out in the World Wide Web database in Portuguese and English. The selected articles can be found in the bibliography of this work. In the second stage, a survey was carried out through the application of an open questionnaire, answered manually, composed of 5 questions related to what you like the most (liked), what you like the least (liked), the reasons for leaving that job, if you would return working there and the memories they kept of the companies they worked for. The questionnaire was carried out openly, so that there was no bias in the answers. The questionnaire was provided to the participant on a sheet of paper and the participant was asked not to identify himself and that the companies' codification was numerical, in order to preserve the identity and privacy of the participant and the companies. Participants were asked to be sincere in their responses. The questionnaire response time was around 30 minutes. In the third stage, the data were measured in an Excel table and are presented as a percentage in the graphs.

4. Results

It is noticed that the intellectual capital of a company goes beyond the information and patents of its product or documentation of its manufacturing processes. There is still more to be known in this area, which offers constant challenges to managers and entrepreneurs around the world. Yes, because human beings change every morning. After each night of sleep and the somatization of lived experiences, cognitions provide changes in behaviour. However, what happens is that the greatest intellectual capital is still with them: people. Be it in your creativity, be it in your reaction to challenges, be it in your resilience. And these changes occur every moment. There is still no system that surpasses human resilience or creativity in problem solving. However, people need something very important: motivation. Systems don't need motivation. And motivation is something personal and non-transferable. What motivates one employee may not appeal to another. And this is still an unknown for many managers and companies. The opportunity for professional and personal growth of an employee in a company brings motivation. Normally, after reaching the growth stage within a company, it can happen that they become demotivated, if the company or the activities they perform are not offering challenges. They can also become

demotivated if the challenges offered by their activities are too unpleasant. However, a healthy human brain likes to overcome challenges every day, as it is part of its nature of cognitive evolution (Goldstein and Ford,2002; Kays, Hurley, and Taber, 2012).

The research, carried out through an open questionnaire containing 5 questions: what you like (or liked) most about the company; what you like least (or liked) about the company; the reason for leaving the company; whether you would work for that company again and what is your best memory(s), was carried out with two groups of students from the professional technical course in Technology in Telecommunications Systems at the Federal Technological University of Paraná, in the first semester of 2023. Thirty-two fully completed questionnaires were obtained, from people aged between 20 and 45 years and with a number of jobs ranging from 1 to 7, with an average of 2.75 jobs per person.

The first question of the questionnaire: what they like (or liked) most about the companies they worked for or still work for, were cited: learning opportunities, with 16%; organizational climate / welcome / treatment, with 9%, feeling of being employed or active, with 8%; friendships, with 8%; professional growth with 7%; activities carried out, with 7%; contact with different people, 6%; freedom to work, with 5%; mobile time, with 5%; high salary, with 4%; company status, with 4%; benefits, work team, deposited trust and working hours reduced to 6 hours a day, with 3% each; organization and management, with 2% each; quality food, stewardship, communication, professional recognition and business trips, with 1% each. The result can be seen in figure 2.

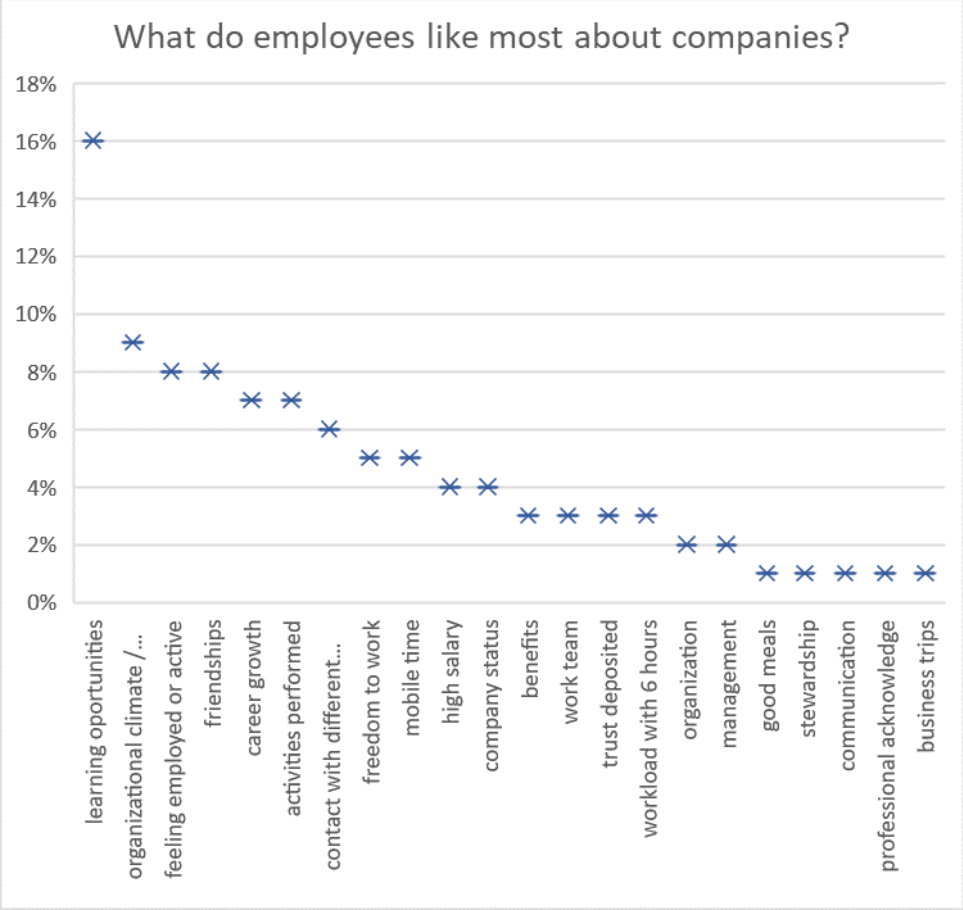


Figure 2: Comparison Chart of What Employees Like Most About the Company

The second question of the questionnaire, what they like the least. The reasons are described below: type of activity, 9.17%; pace of work/excess tasks, 6.42%; pressure for results, 5.5%; boss treatment, 5.5%; communication failures between sectors, low salary and organizational climate, with 3.66% each; workplace, relationship with management, company disorganization, working on days off/holidays and short working hours, short contract, with 2.75% each; commuting time, bureaucracy, company politics, rigid schedule, many trips, low salary, colleagues' character, lack of training, lack of presence of the superior / incompetence or nothing to complain about, 1.83%; treatment of employees, perception of favouritism, incompetence of leadership, lack of activities, activities outside their area, lack of character of owners and managers, lack of privacy, lack of

opportunity, dirty work place, lack of recognition, lack of benefits , salary injustice or late salary, with 0.91% each. The result can be seen in figure 3.

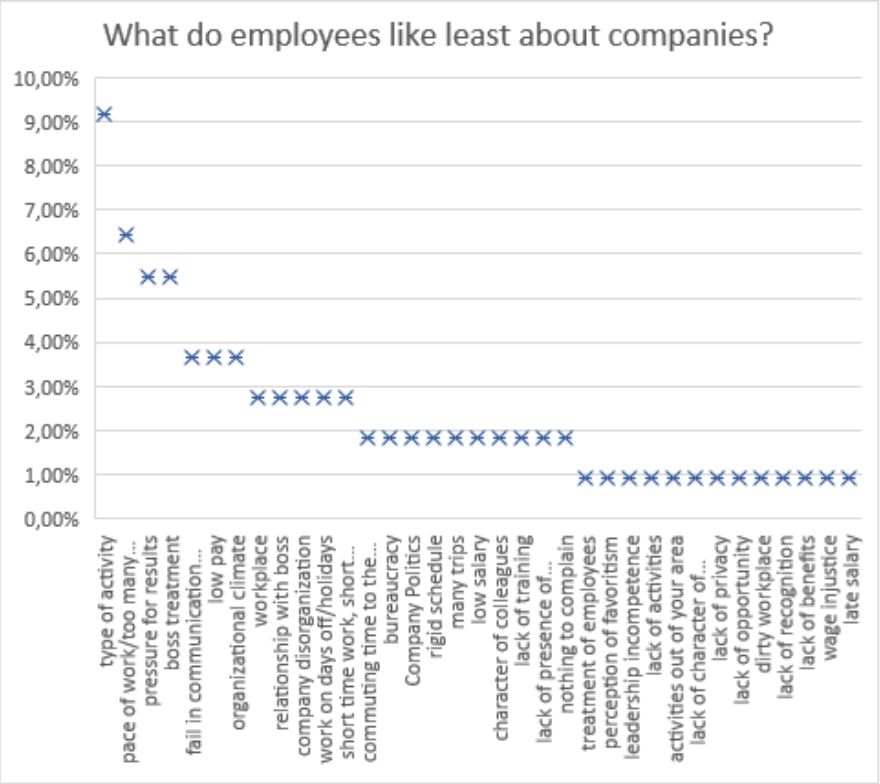


Figure 3: Comparison Chart of What Employees Least Like (Liked) in the Company

The third question in the questionnaire, the reasons that led you to leave the company(ies), are: change of job to better places, 27.63%; finalization of contract, 17.10%; staff reduction, 10.52%; low salary, 6.57%; company bankruptcy, 5.26%; did not like the activity, pressure and fights with colleagues, 3.94% each; bad relationship with superiors and felt devalued, 2.63%; change of state, lack of payment, did not like the workplace, stagnation, limitation of work, to study, disorganization, bad management, organizational environment, change of professional area, lack of appreciation, loss of health, with 1.31% each one of the evaluated items. The result can be seen in figure 4.

The fourth question in the questionnaire, regarding the decision to go back to work in the companies they have already worked for, 47.87% answered yes and 52.12% answered no.

The fifth question in the questionnaire, about the best memories: friendships, with 20.76%; technical learning, with 13.84%; companionship of work teams, with 13.07%; moments and festivities, with 10.76%; recognition and good management, 10.00%; business trips / external training / training abroad, with 7.69%; organizational climate, 3.07%; customer recognition, 3.07%; meet new people, 2.3%; organized work, 2.3%; type of activity, 2.3%; discovering your worth as a person, 1.53%; freedom from work, 1.53%; benefits, 1.53%; and other good memories, such as always being on the move, the company's history, knowing good people, stewardship, high salary, active participation in company changes, partnerships and mobile working hours, divide the rest of the percentage, being 0.76% for each of these items. The result can be seen in figure 5.

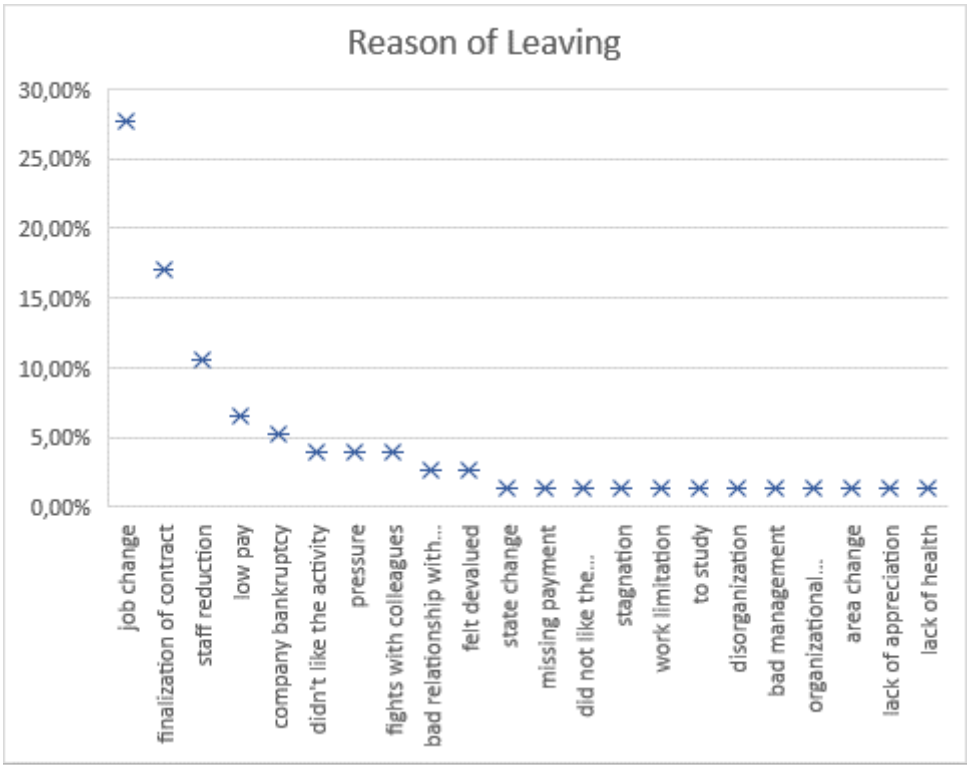


Figure 4: Graph Comparing the Reasons That led Employees to Leave the Company

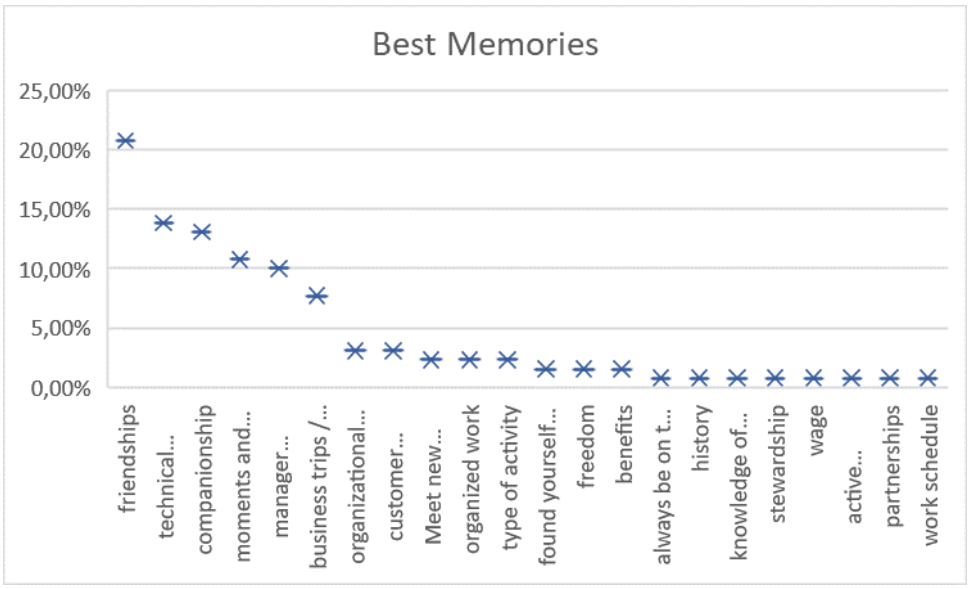


Figure 5: Comparison Chart Of Employees' Best Memories of the Company

5. Discussions

There are factors that shape employees' perception of their worth within a company and this perception influences their motivation and commitment. When a person starts working, there are expectations: salary, professional growth and growth as a person, activities to be carried out and management. Expectations are, in large part, a reflection of the values that came from the cradle and the formation of their personality and character over time, such as ambition or greed, capacity for effort or comfort zone, healthy or harmful competitiveness, ability to cooperate or not, or others. Expectation and return are comparison factors that tend to drive motivation and commitment. Unmatched expectations generate frustration and demotivation, resulting in a lack of commitment. How to work these factors within a company or team is a challenge to be overcome by each entrepreneur or team leader. Managers encounter many challenges when trying to understand and effectively use their employees' intellectual capital, and thus, the biggest challenge is to assess the employee's

reality, understand their strengths/weaknesses in knowledge and as a person, and understand the behaviour of the team and your own behaviour. Having the ability to listen and recognize talent within your team and bring together different people and different views are part of this communication, as well as giving feedback to your superiors and subordinates for improvements in the company. Another great challenge for the manager is to overcome his own fear when realizing that his employee has more competence than he does. And so, instead of persecuting them and sending them away, give them better technical or management or training opportunities within the company and thus not lose this intellectual capital. How to make this professional maturity possible?

6. Conclusions

What makes a person work for many years in a company, even knowing that there are better places to occupy their talent? What makes a person work for many years in the same place, without at least looking for other options? There is more behind an employee's behaviour than meets the eye. Yes, as much as one constantly thinks about professionalism and intellectual and technical growth, there is more. There is something intangible behind the indexes in a company and the performance of its employees, be it technical, administrative, or personal performance (Stewart and Ruckdeschel, 1998; Sullivan, 2000).

It was observed, in the analysed group, what they like (or liked) most about the company they work or worked for, the taste for learning, the feeling of belonging and the appreciation of friendships in the workplace. Feeling important and seeing the company you work for progressing, gives the feeling of life flowing and belonging to a world that evolves in the right direction. Interesting activities, balanced teams and competent management remain in the hearts of former employees. The employee's interest in remaining in a company goes beyond appearances. Often, friendships and companionship in activities, a work team that makes you feel confident and important, contribute to your staying in that place longer. Human beings still have the need to belong, so when they feel welcomed by a certain group, they feel comfortable and stay there longer. Even though the pandemic has brought withdrawal and seclusion, and thus, much of this need and sense of belonging has been lost, still, companionship contributes to staying in a workplace that is not so pleasant. Therefore, affectivity brings with it this attachment to the company (Britto and Elias, 2009; Squire, 2009; Giuliani *et al*., 2011). A company's culture and organizational environment influence employee motivation and engagement, and these two factors have a strong influence on employee behaviour. Motivation and engagement increase productivity, improve relationships between teams and the will to make it work, in addition to reducing stoppages or rework. When the employee comes from another company and from an environment without perspective and hostile, in a short time he will realize that this motivation is changing his behaviour in the way he sees his professional life, with greater perspectives, new horizons and a new destination for his future. What seemed obscure and without definition, now begins to gain new colours. The most common consequence in unmotivated and non-engaged employees is low productivity, inattention, rework and indifference with their team, non-compliance with company goals, absences from work, excess medical certificates, and idle time.

When there is incompatibility between the company's culture and the needs or expectations of employees, there is a need to review the mission, vision, and values, for both. And this evaluation can be carried out through double-blind research and evaluated by a neutral and specialized company. But even so, it can be done in a direct and simple way, when the owners or managers go visit the factory floor and talk with their subordinates, in a friendly but also investigative way, for example, where is the weak point of your process, points of improvement, weaknesses and others. Many of the answers managers look for in business meetings can be on the hands of their simplest employee. Many answers come from observation and evaluation.

Agreeing with the company's mission, vision and values are essential components for a healthy and lasting relationship between employee and company, because without agreement there is no healthy relationship. Even in the Holy Bible it is written (“Can two people walk together, if they are not agreed?” Amos 3:3). Of course, after the agreement comes the will. Therefore, the employee tends to act in such a way that the company is satisfied with his work and the company tends to study ways to value this employee.

Feeling well managed, without injustice and with recognition of the good work done, strengthens the employee's sense of well-being, making him feel motivated through positive affirmation, to always work well and better. Injured employees, poorly recognized for their efforts, become average and lose motivation for evolution. Low wages, not liking the activity they perform and suffering constant pressure for results are among the first causes of resignation in the analysed group. Likewise, the type of activity, overwork, pressure, and the way it is managed are among the first things that employees least like (or liked) in the companies they work or

have worked for. Thus, it can be inferred that the type of activity is decisive for the employee's dismissal. Therefore, care in hiring is essential so that the employee stays longer in that service station and the company does not waste resources with training in that position and never have a well-trained employee in that position. Therefore, it is important to be very clear about the activities that the employee must carry out, the study of the temperament profile for each function of the company. Because it's no use, a person who doesn't have patience, to deal with a customer or to resolve minutiae of a manufacturing process, as the probability of having temper tantrums will be high. This is an assessment that needs to be verified, so that customers are not lost, and unnecessary friction does not occur in a production line, causing even greater damage (Stewart and Ruckdeschel, 1998). There are strategies and practices that companies can adopt to increase their employees' perception of value and appreciation. Training is one of them. The perception of oneself and the other is also training. There are companies that provide this training service in this area, either through lectures, theatre performances about awareness, targeted questionnaires, differentiated teamwork. Providing this type of training is valuing the employee. Each company belongs to an area or branch, be it textiles, automobiles, cosmetics, medical, or others, and it is up to each company to study its customer, study its employee, train its employees to meet customer expectations, so that employees receive a good evaluation from the customer and can discuss improvements in the process, product, or service. However, the goals achieved must also be valued by its employees, such as gifts, such as dinner, travel, cash value, tour, share in the profit's company or company shares, for example. How to know what rewards your collaborator or your team the most?

Likewise, people with focus and attention problems have difficulty performing tasks that require concentration or high-risk tasks. Each person has a coefficient of capacity for innovation, which involves imagination, creativity, taste for research, attraction for attempts, disposition, among other qualities; a coefficient of capacity for managing people, which involves affection, patience, character, loyalty, knack for dealing with people, among other qualities; a coefficient of ability to carry out projects, which involves planning, patience, analysis of details, analysis of logistics, persistence, resilience, among other qualities; and a coefficient of ability to pay attention to rules and methods, which involves attention to quality standards, discipline, obedience, among other qualities. All these capabilities must be carefully studied so that this person can be allocated to the correct place within a company, in order to make the most of their potential and minimize intercurrences with their management. (5) Self-perception and self-knowledge are fundamental for more assertive professional development and also for the well-being of a company's employees, as they direct the best choices, according to their expertise, increasing their chances of success in the company and in the life. Self-perception makes people aware of their environment, their relationship with the world and their place in the world. Self-knowledge makes the person aware of his possibilities for growth, his talents, and his intuitions. This makes a person realize their best place in the world and thus overcome themselves, strengthening their knowledge and skills at each stage of their life.

Individuals are unique in their temperaments, perspectives, dreams, personalities, and character, among other characteristics. Thus, individuals respond differently to various motivational factors. Therefore, companies can direct their strategies to a certain group and thus increase employee motivation based on individual differences. Sellers, research agents, technicians, engineers, and many other professions have very different profiles. Companies often need to hire companies that specialize in behavioural and neuroscience studies and do research around it. In this way, investments will be more assertive.

The intellectual capital of a company has a direct and indirect impact on its tangible and intangible value, as the success of a company is also monetary (tangible value). The value of the character of the company's employees is an intellectual capital of intangible value, which can be measured by the company's reputation. Intelligence and character are highly important factors for the continued success of a company.

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Knowledge Sharing in Manufacturing Subsidiaries: Proactive and Reactive Perspective in the Knowledge Exploitation Context

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Abstract: Employee knowledge-sharing behaviour is an important building block of effective knowledge flow in all organisations. Employees share their knowledge in response to a specific demand for knowledge (reactive knowledge-sharing behaviour) or entirely voluntarily, on their own initiative (proactive knowledge-sharing behaviour). Those two types of knowledge sharing although were recognised but are under-researched. The study aims to shed some light on the specificity of reactive and proactive knowledge-sharing behaviours in the knowledge exploitation context, looking at manufacturing-based entities and groups of knowledge-workers and blue-collar workers. Using survey-based data on a group of 799 employees, the study answers the questions regarding the dominance of reactive or proactive knowledge-sharing behaviours in manufacturing-based organisations and the influence of work specificity and individual knowledge on those behaviours. Based on ANOVA and t-test analyses, the main findings showed that regardless of the type of work performed, employees in manufacturing subsidiaries were more likely to share their knowledge with others when they were explicitly asked for it. This suggests that managers should create opportunities and incentives aimed not only at enhancing knowledge-sharing but also knowledge-seeking. The results also showed that work-related characteristics influence knowledge sharing. The type of work was related to reactive knowledge sharing of blue-collar workers, while the perceived need for creativity at work, and coordinating work of others were related to proactive knowledge-sharing of knowledge-workers. Also, the individual knowledge of the blue-collar employees was significant for both knowledge-sharing behaviours and the relationship had an inverted U shape.

Keywords: Proactive knowledge sharing, Reactive knowledge sharing, Job design, Tenure, Education, Work experience

1. Introduction

Looking at organisations from the viewpoint of knowledge their success depends on the knowledge stocks (what knowledge they have access to) and the knowledge flows, which covers sharing, transferring and applying knowledge among organisational units and members. The flow of knowledge on the individual and group levels is a source for knowledge creation and integration (Zahra *et al.*, 2020) and results in better organisational performance (Monteiro *et al.*, 2008) and innovativeness (Sung and Choi, 2018). Schulz (2001) argued that in organisations, the knowledge flow takes place in the form of (1) a "knowledge pull", where knowledge is shared by a knowledgeable unit in reaction to a specific request placed by another unit (due to the problematic search), and (2) a "knowledge push" by broadcasting the solutions to others as new knowledge.

The micro-foundation of the organisational knowledge flow is employees' knowledge-sharing behaviour (KSB) (Foss *et al.*, 2010). While the vast amount of research emphasised the benefits of knowledge sharing (KS), and distinguished different types of KSB regarding the knowledge types (tacit vs explicit), inclusion of sharing behaviour in the job description (in-role vs extra-role), a situation when KS takes place (e.g. planned vs unplanned) (Ahmad and Karim, 2019), only a few addressed an issue of pulling and pushing knowledge proposing proactive and reactive KSB (Berends *et al.,* 2006; Teng and Song, 2011; Zhang and Jiang, 2015). The main differences between reactive and proactive KSB is an agent that initiates and leads the exchange, then the reason and focus of KS (Berends *et al.*, 2006). The theoretical base for those two forms of KSB derives from the organisational behaviour literature on prosocial behaviour (Bolino and Grant, 2016).

While the proactive-based KS mechanisms are more frequent in the knowledge explorative work context, where innovativeness and knowledge re-creation are important, like in the R&D team (Berends *et al.*, 2006), there are no studies analysing proactive and reactive KSB in more knowledge exploitative context, where refinement and efficiency play main role (March 1991), like manufacturing-based subsidiaries. This is the gap this study aims to fill by answering the following research questions:

- Which type of knowledge-sharing behaviour is more frequent in manufacturing-based organisations?
- Does the KSBs depend on the work specificity and individual knowledge of employees'?

This study aims to contribute to the literature on KS by identifying how a work type and individual knowledge base affect the reactive and proactive KSB among both knowledge-workers and blue-collar workers. Apart from differentiating proactive from reactive KSB, blue-collar workers are investigated. This group was rather neglected in the knowledge-sharing and knowledge-management studies (Sergeeva and Andreeva, 2016).

Meanwhile, KS among employees is a component of informal workplace learning and by this is important for the task quality and process performance on the shop-floor (Nakano *et al.*, 2013). Also previous studies on KS surprisingly did not pay much attention to individual knowledge of knowledge providers in the form of education, work experience and organisational tenure (Kim *et al.*, 2018).

2. Theory and hypotheses

2.1 Knowledge-Sharing Behaviours

This study applies the perspective of KS as relational behaviour, through which knowledge possessed by one individual is made available (Foss *et al.*, 2009) for the interpretation, understanding and assimilation by others in an organisation (Bonti *et al.*, 2017). The act of sharing one's knowledge with others occurs through interpersonal interaction, which can be realised face-to-face or through various means of communication, both synchronous and asynchronous. Knowledge is understood as "ideas, facts, expertise, judgements relevant for task or performance" (Wang and Noe, 2010, p. 117). This conceptualisation underlines that KS refers to the behaviour of a knowledge provider only and is a type of prosocial behaviour (Bolino and Grant, 2016). Looking at the process of that knowledge-related interaction and the typology of prosocial behaviours, KSB can be distinguished into reactive KSB – that is, providing knowledge in response to a request – and proactive KSB – fully voluntary providing knowledge with an anticipation of future outcomes, willingness to take control or cause change. In previous studies knowledge-sharing has been mainly assumed as an in-response format (Teng and Song, 2011).

Reactive KSB is initiated by the other individual that identified and defined the knowledge gap, identified individuals who can fill it and expressed a request to them. The reactive KSB depends mostly on a knowledge-seeker and on how the knowledge provider is willing to react to the request by sharing knowledge (or manipulating, hiding). It causes that reactive KSB is situational, thus, is hard to plan for the sharer. Also, its temporal stability depends on previous benefits of sharing and context that allows questions to be asked and knowledge shared (c.f. Spitzmuller and Van Dyne, 2013). This KS interaction focuses on the interest of a requester and the potential reciprocity relationship between the requester and provider. With reactive KS it is more likely that knowledge transfer would be effective as the knowledge receiver is keenly interested in interpreting, understanding and applying the knowledge received. Problematic are situations when the potential receiver cannot identify or express knowledge need, does not know whom to ask, et cetera, because no request means no sharing. In line with that, the scarce studies on reactive KSB suggests that when the procedural and process knowledge is well established (task routineness) the reactive KSB will take place (Teng and Song, 2011).

In the case of proactive KSB, the knowledge provider voluntarily defines the content, situation and a receiver of sharing. The focus of proactive KSB is not necessarily on the knowledge recipient's immediate needs but also on the self-interest of the provider ('self-suggesting') to receive some reaction to the ideas and further re-create knowledge for the self-use. It also might be directed towards a potential selected recipient or a group by diffusing new insight, pushing new solutions and pooling solutions (Berends et al. 2006). It focuses on the future change or improvement by developing collective knowledge and transactive memory (Kotlarsky *et al.*, 2015), available for others to use when needed. In a work context aiming to develop new knowledge, combine existing solutions in a new way, and where individuals are open to diversifying their knowledge base, a proactive KSB is needed (Berends et al. 2006).

The manufacturing subsidiaries of multinational enterprises (MNEs) in Central and Eastern Europe usually concentrate on effective exploitation of the technological and procedural knowledge transferred to their locations. This suggests that within a manufacturing-based subsidiary, a pull knowledge flow would be addressed with the predominance of reactive KSB.

> *H1: In manufacturing-based subsidiaries, employees more frequently share their knowledge in response to requests than proactively.*

2.2 Type of Work and Knowledge-Sharing Behaviour

The previous research on KSB found evidence that the work design influences motivation to KS and KSB itself. However, they did not differentiate the reactiveness or proactiveness of that behaviour. The studies showed that work autonomy or task identity (Foss *et al.*, 2009) positively relate to KSB, because in such context individuals gain greater sense of responsibility in what they do. On the other hand, low autonomy or strictly defined job descriptions increase knowledge-hiding behaviours (Škerlavaj *et al.*, 2018). In this line, it can be

assumed that the blue-collar workers with more precise work descriptions than the knowledge-workers, would less frequently share their knowledge.

Additionally, the cognitive demands of a job (job complexity, information processing, problem-solving and specialisation) positively affect the frequency of KSB (Gagné *et al.*, 2019). Therefore, the employees perceiving their work requiring more creativity would more frequently share knowledge. Moreover, performing work that involves task interdependencies and coordinating others, like in problem-solving projects (Gagné *et al.*, 2019) also positively affects the KSB.

H2: The frequency of reactive (H2a) and proactive (H2b) KSB differs in the type of work employees perform.

H3: There is a relationship between the level of creativity required at work and reactive KSB (H3a) and proactive KSB (H3b).

H4: There is a relationship between coordinating the work of others and reactive KSB (H4a) and proactive KSB (H4b).

2.3 Individual Knowledge and Knowledge-Sharing Behaviour

Individual knowledge in the form of the educational level, work experience and organisational tenure represent both employees' general and firm-specific human capital (Yanadori and Kato, 2007). With the level of education the general competences grow (skills and understanding over general and specified subject; social and communication skills) that help individuals to listen and communicate, explain ideas more precisely using professional expressions. Next, work experience, event if not related with current job, gives individuals understanding and skills to behave in work situation according to work norms. Finally, employees having log-term experience in the organisation possess firm-specific work skills, experience and knowledge (Kim *et al.*, 2018). All the above suggest that with an increase of knowledge level employees should be acknowledged as important knowledge providers and more frequently reactively share knowledge.

Additionally, with the development of knowledge an individual develops their self-efficacy, which reflects their individual belief that one has ability to provide knowledge. Individual with greater knowledge levels would be more willing to react to knowledge-related question and also to share knowledge proactively (Cavaliere *et al.*, 2015).

H5: Employee's organisation-based knowledge, in the form of organisational tenure, is related to reactive KSB (H3a) and proactive KSB (H3b).

H6: Employee's experience-based knowledge, in the form of employees' work experience, is related to reactive KSB (H4a) and proactive KSB (H4b).

H7: General employee's knowledge, in the form of educational level, is related to reactive KSB (H5a) and proactive KSB (H5b).

3. Methods

3.1 Data Collection and Sample

Data for the study was collected in 2019 and early 2020 (pre-pandemic) from ten manufacturing subsidiaries of multinational enterprises located in North-West of Poland, which were medium to big in size and were operating for more than 15 years in different industries. The data collection proceeded using a self-report survey in Polish with web-based and paper-based questionnaires, depending on employees' group (knowledge-workers, blue-collar workers). Every invited participant was informed about the study and its purpose before the start of data collection through in-company communication. In the questionnaire's cover letter, participants were informed about the study's aim and the use of data, assured of the voluntariness of their participation, confidentiality and need of their consent to participate.

In total, 799 complete responses were received (54%response rate), of which 274 were from knowledge-workers, and 525 were from blue-collar workers. Among the knowledge-workers, 42% were female; an average work experience was 9.5 years and organisational tenure - 7.5; 74% held at least a bachelor's or engineering degree. The blue-collar workers, of which 15% were female, had 11.9 years of average work experience and 7.2 years of organisational tenure, and 82% had a maximum of secondary education.

3.2 Measures

To measure reactive and proactive KSB, the scales proposed by van den Hooff and de Leeuw van Weenen (2004) and Teng and Song (2011) were assessed, and four items for each KSBs were selected, noting whether they covered only the behaviour of giving knowledge and were explicitly specifying that the sharing took place in response to a request or on employee's own initiative. Respondents were asked about the frequencies with which they faced the knowledge-sharing situations on a 7-point scale from 1 (never) to 7 (always, it is my daily routine). Eventually, *proactive KSB* was measured with four items that concerned sharing on the employee's own initiative with observations and insight regarding the employee's own work or the company, new things that the employee has learned or sharing skills. The *reactive KSB* was measured with four items that captured the frequency with which employees shared skills, task-related experiences and opinions, problem-related knowledge or information when specifically asked for it. The exploratory factor analysis (EFA), with two factors that explained 74% of the variance, and confirmatory factor analysis (CFA) showed good reliability and validity of both measures, as presented in Table 1. Moreover, the CFA with two factors of reactive and proactive KSB had significantly better model fit to data ($\chi^2(16)=79.4$; CFI=0.98; TLI=0.97; RMSEA=0.07; SRMR=0.019) than one-factor model ($\chi^2(17)=318.2$; CFI=0.93; TLI=0.88; RMSEA=.15; SRMR=0.042). The values of reactive and proactive KSB were calculated as items' means.

Table 1: Factor Loadings and Reliability Indices of Proactive and Reactive KSB

Variables	Items	EFA factor loadings		CFA standardised loadings	Cronbach's α	Composite reliability	AVE
		Proactive KSB	Reactive KSB				
Proactive KSB	P-KSB1	**0.824**	0.201	0.711	0.87	0.886	0.66
	P-KSB2	**0.730**	0.380	0.832			
	P-KSB3	**0.791**	0.361	0.861			
	P-KSB4	**0.758**	0.395	0.840			
Reactive KSB	R-KSB1	0.396	**0.782**	0.824	0.88	0.888	0.67
	R-KSB2	0.484	**0.731**	0.855			
	R-KSB3	0.502	**0.706**	0.871			
	R-KSB4	0.171	**0.847**	0.705			

The *organisation-based knowledge* was measured with a proxy of employees' organisational tenure, which respondents indicated in years. For further analysis, tenure was categorised in five groups 0-5 years, 5-10, 10-15, 15-20 and above 20 years. It is assumed that the longer employees work in an organisation, the better organisation-based knowledge they have, considering their own work, organisational policies and processes. The *experience-based knowledge* was measured with a proxy of work experience, specified in the questionnaire in years, and further categorised into five groups, similarly to organisational tenure. Finally, the *general knowledge* was measured with a proxy of the employee's level of education. There were five levels of education: 1-primary, 2-secondary, 3-bachelor's or engineering degree, 4-master's degree and 5-postgraduate or doctoral.

The employees were assigned to the group of *knowledge-workers* or *blue-collar workers* based on the information received from the HR department, basing on the premise that blue-collar workers are those whose majority of work considers manual, routine work and do not have a company email account. Otherwise, they were assigned as knowledge-workers. Additionally, based on the brief job descriptions received in the questionnaires, the specific *type of work* related to the functional area was defined - eight in the group of knowledge-workers (administration, customer service, quality assurance, logistics, production engineering, new products, organising production process, production support) and three in the group of blue-collar workers (production; warehouse; production technical support). Additionally, in the group of knowledge-workers, employees rated the extent to which *creativity is required* for performing their job on a scale of 1-'not at all' to 5-'very largely'. For the analyses, the received answers were grouped into three categories: "low creativity" (answers 1 and 2), "medium" (3) and "high creativity" (answers 4 and 5). Employees also indicated (yes/no) whether they *coordinate the work of others* in their work.

3.3 Analytical Procedure

To verify the hypotheses, I used: two sample t-tests, one-way ANOVA with Tukey HSD post-hoc tests, dependent-t-test (to analyse the differences between reactive and proactive KSB). Because of significant differences in gender and educational level in the group of knowledge-workers and blue-collar workers, most of the analyses were performed separately for those two groups of employees.

4. Results

4.1 Frequency of Reactive and Proactive KSB

Considering the H1, the dependent-t-test performed both in the group of knowledge-workers (t(df)=14.2(273), p<0.001) and blue-collar workers (t(df)=11.2(524), p<0.001) showed that employees more frequently were sharing knowledge when they were explicitly asked to do so (knowledge-workers=5.4 and blue-collar workers=4.9) than proactively (4.7 and 4.5 respectively) (Figure 1). These results support the H1.

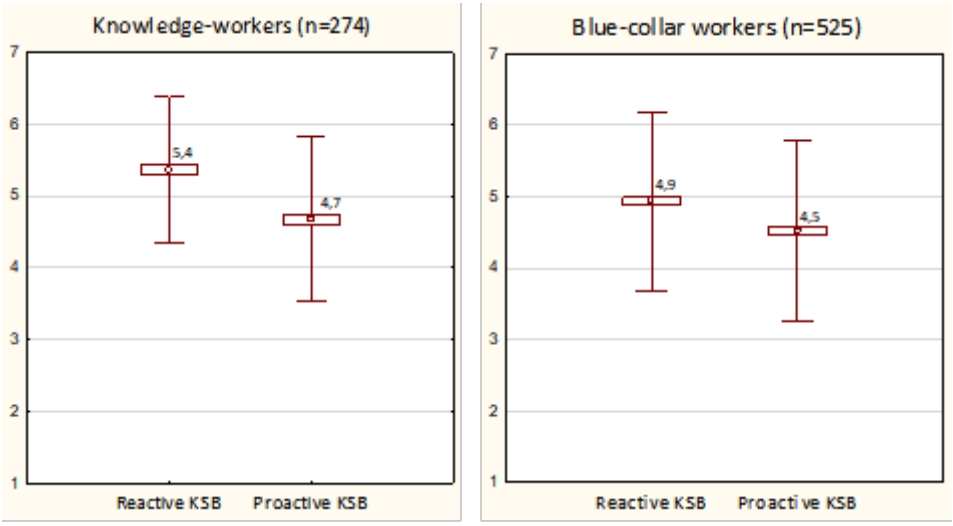


Figure 1: Means and Standard Deviations of Proactive and Reactive KSB of Knowledge-Workers and Blue-Collar Workers

4.2 Work Characteristics and KSBs

Regarding H2 firstly, using a two-sample t-test (t(df)=4.95(797); p<0.001), it was found that the knowledge-workers were more frequently reactively sharing their knowledge (mean 5.36±1.02) than blue-collar workers (mean 4.93±1.25). However, the difference between these groups in their proactive KSB was smaller (t(df)=1.81(797); p=0.07), as presented in figure 1. This supported H2, indicating that when performing intellectual work, employees share their knowledge more frequently than when performing physical work. However, the difference was mainly in reactive KSB.

Next, separately in each group of workers, using one-way ANOVA, it was analysed whether the work type was related to KSBs (Table 2). In the case of *blue-collar workers,* ANOVA showed that the type of work was not related to proactive KSB (p=0.174) but was linked to reactive KSB (p=0.039) with small effect size (η_p^2=0.01). The technical support employees (reactive KSB=5.4) were more frequently sharing their knowledge than workers of production (reactive KSB=4.9; p=0.04) and warehouse (reactive KSB=4.8; p=0.06). With that result, the H2 was supported for blue-collar workers.

Table 2: Relationship Between Job Characteristics, Employee's Knowledge and KSBs (Results of one-way ANOVA)

		Knowledge-workers (n=274)		**Blue-collar workers (n=525)**	
		Reactive KSB	**Proactive KSB**	**Reactive KSB**	**Proactive KSB**
		Mean (SD)	*Mean (SD)*	*Mean (SD)*	*Mean (SD)*
Work types		*F(7;265)=1.29 p=0.26*	*F(7;265)=2.32 p=0.03*	*F(2;522)=3.25 p=0.04*	*F(2;522)=1.76 p=0.174*

		Knowledge-workers (n=274)		Blue-collar workers (n=525)	
		Reactive KSB	**Proactive KSB**	**Reactive KSB**	**Proactive KSB**
8 for knowledge-workers* **3 for blue-collar workers***			prod. proc. org.: 5.1 quality ass.: *4.4*	tech. supp.: 5.4 production: 4.9 warehouse: 4.8	
Creativity requirement of work		*F(2;271)=15.59 p<0.01*	*F(2;271)=19.70 p<0.01*		
Low		4.47 (1.32)[a,c]	3.94 (1.11)[a]		
Medium		5.06 (1.03)[b,c]	4.24 (1.22)[b]		
High		5.63 (0.87)[a,b]	4.93 (1.01)[a,b]		
Coordinating work of others		*F(1;233)=-1.06 p=0.30*	*F(1;233)=-6.83 p<0.01*		
Yes (1)		5.52 (0.89)	4.96 (1.03)		
No (0)		5.20 (1.13)	4.37 (1.21)		
Experience-based knowledge		*F(4;248)=1.91 p=0.11*	*F(4;248)=2.24 p=0.06*	*F(4;454)=5.48 p<0.01*	*F(4;454)=4.27 p<0.01*
Work experience					
0-5 years			4.36 (1.28) [a]	4.46 (1.43)[a,b,c]	4.03 (1.32)[a,b,c]
5-10 years			4.70 (1.09)	4.96 (1.12)[a]	4.51 (1.19)[a]
10-15 years			4.92 (1.10) [a]	5.24 (1.14)[b]	4.77 (1.22)[b]
15-20 years			4.60 (0.83)	5.16 (1.26)[c]	4.56 (1.24)[c]
above 20 years			4.81 (1.04)	4.83 (1.33)	4.52 (1.30)
Organisation-based knowledge		*F(4;265)=1.89 p=0.13*	*F(4;265)=2.22 p=0.07*	*F(4;507)=6.09 p<0.01*	F(4;507)=3.77 p<0.01
Tenure in organisation					
0-5 years				4.68 (1.36)[a,b]	4.29 (1.35)[a,b]
5-10 years				5.12 (1.13)[a]	4.67 (1.18)[a]
10-15 years				5.26 (1.10)[b,c]	4.79 (1.14)[b]
15-20 years				4.78 (1.40)	4.25 (1.34)
above 20 years				4.45 (1.20)[c]	4.51 (1.22)
General knowledge		*F(4;265)=0.50 p=0.73*	*F(4;265)=0.95 p=0.44*	*F(4;510)=4.51 p<0.01*	*F(4;510)=1.19 p=0.31*
Education					
1-primary				4.59 (1.23)[a,b]	
2-secondary				4.95 (1.28)	
3-bachelor/engineer				5.31 (1.07)[a]	
4-master's degree				5.48 (0.93)[b]	
5-higher				5.00 (0.71)	

Note: * only significant at p<0.05 differences between work types are shown baes on post-hoc tests; [a,b,c] designate significant at p<0.05 differences between categories based on post-hoc test.

In the group of *knowledge-workers,* there were no significant differences in the extent of reactive KSB (p=0.256) between employees performing different work types. Nevertheless, there was a significant difference in proactive KSB (p=0.025) with medium effect size (η_p^2=0.06) - employees working in organising production

processes were more frequently proactively sharing their knowledge (proactive KSB=5.1) than employees in quality assurance (proactive KSB=4.4; p=0.03).

Finally, ANOVA analyses showed that the creativity requirements of work were significantly related to both reactive KSB (p<0.001) and proactive KSB (p<0.001) with significant effect (η_p^2>0.12). Employees who perceived higher creativity requirements shared knowledge more frequently (reactively and proactively) than those whose jobs required medium or low creativity (supporting H3a and H3b). However, coordinating work of others was not related to the reactive KSB (p=0.3) but affected the proactive KSB (p<0.01) (H4a-not supported; H4b-supported). Additionally, separately for the groups of employees that rated the creativity requirements as high (n=183) and whose work was related to coordinating others (n=126), the dependent-t-test showed that those employees were still more frequently sharing their knowledge in a reactive than proactive way.

4.3 Employees' Knowledge and KSBs

In the group of knowledge-workers, the one-way ANOVAs and post-hoc tests, showed some differences in proactive KSB between employees with different levels of experience-based knowledge (p=0.066) and organisation-based knowledge (p=0.067). Employees with 10-15 years of work experience more frequently proactively shared knowledge than those with work experience of fewer than 5 years (p=0.03). However, post-hoc tests did not reveal any differences between employees of different tenure. Next, the analyses showed that there are no differences in reactive KSB between employees of different work experience (p=0.109) or organisational tenure (p=0.125). Similarly, level of education did not have any effect neither on proactive (p=0.439) nor reactive KSB (p=0.734). Summing up, in the group of knowledge-workers, the individual knowledge is not related to their reactive KSB (H5a, H6a and H76a not supported). Only the proactive KSB differs among employees with little work experience and average work experience (H6b-supported; H5b, H7b not supported).

In the group of blue-collar workers, ANOVA results showed that work experience and tenure are related to reactive KSB (p<0.001) and proactive KSB (p<0.01). Employees with tenure of 5-15 years or 5-20 years of work experience share knowledge more frequently than employees with tenure up to 5 years. Educational level was found to be important only for reactive KSB (p=0.001). Results showed that employees with higher education degrees share their knowledge more frequently than those with only primary education (H5, H6, H7 supported).

5. Discussion and Conclusions

The presented study shed some light on the KSBs of knowledge- and blue-collar workers in the manufacturing-based context by analysing the frequency of giving knowledge to co-workers in the demand-driven (reactive) and supply-driven (proactive) format. Firstly, this study allowed comparing the frequency of KSBs of employees whose work was more intellectual and more physical. One of the findings was that on the shop-floor, there is a significant amount of interpersonal knowledge flow (considering the means of KSBs variables), even though the work was not knowledge-intensive (Nakano *et al.*, 2013). However, the frequency of KSB of blue-collar workers was lower than knowledge-workers, as it was assumed. Also, further analyses suggest that the knowledge-based antecedences of KSBs for blue-collar workers and knowledge-workers differ. Specifically, the level of individual human capital (general and firm-specific) seems to be significant predictors of blue-collar workers' KSBs, while for knowledge-workers not necessarily. Therefore, future studies should be more open to investigating knowledge-related behaviours and practices supporting them looking at shop-floor employees because they have an extensive level of experience-based knowledge with fewer opportunities for sharing it.

Secondly, several analyses confirmed that KS in the manufacturing-based subsidiaries, where tasks are more routinised due to procedures (Teng and Song, 2011), is mainly reactive, meaning that KS is driven by the specified demand for it in the form of knowledge request form co-workers (Bonti *et al.*, 2017). One of the conclusions resulting from these findings is that to support knowledge flow in such context, it is needed to facilitate knowledge-seeking behaviours. From the research perspective, there is a need for more studies in this area.

Thirdly, the work type characteristics influence KSBs, which signals that employees perceive KSB as a means of performing their work well and engage in those behaviours if they perceive it as meaningful (Gagné *et al.*, 2019; Stenius *et al.*, 2016). This is an important implication suggesting that employees engage and choose the KSB type if they see the relevance of this behaviour to what they do. Also, the more employees perceive that their work requires high levels of creativity, the keener they share knowledge. It could be explained that KSB, and proactive KSB specifically, stimulates their own learning and ideas testing (Nonaka and von Krogh, 2009). However, the more frequently they help co-workers by sharing the knowledge they request, they develop and maintain the reciprocity relationship, which is important for their creativity in the future (Černe *et al.*, 2014).

Finally, it was found that among different types of knowledge, the general work experience affects the KSBs of both group of workers, with the highest KS frequency between 10-20 years of experience. Also, results show that knowledge is a significant predictor of reactive KSB of blue-collar workers. This can suggest not only that more knowledgeable individuals are more willing to share what they know but also that knowledge-seekers are selecting more knowledgeable individuals. However, the results on the relationship between organisational tenure or work-experience and KSB signals an inverted U shape, showing avenues for future research.

One of the study's limitations that could be addressed in future studies is related to analysing only the frequency of KSB without its quality. This issue should be addressed, as KSB is vulnerable to manipulation.

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Utilising Shared Service Organisations for Dynamic Service Networks

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Abstract: Collaborative governance which repositions citizens as service co-ordinators - has become an increasingly visible methodology within public organisations. In this new model, service management is dependent upon a complex series of iterative interactions between multiple stakeholders, making the service network is notoriously difficult to manage. Shared Service Organisations (SSOs) - unit(s) within an enterprise that deliver specialized, value-added services across the organization to multiple internal users – are uniquely positioned to understand and manipulate the complex, non-linear, relational nature of collaborative networks and fully harness operant resources for long-term impactful service delivery. Despite significant potential for SSOs within collaborative governance, there is a surprising lack of insight best managerial practices and the effect on staff behaviour, and even more so on the potential of SSOs to manage these networks. This research presents a single in-depth case study with the Project Management Office of an Irish national economic development agency using a Participatory Action Research (PAR) Methodology within a Design Thinking Framework. This allowed the researcher to see and interact with the challenges faced by participants and hone their understanding of influencing factors and contextual considerations. The research identified three key managerial implications. Firstly, explicit actions to establish and maintain a service mindset - which recognises and values operant resources - must be formally implemented into SSO operations. It is not sufficient to for managers to assume staff have a service orientated mindset, particularly when existing organisational processes reinforce old practices through quantifiable, process orientated outputs. Secondly, critical reflection must be formally integrated into management processes and must support the questioning of current operations in an open and frank atmosphere. Formalising time for critical reflection provides staff with opportunities and resources to question old practices and discuss and construct knowledge collaboratively. Thirdly, relational user engagement and communication practices within SSO service strategies must be deliberate and strategic. Due to the integrated nature of SSOs and the collaborative nature of their operations, clear operational and interaction guidelines empowers SSO staff fully harness their strategic role, question high level management and support critical strategic thinking.

Keywords: Collaborative governance, Shared service, User-centred design

1. Introduction

Despite their potential for innovation and cost efficiency, collaborative governance – which repositions citizens are service co-creators – are notoriously difficult to organise. Establishing and maintaining alignment between participants within the service network is challenging due to the diversity of goals, values and interests (van der Voet and Bram, 2021; Kivleniece and Quelin, 2012). Shared Service Organisations (SSOs) - unit(s) within an enterprise that deliver specialized, value-added services across the organization to multiple internal users – are uniquely positioned to understand and manipulate the complex, non-linear, relational nature of this service network (Ruijer, Dingelstad, and Meijer, 2021). As such, they have significant influence on how services are structured, delivered and adopted. Drawing on service design theory and public management literature, we argue that SSOs can be utilised to drive effective service delivery in collaborative governance. We generate managerial practices and methodologies for proficient internal service delivery through an empirical case study of a public sector SSO. Firstly, we demonstrate that a user-centred approach is required to capture and utilise the knowledge and operant value generated within a multi-stakeholder service network. Embedded output-orientated mindsets within the SSO and the wider organisation must be actively challenged and altered to utilise the full SSO service value. Secondly, we illustrate the need for critical reflection to question assumptions and expediate knowledge exchanged within the SSO and the wider organisation. Additionally, user-centred tools provide powerful visualisations of the intangible activities, values and organisational perceptions to facilitate the questioning of organisational norms. Thirdly, our research identifies the need for deliberate and strategic integration of relational user engagement. Clear, unified communication of the value of the SSO to the organisational strategy is essential to ensure relevant and effective interactions within the service network.

As a result of collaborative governance practices, public sector services are being provided through increasingly complex heterogeneous service networks (Hiedemann et al., 2017; Alford and Yates, 2014). Within these networks service management is dependent upon a complex series of iterative interactions between multiple stakeholders (Radnor et al., 2014), in both the development and collaborative delivery of services. Consequently, service effectiveness is closely related to the quality of the network, rather than the

individual organisation or individual service performance (Hiedemann et al., 2017; Badinelli, et al., 2012; Enquist et al., 2011; Alford and Yates, 2014). Public sector SSOs, by their nature, work cross-departmentally, are experienced in navigating highly bureaucratic methods of working (Mustafa Kamal, 2012) and in addressing staff resistance to organisational change (Burns and Yeaton, 2008). This paper demonstrates the importance of SSOs organisational knowledge, learning and strategy influence. Section two examines the implications of collaborative governance on public sector operations and policies. Section three provides information on the public sector organisation studied, the research methodology and the data collection/analysis process. Section four captures the key research findings. Section five discusses the managerial implications for these findings.

2. Policy Context: Implications of Collaborative Governance for the Public Sector

Collaborative service development has become an increasingly visible methodology within public organisations. This is demonstrated by the proliferation of Living Labs (Gascó, 2017; Fuglsang et al., 2021; Komatsu et al., 2021; Whicher, 2017). This positions employees, not as passive recipients in a change initiative but active participants in the transition to and acceptance of new operational models (Augustsson et al., 2017; Koskela-Huotari et al. 2016). As a result, public sector staff involved in collaborative services should recognize themselves as service providers with *distinctive* service operations, management logic and managerial challenges (Hodgkinson et al., 2017). However, lack of staff involvement – or one could argue lack of *internal* collaboration - in public sector service initiatives has resulted in cases of passive, partial and/or tokenistic application of collaborative approaches (Camén et al., 2011; Sinclair, 2004). Staff can be resistant to collaborative services due to professional opposition, emotional attachments to existing arrangements, cognitive biases, internal politics, and inadequate or poorly distributed training (Khine et al., 2021; Joha and Janssen, 2011; Burns and Yeaton, 2008; Elston and MacCarthaigh, 2016). Despite the active role staff play in collaborative governance, there is a surprising lack of insight into user-centred managerial practices and their effect on staff behaviour (though see Andrews and Beynon, 2017; and Walker et al. 2007). Empirical research on this topic is lacking even more so (Blom-Hansen et al., 2015; Margetts, 2011). In this research, we explore a user-centred approach to collaborating with a public sector SSO to explore its current and future operations, and the resulting organisational change from staff applied learnings.

3. Irish National Economic Development Agency SSO

Ireland has eighteen State Agencies or public sector bodies that have a statutory obligation to perform specific tasks on behalf of the Government of Ireland. Each department employs a large number of civil servants or public sector staff who remain in their positions regardless of changes in the Government. Four of the State Agencies are national economic development agencies whose primary role is to support the long-term sustainable growth of the economic, social, cultural and environmental contributions of Ireland. State Agency activities include the implementation of national, regional, and local plans and policies as well as EU plans and policies on the island of Ireland. The empirical study for this article was carried out in the Project Management Office (PMO) of an Irish national economic development agency between 2019 and 2022. The parent organisation had previously applied a design thinking methodology for externally facing services and wished to apply a similar approach for internally facing services. The organisation cannot be identified due to industry sensitive information discussed throughout the workshops, and General Data Protection Requirements which could not be addressed within the timeframe of the project. Established in 2014, the PMO unit provides the organisation with support through the provision of project management services and administrative functions for the development and reporting on annual high-level plans. SSOs in public sector organisations are an increasingly common arrangement as they allow the standardisation, streamlining and consolidation of support services for economies of scale and to ensure organisational responsiveness (KPMG, 2019; De Medeiros Florentino et al., 2020). Following a review of the unit's strategy, the team identified an opportunity to further develop the breadth and scope of this typical SSO approach and expand their organisational value-add through strategy management activities. These activities could align the organisation support strategy, planning and development; enable strategy reviews; and communicate strategy.

3.1 Research Strategy and Methodology

This research is a case study using a qualitative research approach that produces descriptive data in the form of oral words from interviews, the observed behaviour of people, and written content produced through workshop design tools/activities. The purpose of this case study is to understand real-life phenomena in-depth (Yin, 2009). In a single instrument case study, the researcher focuses on an issue or problem and then chooses

one limited case study to explore this problem (Creswell, 2007), in this case the utilisation of SSOs for the embedding of organisational knowledge, learning and strategy influence. The study was conducted by a single researcher using a Participatory Action Research (PAR) Methodology. Rooted in the principle of learning while doing (Reason and Bradbury, 2007), it uses an iterative process of practice and adjustment to refine the applied approach and closes the gap between theory and practice (Soh et el., 2011). The PAR methodology allowed the researcher to see and interact with the challenges faced by participants and hone their understanding of influencing factors and contextual considerations. Understanding was further developed by continuously prototyping new interventions and observing results. This data - which would otherwise not be reported due to overfamiliarity, unconscious and/or embedded practices – would not be captured or harnessed with traditional case study design. PAR was coupled with a design thinking framework. This offered an innovative approach to address complex user-centred problems while allowing exploration, understanding and reflection of the process in real time (Treisman et al., 2016; Hahn-Goldberg et al., 2022). It encourages participants to reflect on their individual and collective practices and patterns of engagement (Ripoll and Gale, 2020), and expediates transformational change within the organisation (Vallaster, 2004). Through the design thinking framework, the researcher could embed insider action research and enhance continuous learning and improvements for organisational impact.

3.2 Data Collection and Analysis

The PMO team (n=7) and relevant key stakeholders (n=3) participated in the project through a series of collaborative design thinking workshops (n=3). Secondary data and a preliminary interview with the SSO manager were used to provide an understanding of the organisation before the project began, the current role of the SSO, and to support primary data interpretations throughout the project. There are many iterations of 'design thinking' models but the activities that underlie these models are closely aligned and can be categorised into four main phases (Elsbach and Stigliani, 2018): discover, define, develop, deliver. Though often depicted as linear, the process integrates feedback loops as participants learn and evolve their knowledge. The phases covered in each workshop was determined by the insights made in the previous workshop and the learnings gained through application between workshops. Each workshop was 4-6 hours long (with 40 minutes/ 1 hour for lunch), were held in the organisation's head office and were facilitated by the researcher (see table 1). It is important to emphasise that collaborative outcomes were not influenced by the design thinking process but was facilitated through its approach. Participants were provided with a series of design thinking tools – such as prioritisation matrixes, strategy frameworks and brainstorming matrices – which they completed with guidance and support from the researcher.

Table 1: Workshop 1 and 2 Summary

Workshop no.		Design Thinking Phase(s)	Objective
1		Discover	Identify documented & undocumented activities.
			Review current team strategy.
		Define	Critically review the activities for potential project governance growth/value add.
			Prioritize areas for strategic growth/expansion
2		Discover	Brainstorm *new* areas for potential project governance value add.
		Define	Identify *next* steps to implement priority project governance activities.
3		Define	Define specific steps to implement identified activities & grow project governance impact & value-add (short, medium & long-term).
		Develop	Development of a defined value-offering for clear communication outside of the core team.

Due to industry sensitive information being discussed, sessions were not recorded. Detailed field notes of the discussion between participants were taken throughout the use of the tools, and during cross-share of findings at the completion of each tool. Participants were asked to identify any key findings/outputs of each tool and

additional discussions were held to gain further insights on these points. Supplementary notes were created immediately after the workshops in a 'debrief' to capture additional perspectives, observations, and thoughts (Beyea and Nicoll, 2000). Completed tools were photographed and used for further analysis following each workshop. Workshop findings were documented in reports for circulation within the SSO team before the successive session to allow participants to reflect on the topics/findings discussed and undertake actions where appropriate. The notes and completed tools of each workshop were reviewed and cross-compared to identify common themes and insights. The author was primarily responsible for data analysis, and regular discussions were held with the SSO manager to provide further insight into arising themes.

4. Workshop Findings and Results

4.1 Embedded Output-Orientated Mindsets Must be Actively Challenged

In the first discovery phase of the first workshop, participants were requested to capture *all* SSO services and their corresponding value to individual projects and the wider organisation. To provide a degree of objectivity and context, participants provided supporting evidence through work and/or situation examples. In the initial discussion, staff were clear and confident of the tangible deliverables captured through project Key Performance Indicators (KPIs) – e.g. reports, training, budget management, project delivery milestones. In contrast, 'soft strategic activities' were overlooked, despite constituting a significant percentage of SSO activities. As these were not formally reported, staff considered them 'just something you have to do'. In subsequent workshops, through discussion and critical reflection, the extent and degree of the value of these 'soft activities' to the organisational strategy were exposed. Activities - such as knowledge dissemination, skill share, a 'helicopter' view of the organisation, cross-departmental collaborations, ongoing strategic clarification and guidance - confirmed the unit as an overarching strategy support presence. This emphasised to staff the potential of the SSO to unify operations and support the achievement of organisational goals. With this shift in mindset, participants developed new short, mid- and long-term unit goals and actions which clearly captured and communicated all SSO activities - KPI and knowledge driven. Frequent, high strategic-value projects were prioritised as key opportunities to demonstrate the strategic support role of the SSO. Priority activities were then cross-referenced to identify key engaged stakeholders. Using a communication matrix, the team developed a stakeholder engagement strategy. This captured relevant key stakeholders with the authority to reposition the SSO as strategy coordinator; the key strategic-value offering(s) for these stakeholders; appropriate, meaningful long-term communication channels for each stakeholder; and relevant projects confirming the SSOs strategic impact. Succinct and streamlined messages were developed and integrated to the communication matrix to purposefully shift SSO engagement from 'crisis point' to pertinent engagement. The communication plan clarified unit's strategic value for the organisation, and established actions to establish a consistent unit identify within the wider organisation.

Utilising the value of *all* activities identified in the workshop, the unit developed a clear and transparent document proposing a new SSO role as strategy support. Included were the strategic benefits and impact of this approach emphasising both their KPI and knowledge-based value. This document was presented to and agreed by high-level management. Through this agreement, the unit categorically repositioned themselves as 'architects' responsible for the overall design and execution of the performance management processes, and 'process custodian' of integrated organisational planning and control systems. Within this new role, the unit would now attend at all high-level management strategy meetings and was granted permission to critically review the organisation's divisions and their alignment to the organisations strategic pillars. This embedded the SSO as strategic co-ordinator, ensuring a comprehensive overview of the strategic position and objectives of the organisation, and insight into the decision-making process of current and future strategy policies.

4.2 Critical Reflection is Necessary to Question Assumptions and Expediate Knowledge Exchange

Over the course of the workshops, participants were encouraged to *critically* reflect on their current activities, approaches and assumptions. Opinions differed when participants were asked to review the role of the SSO in relation to strategy support. While risk management was clearly communicated as part of the high-level management project allocation process, organisational capacity building was significantly less structured. As SSO staff were engaged at 'crisis point' within high-risk projects, there was limited time for knowledge transfer of best practice project management. As knowledge transfer was primarily organic through learning by application, some staff were of the opinion this was not a priority activity. This highlighted an unclear unit direction and a need 'to stop and ask what we are trying to do'. To facilitate discussion, participants were then asked to divide activities into a four-quadrant matrix based on their level of strategic criticality and frequency of occurrence. Time was given to collectively discuss where each activity should be placed. The value of this

reflection strongly resonated with participants. It highlighted an incorrect assumption of common knowledge and understanding of SSO activities and its strategic direction. Reflection provided a 'mental distance' from the day-to-day operations, space to question embedded practices and to understand the operations of the unit as a whole. This provided an opportunity to consider the SSO activities beyond streamlining and into strategic support.

Based on the learning from the critical reflection, the SSO employed a 'thinking more than doing' approach for impactful strategy support by developing a streamlined, closed-loop strategy management system. With SSO at its centre, the system first works with high level management to restructure the lines of strategy responsibility and cross-collaboration across the organisation. High-level managers are now individually or jointly responsible for a strategic pillar, and are supported by the SSO to thinking strategically, instead of operationally. Managers now critically reflect annually on their pillar's achievements, consider the pillar performance from a strategic alignment perspective, and identify/develop additional opportunities for the following year which directly contribute to their pillar's strategic impact. As described by the SSO manager 'We are there to challenge and guide the pillar lead. This is very different from our previous admin voice. We now have an emerging strategic support voice to ask are we doing the right thing and are we doing it in the right way?' Secondly, SSO support the organisational strategy through tactical project collaboration, streamlining and solidifying links between organisational strategy and operations. The unit prioritises the communication and maintenance of projects, initiatives, and policies between departments under each pillar. SSO staff have been given 'licence to discuss and adapt non-priority projects that don't contribute to the overarching strategic alignment'. They are encouraged to challenge actions – 'Why do you want to do this?' – as well as a strategically align their own activities to the pillars – 'What do we need to do for this pillar?' SSO embeds regular strategic reviews and critical reflections to enable the collaborative, innovative and rapid response of staff to changing organisational needs. Moving away from the previous 'first come, first serve' model of engagement, SSO now examines and prioritises their activities - in collaboration with high level management – based on strategic alignment.

5. Relational User Engagement Must be Deliberate and Strategically Designed

The PMO develop a project management framework to formalise and systemise their role in project management capacity development. This provides a three-strand engagement structure with key lines and responsibilities for engagement. This framework restructures the unit into three distinct but complementary service streams: Project management capacity building, SSO support and mentoring, and the allocation of a dedicated member of SSO staff. The framework is broken into seven steps: Scoping the project, work package breakdown, stakeholder management and communication, project plan strategic alignment, maintenance plan, risk analysis and impact report. The stream allocation is determined by the project's strategic importance and potential risk. SSO acts in an advisory role for low risk, low strategic projects. Moderate strategic impact and risk projects engage through ongoing collaboration with SSO staff, who also act in a mentoring capacity 'to work with them to co-create a solution'. High strategic value, high risk projects are allocated a dedicated member of SSO staff. SSO best practice principles are reinforced through a structured training and mentoring program. Consisting of three modules delivered annually, it empowers project managers and support staff to become SSO leaders within their own units/divisions. In addition, the SSO team have adapted a set of project management tools such as actions trackers and a project maturity index to reflect the organisations strategic priorities. This provides a homogeneous SSO approach across all projects and a consistent review process to determine the appropriate level of SSO engagement. From an organisational perspective, this three-stream approach has expedited organisational learning and knowledge dissemination for effective and consistent project management; and embedded best practice SSO methodologies across the organisation. From a SSO perspective, it streamlined SSO engagement across the organisation; and prevented/limited SSO staff time spent on non-strategic, undocumented and low-value activities.

6. Discussion

This case study demonstrates three key managerial considerations in utilising SSO operations for effective collaborative governance. Firstly, it cannot be *assumed* staff in a service provider role have a service orientated mindset or user-centred approach to service provision. Until relatively recently, public service delivery has been dominated by approaches that consistently treat public services as manufactured goods rather than services. This has resulted in a sectoral focus on efficiency and performance evaluation rather than the process of service delivery and collaboration. Under this logic, emphasis is on *co-production* –

focusing on the output – which can be added to 'traditional' public service delivery for a distinct end. In contract, a service approach considers *collaboration* as an essential and intrinsic process of interaction between a service provider and service user during service delivery (Radnor et al., 2014). It cannot be 'added on' but instead is an inalienable element of the service delivery. While the SSO considered themselves as service providers, the organisational focus on KPIs overlooked the operant value of the unit and reinforced this output mindset both within the unit itself and the organisational perspective of the unit. Focusing only on quantified operations limited its potential for expansion into strategic support services as a substantial amount of its resources were spent on undervalued and undocumented activities. It was only as the unit became more confident in understanding its *own* operant value could it cohesively and effectively communicate this with the wider organisation.

Secondly, a user-centred process must provide staff with a structure to critically reflect and question current operations in an open and frank atmosphere. During the workshop process, critical reflection orchestrated a shift from simply doing, to providing space to question assumptions and expediate knowledge exchanged between individuals. It identified the need for a collective team perspective and generated a depth of knowledge and learning to develop a unified SSO strategy approach. It must be noted, critical reflection is not a superficial exercise. It is a transformative process which must be intentionally designed to provide structure and guidance, while being simple to understand and apply. The presence of a third-party facilitator – in this instance the researcher – is a useful source of prompt questions which focuses the discussion, ensures equal voice to all participants and acts as an unbiased perspective to question embedded practices. Nor is critical reflection necessarily a quick exercise. While initiated within the workshop, the SSO continued to reflect on the value and objectives of the unit and critically *self*-reflect on their own assumptions and perceptions between workshops. Users can question and reason more powerfully with visual representations (Liu et al., 2008). User-centred design tools were powerful visualisations of the intangible activities, values and organisational perceptions of the SSO. This transformed abstract information into actionable mapping exercises. This both supported a unified consensus of information within the unit, encouraged further discussion outside of workshops, and provided a visual representation of the impact of potential strategic development plans. Taken together, the time to critically reflect and self-reflect with the visualisation tools facilitated a deeper and transformative dimension of learning. This reflection is evident in both the continuation of this approach as part of the SSOs activities and the formal integration of critical reflection into high level management operations.

Thirdly, our research identifies the need for deliberate and strategic integration of relational user engagement and communication within SSO service strategies. While the quality of the service is shaped by the active or passive role of users in the service (Osborne, 2018), there is little guidance on managing these relationships to ensure appropriate and relevant interaction. In our study, the three-stream operational framework was instrumental in the effectiveness of the SSO as a strategic coordinator. The structured hierarchy of engagement manages expectations of services delivery. It explicitly communicates each participants collaborative role and responsibility within the service, and provides clear operational and interaction guidelines. This ensures staff can *justifiably* refuse non-priority projects and empowers them to lean into their strategic role, question high level management and support critical strategic thinking.

The findings of the research have proven extremely valuable to the case study organisation as seen in the improvements to its SSO strategy support operations and wider organisational strategy alignment. From an academic perspective, this study contributes to the body of empirical research in collaborative governance, demonstrating the power of applied empirical studies to capture the contextual considerations of the public sector. There are some limitations to the case study. It adds to the limited body of empirical research within the public sector, but additional work is required to extrapolate the findings across multiple contexts. Collaborative services are, by their nature, dynamic and variable; it is difficult to validate theorical collaborative models due to the complexity of service network. As collaboration is 'a means of transforming public services, by challenging traditional relationships or power, control and expertise' (Durose and Richardson, 2016) further empirical studies of the relational dynamics within public sector organisations is required. It is only through application and reflection that insights and limitations of theorical models can be tested and adapted to the dynamic environment of collaborative governance.

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Managing Knowledge in Non-Profit Organisations

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Abstract: This article aims to present the impact of knowledge management on non-profit organizations. The collected empirical evidence clearly indicates the need to change the employment policy and include volunteers in knowledge management. The article is based on organizations operating in Poland, which narrows down the research to be able to transfer it to not-for-profit organizations operating in other European Union countries. However, it allows you to join the debate on knowledge management and its inclusion in the management system of non-governmental organizations.

Keywords: Knowledge management, Non-profit organization, Social economy entities

1. Introduction

This article aims to contribute to the literature on knowledge management, especially knowledge management in non-profit organisations. Differences can be noticed between individual NPOs due to different approaches to knowledge. NPOs in Poland face many problems and barriers. Most often these are financial barriers, but knowledge management in these organisations has not been properly researched. Few studies published in this area address the lack or inability to diagnose human capital problems and knowledge linkages. While source literature in the field of management emphasizes the importance of knowledge as a strategic resource for organisations in the economic sphere, there is a lack of literature on knowledge management in the non-profit sector. Few publications (Kong 2007, 2008; Sillanpää et al. 2010, Massingham 2018) on the use of intellectual capital (IC) for strategic positioning of non-profit organizations emphasize the need for further research on this subject. A better understanding of resource allocation through knowledge management will contribute to increasing the social and economic performance of these organizations. However, we believe that despite the different paradigms on which both organisations are built: not for profit and for profit, they both need to consider knowledge as a determinant of effective management.

The article is divided into a theoretical and research part. The theoretical part presents literature in the field of knowledge management and the opportunities offered by its use in non-profit organizations. The practical part, based on statistical data, was aimed at diagnosing the cause of the problems of incompetent knowledge management. The focus was on the forms of employment of employees and volunteers of these organizations as ICs. Based on the analysis of the literature on the subject, a research hypothesis was formulated assuming that knowledge management in non-profit organizations, especially in the Polish economy, is insufficient, which results in the organization's inability to acquire and retain knowledge from people involved in the activities of NGOs, which results in unstable forms of staff employment**.**

In this paper, the terms non- profit, non- government organizations (NGO), not for profit, and the nomenclature of the legal form of these organisations, i.e. Associations and Foundations, are used interchangeably.

2. Literature Overview

Knowledge in organisations constitutes an intangible resource that has an impact on the broader economic and business performance of a company. In our considerations, knowledge management concerns not for profit organisations whose economic efficiency translates into implementing the activities for which these organisations were set up. Knowledge as a resource constitutes an indispensable part of creating added value to any organisation, which is why research into knowledge management by non-profit organisations, whose activities are focused on both social and economic aspects, is so important. The use of solutions that come directly from the enterprise sphere is not suitable for NGOs, therefore it is urgent to develop a knowledge management framework for this sector.

2.1 Knowledge Property

The term knowledge management is used to refer to the practices, implicit or explicit, used by an organisation to acquire new knowledge and to reorganize and disseminate existing knowledge. The term also includes strategies to prevent an organisation's own knowledge from "leaking out" or to encourage its dissemination to partner entities as well as others from whom the NGO can mutually benefit due to its exchange (Hall, Mairesse, 2006). The following facts result from the property of knowledge:

- It is often embedded in the workforce,
- it is partly a public good, and
- there are frequent difficulties in buying it on the market.

A significant part of knowledge is embedded in human capital, employees and/or volunteers who acquire it consciously as part of their duties or unconsciously along with other activities they perform. This fact has several implications for knowledge management: firstly, human resource management (HRM) becomes very important because current employees and volunteers are not easily interchangeable with others outside the organisation. In fact, NGOs take advantage of the local knowledge of volunteers to help reduce the start-up costs (Haugh, 2005). Secondly, it is the protection of the subject rather than the ownership of the person of such knowledge that may require active management of such knowledge and the transformation of forms of tacit knowledge into a codified formula that can be transferred to other people (Cowan et al., 2000). By the time volunteers leave the organisation, the tacit knowledge may disappear because it is not stored in a central repository. In some cases, it is not even transferred to other people. That is why knowledge can be lost. IT solutions are more and more often integrated into this process to transfer tacit knowledge into a network of bit links (artificial intelligence) activated when required. However, such a solution is related to high costs and NGOs often cannot afford it. The third aspect of knowledge management is the organisation's ability to absorb knowledge - that is, to acquire and use the knowledge of its employees and volunteers in order to create social added value. Seeing how not for profit organisations are small and operate on markets that are poor in resources, they do not have access to quality resources or advanced knowledge management tools. According to Maalaoui et al. (2020) knowledge management in social enterprises bases on a kind of collective bricolage, defined as a continuous process of creating and taking advantage of practical knowledge (Duymedjian and Ruling, 2010) based on unused or low-value resources, in unconventional or non-obvious ways. However, according to Baker and Nelson (2005), the overuse of collective bricolage based on sharing knowledge as well as acting in common environments and organisations and a shared worldview, can lead to a lack of opportunities to discover and acquire new knowledge, resulting in no development and not creating new knowledge. Selective bricolage can become the equivalent of this, thanks to which new resources can be created to help companies avoid the spiral that leads to less professionalism in operations and the many resulting negative consequences (Rönkkö et al., 2013).

Another issue arising from knowledge ownership is the responsibility of the entities and the products they produce. Knowledge, as a public good, is both non-competitive and non-excluding (at least not to be easily excluded). Hence, the conclusion is that knowledge creators should consider both the positive and negative effects of disseminating the services and solutions that their organisation has created (Lhuillery, 2006). The property of knowledge consists in its uniqueness and, as the most valuable resource, it is difficult to be purchased. Research by Negassi et al. (2019) shows that the public research sector is "innovative", while the private sector appears to be "catching up". Hence, the conclusion is that the uniqueness of knowledge is more dependent on mutual open cooperation than competition in the industry, where cooperation may lead to fears of loss or uncontrolled transfer of knowledge in joint activities. In activities carried out by NGOs, one can notice in-depth knowledge concerning the local environment and experiences as well as locally available resources to meet local social needs on a small scale and connections to the community. They share common characteristics of social entrepreneurs, including skilfully managing unexpected opportunities, spontaneous innovation, improvised risk-taking, and rearranging resources to create social value (Bacq and Janssen, 2011 ; Zollo et al., 2018*;* Scuotto et al, 2023). The limited nature of purchasing knowledge on the market leads to imitation or an inability/impossibility to make effective use of it through lack of adaptation and integration into the organisation's structures, of which non-profit organisations are unfortunately a frequent example. Even though Malsch, and Guieu (2019) have shown that knowledge plays a key role in social entrepreneurship it is often not used as a knowledge management tool in social entrepreneurship networks. Resources and knowledge are acquired and managed in the course of a learning process, and social entrepreneurs are able to manage knowledge and resources and do more with less, despite a scarcity of resources. According to Granados et al. (2011), not-for-profit organisations develop knowledge management capabilities that are based on a culture of trust, knowledge sharing and learning in decentralized and flexible structures, rather than on information systems and external motivation. Taking advantage of this in a collaborative network of not-for-profit organisations would allow for better social and economic results, thus leading to excellence. The strategic nature of unique knowledge constitutes a source of competitive advantage for a company in general and non-profit organisations in particular, so the latter must protect it. In fact, Uygur and Marcoux (2013) believe that social entrepreneurship ventures show additional complexity. When managing their knowledge, or more precisely when trying to protect their knowledge concerning the responsibility of their actions and

identity, they must always take into account a double bottom line, namely social and economic. Access to knowledge forces these organisations to control their actions in protecting the general and practical knowledge developed in the course of their operations, and dispersing this knowledge among the various stakeholders results in extreme difficulties and fear of uncontrolled disclosure or transfer.

2.2 Knowledge Management

Coordinating activities resulting from the ownership of knowledge requires a systemic approach.KM has been defined as a strategy for managing organizational knowledge as a corporate asset (Cardoso and Meireles , 2010) and harnessing processes such as creation and acquisition, storage, share and dissemination, retrieval (Cardoso and Gomes, 2011) and use of tacit and explicit knowledge (Civi, 2000). Lettieri et al. (2004) demonstrated that knowledge management enables excellence in the non-profit sector. Whereas, Granados and Rosli (2020) pointed out that the legal form of NGOs strengthens their credibility and the trust of external stakeholders for whose favour these organisations compete. Therefore, the competition between them constitutes a following challenge that these actors have to face. Particularly intense competition for donor funds can lead to inefficiently high fundraising expenditures and drawing resources from development projects (Kim and Lim, 2017, Zhang 2016), because sources of capital are limited or unstable, while fierce competition for capital between organisations usually results in barriers to their own development. Examples were provided by Khieng and Dahles (2015) who found that competition for resources led to the collapse of many organisations. According to Maalaoui et al. (2020) there are six main clusters of knowledge that need to be managed effectively in non-profit organizations, i.e. accounting/administrative knowledge related to the economic and legal aspects of non-profit organizations, teaching and training knowledge related to the training and skills of volunteers and staff, managerial and organisational knowledge related to human resource management, fundraising and public relations, marketing knowledge related to the knowledge required to manage relationships with key stakeholders such as partners and sponsors, operational knowledge related to daily operations, and finally knowledge gained from external sources such as volunteers, which is often neglected. Such an approach has made it possible to systematize knowledge concerning the units in which this knowledge is generated and will help to propose a general knowledge management system. The strategic dimension of knowledge management consists of the following stages: selecting the possessed knowledge that is available from various sources, then codifying the knowledge, and the final stage which consists in getting rid of knowledge that is redundant and inadequate in terms of the organization's needs. The aim of the organisation is to exploit well-defined knowledge. Thus, a strong emphasis in the concept of knowledge management on knowledge selection skills. Codification of knowledge, meaning recording it in various forms to protect against its loss when an employee or volunteer leaves. The final element of the strategic dimension of knowledge consists in eliminating redundant and useless knowledge that creates confusion and information noise in the organisation. (Dolińska, 2010)

2.3 Knowledge Management Systems

The knowledge management system must be aligned with the organisation's mission, vision, and development strategy to ensure its effective use. Building a system requires the formation of an organisational culture focused on collecting, creating, distributing, and using knowledge to fulfil the social and economic purpose of the non-profit organisation. The knowledge management model proposed by Lettieri et al. (2004) (Fig. 1) indicates how knowledge should circulate in NGOs.

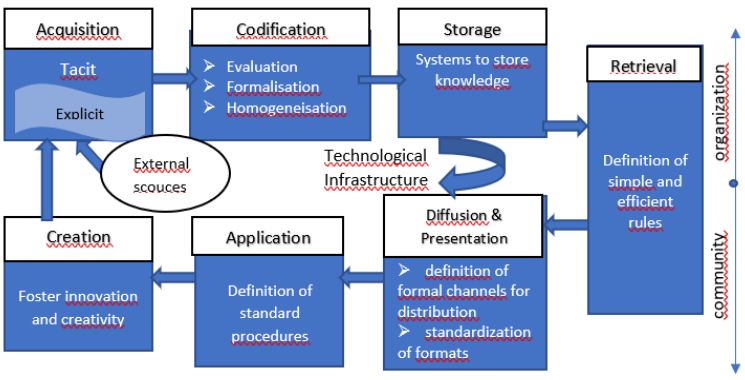


Figure 1: The Cycle of Knowledge Management in NGOs

The authors divided the process into 7 steps. The first step consists in acquiring knowledge, i.e. knowledge should be acquired and brought into the organisation from various sources, e.g. everyday experience, external information, know-how of operators, volunteers, and community input. This step includes all activities carried out at both the individual and group level aiming to collect and take advantage of knowledge before it is codified and disseminated throughout the organisation. Due to the barriers associated with maintaining knowledge in a tacit form and sharing it through informal and/or personal contacts, NGOs often do not take the next step - codification. Such behaviour can result in low levels of sharing, imprecise exploration, and high dispersion. The codification activity aims to bring together available knowledge using common formats, previously assessed and validated. Often it constitutes the initial verification of the usefulness of knowledge, and the transformation of that knowledge into explicit knowledge. Tacit knowledge can always be encrypted so that it is not generally available, but limited to individuals or a targeted group. Once codified, knowledge can be stored in specific repositories (databases, archives, manuals, etc.) and then reused according to user needs. This activity should be simple, fast, and precise so that the knowledge is truly accessible and used within the organisation. The following step consists in the distribution and presentation of knowledge. Distributing knowledge means making it available to anyone who can use it. In this case the form of presentation is important: defining standard and easy-to-use formats in order to make the best possible use of the knowledge present in the organisation. Knowledge can then ultimately be applied, i.e. transformed into action and used by NGOs. In this way, the organisation gathers new experience, interacts with other actors and generates new ideas, so that it is able to create new knowledge that invigorates and restarts the entire process. In this sense, creative activity also includes the integration of knowledge. In general terms, the knowledge pathway is indeed a cyclical process that activates and restarts itself. Different members of the non-profit organization community may have been involved at each stage of this pathway, but typically activities such as knowledge acquisition, codification, storage, and retrieval are managed at the operational level, while dissemination, application, and creation activities should involve all of the organization's members. (Lettieri et al., 2004).

Despite the spectrum of issues related to knowledge management in NPOs presented in this part of the paper deals with those aspects that are most frequently addressed in the source literature, they are also crucial for creating social added value by these organisations. However, the empirical studies carried out by researchers so far do not fully clarify how non-profit organizations manage knowledge, and researching the relationship between knowledge management and staff working for NPOs has not yet been confirmed by sufficient empirical evidence in a satisfactory manner.

3. Methodology

The study was based on data from the Central Statistical Office in Poland (Główny Urząd Statystyczny - GUS), as well as supplemented and extended by research conducted by the Klon/Jawor Association. The data carried out by GUS is conducted as part of the tasks of official statistics, whose activities consist in collecting and compiling data received from entities operating in Poland.

Techniques used to communicate statistical data:

- Internet (Reporting Portal, e-mail),
- direct interview (taking advantage of a paper form or the CAPI method by means of an interview recorded on a portable electronic device),
- telephone interview (traditional or using the CATI method via computer-assisted telephone interview).

The studies used in the article are from 2008, 2010, 2011, 2014, 2018, and 2020. However, the year 2020 has been analysed in a special way.

The social sector in Poland is made up of organisations that are neither profit-oriented nor part of the state structure[1]. Therefore, the names non-government organizations, community organisation, non-profit, not for profit, or NGO are used interchangeably. And the totality of these organisations is referred to as the social

[1]According to definition, a non-profit organisation is: A legal person or an organisational unit without legal personality which is granted legal capacity by a separate act, including a foundation or an association, which meets the conditions: 1) it is not a unit of the public finance sector, within the meaning of the Public Finance Act, 2) does not operate with the intention of achieving profit, from the Act of 24 April 2003 on public benefit activity and voluntary work. Place of publication: (Journal of Laws 2020, item 1057).

sector or third sector (while the first sector consists in state institutions and the second sector is business). Social sector organisations in Poland can take advantage of various legal forms. The most typical legal forms of NGOs are foundations and associations. These organisations are the focus of the study. It is worth noting that, apart from foundations and associations, there are also other types of organisations that can be classified as part of the broader social sector, but they have been omitted in this study.

The statistical division of Poland into macro-regions was used in the course of the study, as it allows observing changes in the regional distribution of NGOs, which could result in the migration of employees and beneficiaries of these organisations or social changes in the studied field.

In Poland, according to the data of the Central Statistical Office, in 2020 there were 113.9 thousand actively operating foundations and associations (Fig. 2).

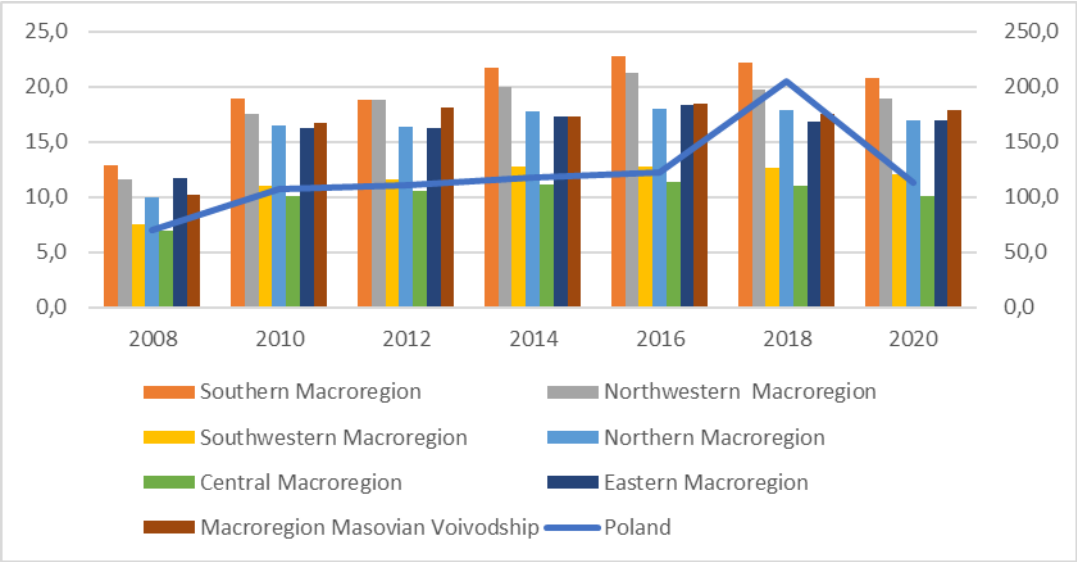


Figure 2: Number of Active Associations and Foundations 2008-2020 (thousands pcs)

The leader in the number of most registered Associations and Foundations is the Southern Macroregion and has not changed over the studied period. The data also shows that the number of registered foundations and associations has increased by 60% since 2008, despite the fact that 2016 marked the highest number of actively operating organisations. During the studied period, no differences in the increase in the number of organizations across the regions were noted. Each region has successively increased the number of NGOs. Seeing how the situation concerning regional changes has not changed, only Poland in general can be taken into consideration as a representative value for all regions.

From the point of view of knowledge management, the legal personality of NGOs associated is important (Table 1), because it strengthens the credibility of the organization in the eyes of donors, and gives a sense of security to stakeholders - recipients of NGO's products or services.

Table 1: The Division of Associations and Foundations by the Legal Personality of the Associated Persons

Poland Years	Organisations of individuals (thousands)	Organisations of legal entities (thousands)	Organisations of individuals (%)	Organisations of legal entities (%)
2010	69.7	5.9	92.2	7.8
2012	71.2	6.2	92.0	8.0
2014	74.2	5.4	93.2	6.8
2016	74.7	5.8	92.8	7.2
2018	70.2	5.8	92.4	7.6
2020	76.1	3.6	95.5	4.5

In Poland, the dominating forms are organisations of individuals. The highest number of organisations of individuals was recorded in 2020, while that for legal entities in 2016 and 2018. The decreasing number, both percentage and quantity, of organisations of legal entities is not the result of establishing organizations of individuals but rather is the result of consolidating legal entities which clearly translates into the number of organisations of legal entities. Active NGOs bringing together both groups work in other areas of the social economy and their activities are not mutually exclusive.

An important factor in terms of knowledge management is job stability. From the knowledge management point of view, the possibility of systemic knowledge sharing in both groups should be considered. If we take into account the dispersion of tacit knowledge in organizations associating natural persons, employment stability becomes an important factor in knowledge management in this regard. In Poland, non-profit organizations did not employ employees, which is shown by the data of the Central Statistical Office of Poland from 2018 and 2020. It was respectively 63% (GUS, 2018) and 61.6% (GUS, 2022) of NGOs. Whereas, if there are employees then civil contracts constitute the dominant form of employment (Table 2).

Table 2: Forms of Employment of People in NGOs

Poland Years	total persons employed on a contract of employment as at 31 December (thousands)	Median	total persons employed on a contract of employment basis as at 31 December (%)	total persons employed on the basis of civil law contracts (thousands of persons)	Median	total persons employed on the basis of civil law contracts (%)
2008	70.8					
2010	132.5	3	25.4	389.9	4	74.6
2012	147.0	3	28.1	375.4	4	71.9
2014	150.4	3	27.5	397.3	4	72.5
2016	162.4	3	28.4	410.1	3	71.6
2018	173.4	3	28.2	441.2	4	71.8
2020	181.2	4	31.5	393.4	3	68.5

The trend of NGOs employing staff on the basis of civil contracts has been practised throughout the entire studied period, while the median distribution for both contracts is similar at 3-4 people employed by an organisation. The study included only those organisations that claimed to employ people.

The following step consists in comparing the forms of employment in an organisation by Association and Foundation (Table 3). The critical determinant of KM's success is the human factor. Researchers emphasize that personal commitment to the mission, values, strategies and goals of the organization, as well as encouraging and strengthening it, are crucial for the creation of knowledge, both explicit and tacit. In order to carry out KM activities, a lasting relationship must be built between the organization and the staff. Such a relationship requires a legal act in the form of a contract. Therefore, it is important to analyze the forms of employment in the surveyed NGOs.

Table 3: Paid Work in Associations and Foundations in 2020

SPECIFICATION **a – in thous.** **b –percentages of the numbers mentioned in the row 1** **c –percent of the total number of persons employed on the basis of employment contract** **d – in persons**		**Associations and social organizations**	**Foundations**	**Total**
1		**2**	**3**	**4**
TOTAL ORGANIZATIONS	a	31,1	16,0	47,1
	b	100,0	100,0	100,0
Organizations without paid employees	a	18,5	7,1	25,6

	b	59,6	44,3	54,4
Organizations with personnel employed only on the basis of civil law contracts	a	7,6	5,0	12,6
	b	24,4	31,4	26,8
Organizations with personnel employed on the basis of employment contract	a	5,0	3,9	8,9
	b	16,0	24,3	18,9
1 - 5 employees	b	8,5	16,3	11,1
6 - 19 employees	b	4,4	5,0	4,6
20 employees and more	b	3,2	3,0	3,1
of which organizations employed at least one person with disability	b	2,5	4,8	3,3
Total persons employed on the basis of employment contract as of 31.12.2020	a	82,5	39,8	122,3
of which persons for whom the organization was the main employer	c	80,5	84,2	81,8
of which women	c	61,8	64,1	62,6
of the total employed on the basis of employment contract:				
pre-working age	c	0,6	0,0	0,4
working age	c	90,4	93,8	91,6
mobility age	c	57,2	64,5	59,7
on-mobility age	c	33,2	29,3	31,9
post-working age	c	9,0	6,2	8,0
Average[a] number of persons employed on the basis of employment contract as of 31.12.2020	d	17	10	13,5
Median[a] number of persons employed on the basis of employment contract as of 31.12.2020	d	5	3	4
Average[a] number of persons employed on the basis of employment contract in full-time jobs in 2020	a	67,3	32,4	49,9
Average[a] number of full-time jobs within organizations employing on the basis of employment contract in 2020	d	13	8	10,5
Median[a] number of full-time jobs within organizations employing on the basis of employment contract in 2020	d	4	2	3
Total persons employed on the basis of civil law contracts in 2020	a	141,5	107,5	249,0
of which women	c	83,7	58,5	58,8
of which persons for whom the organization was the main employer	c	19,5	11,8	12,8
Average[a] number of persons employed on the basis of civil law contracts in 2020 for whom the organization was the main employer	d	12	8	12,9
Median[a] number of persons employed on the basis of civil law contracts in 2020, for whom the organization was the main employer	d	2	2	2
1		**2**	**3**	**4**

Organizations benefiting from work of volunteers	a	28,7	14,3	43,0
of which: members of the organization	c	98,9	96,4	98,1
external volunteers	c	29,4	44,5	34,4
volunteers having volunteer contracts	c	16,5	24,9	19,3
Total volunteers	a	1459,5	345,4	1804,9
of which members of the organization	c	88,0	13,9	63,5
of which women	c	55,1	54,5	54,9
Average number of volunteers	d	51	24	42,1
Median number of volunteers	d	8	4	7

In 2020 54.4% of the foundations and associations had no employed staff and 12.6% employed people only under a civil contract. Abusing civil contracts is the domain of non-profit organisations. Organisations that create full-time positions for employees constitute only 18.9%. Individuals whose primary employment consists in that for associations and foundations account for 80.5%, of which 84.4% are employed on contract of employment and 12.9% on civil contracts. It should be assumed that people working in organisations are committed to their work and willing to share their knowledge. It is also important to note that organisations most often (11%) employ up to five people. Meaning that NGOs are small organisations, often lacking sufficient human capital and thus finding it difficult to manage knowledge. If we take the knowledge management cycle into consideration, there are not enough employees to handle every element, so the people employed probably handle the entire cycle simultaneously. This also proves the higher competence of those working for NGOs. To a large extent, the desire for social action motivates these people to work and act for these organisations. However, treating people inappropriately does not work in favour of building trust in the organisation and building the potential in sharing their knowledge. NGOs most often employ women of working age (they account for 60% of those employed).

According to a study by GUS, in 2020, 91.3% of organisations took advantage of community service. A following 34% were volunteers and only 19% signed a volunteering agreement. According to the GUS study, 74.1% of organisations used exclusively social work. A following 13.1% pay for work irregularly (on the basis of individual civil law contracts), which constitutes a barrier for knowledge management in non-profit organizations. Employees in such organisations do not feel safe, and it should be emphasized that working in such organisations may result from a desire to acquire competences and leave the organisation, but it also indicates a need to act in the social sphere. Treating the staff in such a way is the reason for knowledge retention problems in non-profit organisations. People working in such organisations do not feel comfortable in sharing knowledge, and the contacts with the beneficiaries of these organisations are often individual and limited. Knowledge sharing and management should be prioritized in order to better and more effectively carry out activities in the social sphere.

4. Discussion and Contribution

This paper reviews the literature in the field of knowledge management and adapts it to the needs of non-profit organisations, thus filling the research gap. The findings of the study concerning knowledge management in NGOs are worrying. KM as a critical success factor of the organization requires the involvement of people who are associated with the organization. Knowledge is a human domain, and thanks to acting and sharing it, organisations are prepared to meet demands, needs, and expectations. Knowledge is the domain of man, and by acting and sharing it, organizations are prepared to meet the requirements, needs and expectations. Unfortunately, NGOs often face staff shortages - only 18% of organisations employ paid staff. The interaction between the competences of individual organisations and knowledge management is very strong and that is why these organisations should focus more strongly on investing in human capital. By introducing knowledge management components to their management, they increase their competitiveness in relation to stakeholders. Thanks to our findings, the knowledge on the impact of employment stability (forms of staff employment in NGOs) on KM has been supplemented.

Non-profit organisations often benefit from the community work of both their members and external volunteers. Introducing volunteers into the social space of these organizations often constitutes a form of

filling staff shortages. Whereas, using the volunteers is not included or is even ignored in the knowledge management system. The source literature, as well as this paper, points to a great research gap that should inspire researchers. Future research and analysis should be completed in terms of the growth of competences and skills of volunteers as well as their impact on organisations in the social space in the area of knowledge management.

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Relationships Between Leaders, Capital and Knowledge

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Abstract: Intellectual capital describes the knowledge resources that a company can use to reap advantages (Muslih, 2021). While human capital is frequently associated with organizational capital (Beltramino, 2020), it is also important to emphasize the role of humans in generating intellectual capital (Dessein& Pratt, 2022; Ozgun, 2022). Interactions between employees within the organization or between its employees and their larger context are crucial. Such relationships have been described as "relational capital" (Zhang, 2022). By one definition, leadership is the ability to influence people to achieve organizational goals (Daft, 2014). There is increasing recognition, however, that traditional leadership models are insufficient to face the challenges of a modern, turbulent world and must be transformed (Brennan, 2022). This article examines the intricate relationship between leaders, capital, and knowledge within a business environment. It uncovers how agile leaders foster a specific atmosphere of creativity and responsiveness while enabling organizations to seize opportunities and confidently tackle challenges. Lastly, it highlights the tangible benefits of an agile leadership approach.

Keywords: Leadership, Knowledge, Capital

1. Introduction

Navigating the ever-changing landscape of modern business requires leaders to be adaptable and agile. Recent crises have brought this need into sharp focus, sparking extensive research and discussions on agile leadership. In their work, Joiner and Josephs (2007) have defined agile leadership as the ability to effectively guide organizations through conditions characterized by rapid change and high complexity. This form of leadership operates on five levels: expert, achiever, catalyst, co-creator, and synergist, encompassing a range of skills and approaches necessary for success in turbulent times.

Today, it is believed that a key element that has a significant impact on an organization's entrepreneurship and innovation is the managerial staff's agility (Silva et al., 2023). Therefore, organizations ought to foster such abilities in their leaders and assess leadership in a way that enables leaders to successfully handle rapid change, navigate ambiguity, and interact with internal and external stakeholders. However, there is a clear disconnect between what organizations should be doing in this respect and what is actually taking place. Research has shown that even though organizations expect leaders to possess innovative abilities, they continue to promote traditional models and mindsets. The majority of respondents, according to the authors' research, desire a leader with a vision, one who inspires and supports independent thought and action, and one who is humble. The leaders of tomorrow, it seems, must take an agile and proactive approach to their leadership philosophy and look for opportunities to allow them and their teams to grow and become agile.

2. Literature Review

2.1 Intellectual Capital

Intellectual capital plays a crucial role in every organization. As Muslih et al. (2021) write, it represents the entire knowledge potential of an organization and, therefore, can be seen as an intangible value to generate profit. Authors such as Dessein & Pratt (2022), Ozgun et al. (2022), and Al-Omoush et al. (2020) emphasize the primary role of human assets when it comes to increasing intellectual capital resources. Additional research likewise emphasizes the importance of interactions between employees within an organization and interactions between employees and their employers, which some researchers define as a separate type of capital, "relational" capital (Sukarno et al., 2019; Zhang et al., 2022; Drewniak et al., 2020), which is responsible for the accumulation and use of intellectual capital within an organization. For this reason, intellectual capital tends to be equated with organizational capital, or at least with the far-reaching interdependencies observed between these two types of capital (Beltramino et al., 2020; Barbieri et al., 2021; Wójcik, 2021).

Both types of interpersonal relationships impact innovation within companies. The relationship between the organization and the outside world is especially important for innovation. It can contribute directly to the creation and introduction of new products and services (as described by Ramirez-Solis et al., [2022]) and is an important factor to consider when developing innovation strategies (AlQuershi et al., 2021). Developing these relationships, which are critical for learning, decision-making, and problem-solving within an enterprise, can result in better performance, improved product quality, the development of new services, improved delivery

timeliness, cost reductions, and operational efficiencies (Aisyah et al., 2019). According to Rzepka and Sabat (2022), the effectiveness of using acquired knowledge is determined by employees' open-mindedness and readiness to implement new, creative solutions. The nature of the knowledge source upon which a company's absorption capacity depends also plays a role in innovation (Versiani et al., 2021). Intangible assets help to turn knowledge into profitable goods, and the intellectual capital they comprise can be seen as a driver for corporate growth, which also affects a corporation's viability (Xu & Zhang, 2021). On the other hand, intangible assets affect tangible ones, affecting the company's productivity while creating value (Oppong &Pattanayak, 2019). However, they require investment, which may prove problematic, especially for small entities that may treat such investment as inefficient compared to financing material assets (Seo& Kim, 2020). Ocak & Findik (2019) further observe that investments in intangible assets should accompany appropriate staff training, particularly about electronic databases or work organization.

2.2 Traditional Leadership and its Impact on the Organization

The topic of leadership and its impact on organizational processes has been discussed for many years. One definition of leadership is the capacity to persuade others to work toward organizational objectives (Daft, 2014). It should be noted that traditional leadership cannot be defined uniformly, as it comes in various forms. This distinction also results in a hazy understanding of how various leadership styles affect an organization's operations.

Much has been written about the transformational style, often contrasted with the transactional style. Papers like Qalati et al. (2022) and Greimel et al. (2023) argue that transformational leadership, based on inspiring followers rather than focusing on processes and control, helps employees succeed and can also aid companies in attracting and retaining talented employees. Khan & Khan (2019) and Steele & Watts (2022) clearly emphasize the positive impact of this leadership style on innovation. The latter authors, however, concentrate more on the core duties of a leader.

Research by Yue (2021) and Wang et al. (2022) emphasizes the issue of a leader's charisma and its favorable impact on employee attitude and commitment. This study emphasizes how crucial a leader's charisma is in determining how committed and engaged their team members are.

Overall, the literature offers a nuanced view of different leadership philosophies and how they affect organizational outcomes, with charismatic and transformational leadership emerging as key elements in promoting employee success and innovation.

Regarding the transactional model that uses incentives and penalties, as Klein (2023) writes, many scholars perceive it as one that inhibits creativity and entrepreneurship. However, he makes the point that in some circumstances, this leadership style may also promote proactive and risky behaviors, particularly when there are clearly defined expectations and effective communication channels between the employer and employee. Aga (2016) concurs, pointing out that the relationship between conditional reward and project success is moderated by the transparency of the project's purpose. Deichmann & Stam (2015) go even further in asserting that transactional leadership is equally effective as transformational leadership at inspiring people to support the objectives of the organization's program. Even Abdelwahed et al. (2023) mention this style's productivity in empowering organization members and fostering growth in skills, knowledge, and confidence. On the other hand, Abbas & Ali (2023) and Sunarsi et al. (2021) support transactional leadership's lower effectiveness. The detrimental effects of transactional leadership on intra-entrepreneurial behavior are highlighted by Moriano et al. (2014). Based on research, the authors conclude that extrinsic motivation via rewards deters workers from engaging in activities related to experimenting with novel ideas that could be advantageous to the organization and go beyond their professional responsibilities.

2.3 Leadership and Cultural Conditions

A growing number of writers recognize one more important factor that determines the way a given leadership style affects an organization, namely cultural conditions. Authoritarian leadership can be effective if preceded by an appropriate agreement between the leader and the follower (subordinate). Cultural differences, however, can play a significant role in this, as evidenced by the findings of research done in three different nations (the USA, Turkey, and Taiwan) (Karakitapolu-Aygün et al., 2021). Lonati (2020) studied leadership styles in various communities and concluded that these populations' socio-ecological characteristics influenced the emerging leadership prototypes. Conversely, Straka et al. (2018), discussing the results of the review of work on conservation activities on five continents, found that leaders should adapt to the cultural environment because only in this way can they effectively implement strategies based on a shared vision and thus build partnerships

in different cultures. From the standpoint of their sensitivity, competence, and ability to lower decision-making bias, a leader's capacity to function effectively in multicultural environments and interactions can also be of fundamental importance (Richard-Eaglin, 2021).

2.4 Agile Leader and Agile Organization

Increasingly, attention has been drawn to the fact that traditional leadership models are proving insufficient to meet the challenges of the turbulent modern world and must change. The postulate of a change in the perception of competence is included in Jackson & Dunn-Jensen (2021), in which the authors consider this issue in the context of HR departments. The implementation of new leadership, however, is intended to enable a more effective and rapid response to potential crises and to avoid certain abuses that may occur if classic leadership patterns are not reformed.

Organizational and leadership agility emerged as a research topic in the 1980s and 1990s. Nonetheless, it was only in the first decade of the 21st century that this line of inquiry was analyzed systematically. Joiner & Josephs published a paper in 2007 in which they defined agile leadership as the ability to effectively lead in conditions defined by rapid change and a high degree of complexity, which is accomplished by passing through five different levels: expert, conqueror, catalyst, co-creator, and synergist (Joiner & Josephs, 2007, p. 36). Leadership, however, is only one of many examples of agility within an organization. For example, the dominant dimensions of agility in Brazil's Industry 4.0 companies were business, markets, strategy, and process, in addition to leadership (Silva & Oliveira, 2023, pp. 1714). Flexible leaders can positively impact an organization's agility in other aspects of its operations, as evidenced by, among other things, Chen et al.'s (2022) work on the influence of CEOs as corporate leaders on the strategic flexibility of high-tech companies in China; and by research that recognizes a leader's positive impact on the agility of the labor force in small enterprises in the Polish energy sector (Cyfert et al., 2022). Wiechmann et al. (2022, p. 2360) argue that the prerequisite for the effective development of agility is that the process be initiated by management as not every employee can grasp the value added from the outset. An important factor in determining the success of introducing flexibility into an organization is an agile mindset. The work of Eilers et al. (2022), for example, sees the lack of agile thinking as a serious barrier to implementing agile methods.

Leadership should not only increase an organization's flexibility, but organizations themselves should create agile leaders. To this end, it is essential to ensure that human resources are available and conditions are right for human capital development. HR departments have a significant role to play here, which should promote people with the appropriate predisposition to manage situations requiring agility rather than people with a lot of experience. Hedlund and Ingo (2018) highlight this problem in their case studies of the automotive and aerospace sectors in Sweden. They argued that these companies should change their requirements for promotion by following in the footsteps of agile trainers and incorporating the servant leadership style into the courses (Hedlund & Ingo, 2018, p. 61). The overarching goal of this style of leadership is, as Knoll notes, to develop and empower others to achieve their highest potential through leadership qualities such as listening, empathy, awareness, persuasion, conceptualization, foresight, engagement in human development, management, and community building (Knoll, 2019, p. 45). In this context, some researchers attribute a key role to the organization's organizational culture and operational excellence (Carvalho et al., 2019; Mikusova et al., 2023). Gren& Ralph (2022) point out that to create agile leaders, it is necessary to have people willing to share in the leadership work. They suggest that traditional managers working in or around teams may prevent the team from becoming agile.

Organizations wishing to develop agile leaders should use electronic technologies to support decision-making processes. Saputra et al. (2023, p. 332) conclude from their study that the use of information and communication technologies directly affects leadership development in both the exploration and exploitation phases. Gonçalves et al. (2022, pp. 113-114) add that digital tools facilitate leadership mentoring in team building and enable the creation of trustworthy relationships necessary for successful co-creation. Similar conclusions are also drawn in the work of Wang et al. (2022c), focusing on sophisticated chatbot technologies and their impact on agility. Among other things, they write that both the routine and innovative use of chatbots increased business flexibility and managers' sensitivity to identifying opportunities for organizational innovation.

3. Methodology

This research is part of an international project called "Teal Organizations in Economy 4.0," conducted in Poland, England, Hungary, India, Spain, Georgia, and the USA. The sample comprised 622 respondents. The methods that were employed were CAWI and CAPI. All studies were conducted in compliance with the recommendations

developed by the OECD-DAL. The Cronbach alpha test, the ANOVA method, and the Fisher-Snedecor F-test were used to test the data. Statistical analyses were performed using the SPSS STATISTICA software.

Table: 1 Scope of Business Activity

		A - Preliminary stage	**B-** ***Primary research***	**C-** ***Repeated tests***
Primary modus operandi	Trade	19.7.	10.3.	16.6.
	Production	17.6.	13.9.	28.0.
	Services	62.7.	75.8	55.4
Geographic scope of operation (%)	Local	19.3.	22.1.	9.4.
	Regional	8.2.	12.4.	27.3.
	National	30.0	23.0.	22.0.
	International	42.5.	42.4.	41.3.
Number of employees (%)	0-9	13.7.	9.1.	3.3.
	10-49	24.0.	18.8.	55.1
	50-249	15.5.	28.2.	16.6.
	250-999	18.5.	20.9.	16.6.
	1000-and	28.3.	23.0.	8.4.

4. Findings

As noted, a leader's role is linked to influencing people to achieve expected results. A total of 44.2% of respondents agreed that good leaders should strive to shape their subordinates' independent thinking and responsibility for their actions, while 34.7% strongly agreed. Only 2.1% of respondents disagreed with this statement, and 18% were undecided.

Table 2: Statements Regarding a Company Leader

	I strongly disagree	**I disagree**	**Hard to say**	**I agree**	**I strongly agree**
In relations with subordinates, a good leader should strive to shape their independent thinking and responsibility for their actions	1.0.	2.1.	18.0.	44.2.	34.7.
Vision is a characteristic of a good leader that unites and inspires the team to act	0.6.	3.4.	19.1.	38.9	37.9
Humility is a characteristic of a good leader thanks to which they can acknowledge when they have been wrong	0.3.	3.2.	18.6.	42.9.	34.9.

Source: A study based on Agnieszka Rzepka's research

As shown in Table 1, over 70% of respondents agreed with the qualities of a good leader, i.e., vision, inspiring teams to act (38.9% and 37.9%, respectively). Similarly, regarding humility (i.e., good leaders should admit when they are wrong), more than 76% of respondents agreed with the statement (columns 4 and 5). Good leaders know, appreciate, and respect their colleagues; they motivate them to do fruitful work, show support during times of difficulty, and possess all the prerequisites to manage a team effectively. Leaders have specialist skills such as knowledge and professional qualifications, innovative skills, creativity, and analytical thinking (Patella 2023). However, the most important characteristics are interpersonal skills related to team building. A leader with all the qualifications who cannot communicate effectively will not succeed. This research suggests that the effectiveness of a leader also depends on having skills that can be learned and constantly improved. The leader should master social skills in effective team building and leading, i.e., the ability to communicate effectively,

listen actively, provide feedback, motivate to achieve goals, have a positive self-presentation, solve problems, and exhibit assertive behavior. An effective leader should also be a visionary, an entrepreneur, an initiator, and open to spontaneous change.

5. Conclusion

On the basis of the literature review, it can be concluded that:

There is a consensus that in difficult, turbulent times, it is necessary to change traditional leadership styles in favor of agile leadership. Such a style has a positive impact on innovation, knowledge transfer, and the other organizational dimensions that comprise a firm's intellectual capital;

- It is often emphasized that an agile leader influences other dimensions of the organization and its outcomes (Silva & Oliveira, 2023; Chen et al., 2022; Cyfert et al., 2022; Wiechmann et al., 2022);
- Some people identify certain dangers that may weaken the positive influence of an agile leader on the organization. Among others, other members of the organization may lack agile thinking (Eilers et al., 2022; Asseraf&Gnizy, 2022), members of the organization may not be prepared for the processes of implementing agile techniques (Rasnacis&Berzisa, 2017; Poscova et al., 2020), or there may be cultural barriers (Smite et al., 2021, Caligiuri, 2013);
- Publications mostly note the positive impact of agile organizations and their leaders on innovation (Sjödin et al., 2020; Alamsjah, 2022), but Annini et al. (2022) present one exception that calls this conclusion into question.

The fact that companies that produce agile managers is rarely addressed in the literature. Research results are not generally about leadership directly, but rather the organization's members. A relatively small number of works highlight, above all, the role of the organization in ensuring adequate human capacity.

- Proper recruitment and promotion with the appropriate predisposition for HR departments (Hedlund & Ingo, 2018), defining leadership qualities useful in developing agility (Knoll, 2019), highlighting the relationship between the dissemination of agility and organizational culture (Carvalho et al., 2019; Mikusova et al., 2023);
- Some authors emphasize the importance in this context of leaders whose actions will encourage others to adopt leadership attitudes (Gren& Ralph, 2022; Das et al., 2023), although they also recognize the risks to agility from traditional leaders uninterested in sharing leadership jobs (Gren& Ralph, 2022; Reunamäki& Fey, 2022);
- Trzeciak& Banasik (2022) list factors that determine the engagement and effectiveness of agile project teams, while Tyagi et al. (2022) emphasize the role of trust in creating agile leaders, believing that this is the duty of the organization.

Part of the work concludes that the development of agile leaders in organizations supports modern digital technologies and tools (Saputra et al., 2023; Gonçalves et al., 2022; Wang et al., 2022c).

Based on the indicated literature and studies, further research is necessary to answer questions that arise, i.e.:

- Which dimensions of the organization are agile?
- What leadership styles are present in organizations (transformational, service-oriented, process-based), and which agility traits do members exhibit?
- What relationships exist between organization members (knowledge flow, trust, etc.)?
- Are the organization's members prepared to implement agile methods (knowledge of agility and the methods for its implementation)?
- Are organizations implementing innovations, including those based on digital information and decision-support technologies?
- Do organizations use motivators to cultivate the agile behavior of leaders (see Trzeciak & Banasiak, 2022)?

These studies may result in barriers to the introduction of agile leaders into an organization (e.g., lack of agile actors in the organization, improper from the point of view of agility, HR management, presence of traditional leaders aimed at increasing control, lack of decision support with digital tools, etc.).

As has been shown, the leader's role is multifaceted. On the one hand, leaders dictate how companies develop, but on the other, they motivate people to make an effort. Change is part of our lives, and embracing it is crucial for any organization.

The research presented above indicates that the majority of respondents desire a leader with a vision, someone who inspires and encourages independent thinking and action while also possessing humility. The study by the article's authors highlights the expectation for a transformational leader who is also agile, demonstrating that these two features are not mutually exclusive. Therefore, the literature on this leadership style aligns, at least in part, with the study's findings and conclusions.

Furthermore, the results presented in this article indicate a greater sense of independence and employee responsibility, which is consistent with the findings of related studies by Gren & Ralph (2022), Reunamäki & Fey (2022), and Tyagi et al. (2022). These works corroborate the notion that agile and transformational leadership can empower individuals within organizations, fostering a culture of autonomy and initiative.

As the above research has shown (Rzepka, 2020; 2023), leaders in the 21st century must be artists, i.e., able to quickly adapt within the workplace, where a talent for "establishing relationships, creating, and initiating change" determines overall success. Leadership today is rooted in the ability to relate, create, and initiate, as well as improve the agility of leaders, managers, and the team.

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Mapping Knowledge-Life Cycle to Process Architecture

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Abstract: A knowledge life cycle has several knowledge management (KM) processes that differ from one model to another. Exploration and utilization of these processes on high levels require mapping them to the core business processes in an organization. A business process architecture (BPA) identifies these core processes and highlights their relationships. Riva method is a BPA approach that allows characterizing these key processes using essential business entities (EBEs). It also proposes a few steps to develop an organization's overall business process architecture (BPA). Matching the appropriate knowledge management (KM) processes to these steps clarifies KM's role in business process modeling. In addition, it contributes to discovering gaps and developing business process modeling (BPM). The Riva-based Knowledge Life Cycle (KLC) model has been suggested to map KM processes to Riva BPA steps. The model is divided into three phases, sequentially including the KM processes of exploration and identification, capturing and refinement, and creation and exploitation. The exploration and identification phase involves searching and discovering business scope resources (Riva step one). Capturing and refinement is the phase of extracting candidate EBEs, determining the EBEs, and filtering them into Units of Work (UOWs) (Riva steps two and three). Finally, creation and exploitation processes involve generating dynamic relationships among UOWs and transforming the UOWs diagram into the first and second-cut process architecture diagrams (Riva steps four, five, and six). A case study of a bank in Jordan will be applied to evaluate this model. A mixed-methods approach using structured and semi-structured interviews will be conducted with the bank financing team to measure KM processes' involvement. Accordingly, the results are expected to identify which KM processes are more engaged to process architecture. It could also suggest using these KM processes as a benchmark to measure the achievement of each BPA step implementation in its domain.

Keywords: Knowledge management processes, Knowledge-life cycle, Business process architecture, Riva method

1. Introduction

A business process architecture (BPA) identifies the key processes to establish a specific business. It also provides a map that guides how these processes are initialized and managed over time (Siviy et al. 2007). Integrating BPA with knowledge management enablers (KMEs), such as information technology and organization structure, has shown effectiveness in developing a dynamic and competitive BPA (Sabri and Odeh 2019). It also suggested a knowledge-based approach for BPA modeling. Nevertheless, the KMEs still do not interact with all the development steps of the process architecture (PA). Utilization of knowledge management processes (KMPs) could be more comprehensive in covering these steps. It could also act as a benchmark for them. In addition, it integrates the BPA domain to the KM area in depth.

Knowledge Management definitions have two approaches; one is a process, and the other is an object. The process approach suggests knowledge encapsulated in individuals, and it is necessary to interact to facilitate this knowledge dissemination and sharing socially (Hislop et al. 2018). Any deliberate efforts for managing knowledge in an organization, such as capturing, creating, sharing, assimilating, adapting, and implementing knowledge, are considered a knowledge process. Thus, a KM could be defined as a set of ordered activities that are implemented in an organization to support knowledge exploitation (Igbinovia and Ikenwe 2017).

This paper aims to develop a model that adopts KMPs in developing a BPA using an object-based approach nominated as the Riva method. This model maps the Riva steps to some KMPs that act as a knowledge-life cycle corresponding to the BPA development steps. A future case study will be applied at a bank financing case study in Jordan to evaluate this model.

2. Process Architecture Modeling and Riva Method

Process architecture is "an organized overview of the processes that exist within an organizational context" (Dumas et al. 2013, p. 38). It connects the entire kernel processes in a business that is essential for the development of a business. It also facilitates the transformation of business processes into application models that are developed by information technology (IT) systems (Peisl 2009).

Riva method is one of the BPA approaches that include action-based, object-based, function-based, goal-based, and reference-based models (Dijkman et al. 2016). It is proposed as a systematic approach for the development of PA using essential business entities (EBEs). This approach is characterized by simplicity and obviosity besides its common diagrams for the same business. It also includes the following steps:

Step 1: Agreement on the field and business scope.

Step 2: Brainstorm the candidate's EBEs (CEBEs) and nominate the EBEs.

Step 3: Selection of the units of work (UOWs).

Step 4: Apply the dynamic relationships between UOWs and prepare a UOWs diagram.

Step 5: Transform the UOWs diagram into the first cut PA diagram.

Step 6: Transform the first cut PA into the second PA.

Integrating BPA steps with KMPs is still a new approach that requires a good understanding of the selected BPA method in order to map with appropriate KMPs. Other previous studies mainly focus on mapping business process modeling concepts into a proposed knowledge-life cycle and knowledge categories, such as formalizable and non-formalizable knowledge (Kalpič and Bernus, 2006).

3. Knowledge Management Processes: A Literature Review

Knowledge is defined as a "process of simultaneously knowing and acting". This process view focuses on the flow of knowledge and the application of expertise, in addition to the processes of creating, sharing, and distributing knowledge (Alavi and Leidner, 2001). These processes permit utilizing of knowledge as an essential aspect of value addition and generation (Migdadi, 2022).

Different models of KMPs were implemented to enhance organizations' efficiency and competitive advantage. These models were related to creating, sharing, and applying knowledge (Jafari and Maleki 2013). Other main processes were also identified and interacted with the previous processes, such as transfer, storage, retrieval, and application (Landroguez and Cepeda-Carrión 2016). Other models of KMPs highlight their role in innovation. Based on 45 papers, Costa and Monteiro (2016) indicated the direct support and leverage of KMPs to innovation. In serving this relationship, they also revealed other variables' roles, such as absorptive capacity and organizational learning. In addition, knowledge creation and application were nominated as major processes through which other knowledge processes impact innovation. As for KMPs' relationship to information systems (ISs), Al-Emran and others (2018) have reviewed existing models from 2001 till 2018 using a list of academic database providers such as Springer, ScienceDirect, Wiley, and IEEE. Their findings indicate that knowledge sharing is the most common process, followed by processes of acquisition and application. They have also found that the questionnaire research method is mainly dependable for data collection in the KMPs context. Furthermore, they have indicated the most used ISs in these studies, including E-business, KM systems, and IS outsourcing.

Systematic KMPs for the most influential knowledge life cycle (KLC) models were reviewed by Evans and others (2015). These models were characterized by the common use of practitioners and scholars' adoption. They were also modern in introducing the KM life cycle and highlighted valuable aspects of understanding the process of organizational knowledge during its lifetime. Some of these models include Meyer and Zack's (1996) and Wiig's (1994) knowledge life cycle models. On the other hand, Heisig (2009) analyzed 160 frameworks introducing different KMPs. The analysis showed that five KMPs were the most commonly mentioned and could be the broad category for all processes. These processes present identifying, creating, applying, sharing, and storing knowledge. Based on previous models and Heisig's (2009) analysis, Evans and others (2015) built their own KM life cycle. The model sequentially comprised seven phases: identify, store, share, use, learn, improve, and create.

Lastly, the nomination of various KMPs through their models and influential roles would not be sufficient without referring to exploration and exploitation processes. These two processes concurrently have a crucial role in organizational success and the knowledge evolution cycle (Zollo and Winter 2002). Furthermore, they form an overlapping field between KM and Dynamic Capabilities (Easterby-Smith and Prieto, 2008). Exploration identifies things an organization captures by concepts and actions such as experimentation, search, discovery, and innovation, whereas exploitation includes production, refinement, efficiency, implementation, and execution (March 1991).

4. A Knowledge Life-Cycle Model Mapping to BPA

Using KMPs to develop the Riva BPA requires identifying the appropriate KMP that corresponds to one or more Riva steps. The steps of the Riva method have a specific definition that could be aligned with a certain KMP role. Accordingly, a group of KMPs was selected to be ordered sequentially in response to the Riva method steps. This group presents the KLC model mapping to BPA (Figure 1).

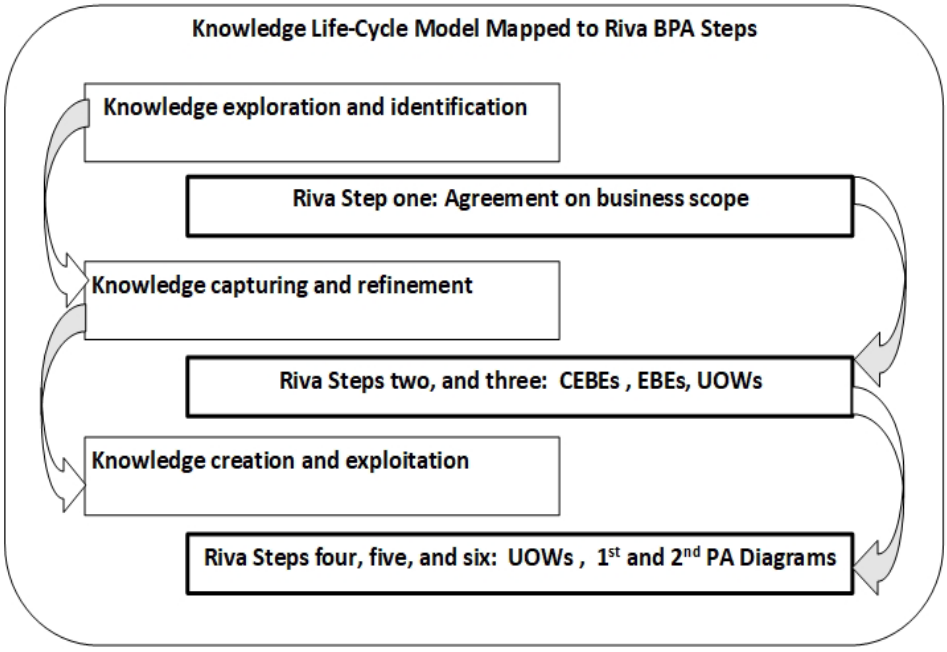


Figure 1: A Knowledge Life-Cycle Model Mapping to BPA

The declaration of each KMP with Riva's steps is as follows:

- Knowledge exploration and identification

Step one: Agreement on business scope

The first step in the Riva method could be mapped to knowledge exploration and identification processes. Knowledge exploration includes *search*, *observation*, and *discovery* (Sabri, 2022), while knowledge identification indicates key problem aspects such as *resources*, *goals*, *participants*, and *existing materials* (Dalkir, 2013). Accordingly, choosing the business field and determining its related resources could be mapped to these processes.

- Knowledge capturing and refinement

Steps two and three: brainstorm the CEBEs and definition of the EBEs, selection of the units of work (UOWs)

Knowledge capturing is finding approaches to transforming *tacit* knowledge into *explicit* knowledge (Dalkir 2013). *Brainstorming* the CEBEs with domain experts in the Riva method is the main process of capturing knowledge through which CEBEs are determined. The CEBEs also require *inspecting* and *nominati*ng EBEs and choosing UOWs in the third step of Riva. This could be implemented in the knowledge refinement process. Knowledge refinement could imply *remov*ing or *addi*ng new rules to specialize or generalize knowledge (Mooney and Shavlik 2021). Certain rules are applied to the third step to distinguish the EBEs from CEBEs and then extract UOWs.

- Knowledge creation and exploitation

Steps four, five, and six: Generation of dynamic relationships between UOWs and preparation of UOWs Diagram, the transformation of UOWs diagram into first and second PA Diagrams

Knowledge creation exists through different approaches, such as *innovations*, *experiments*, knowledge *importing*, and *observation* of the real environment (Dalkir 2013). The generation of dynamic relationships between UOWs, in addition to their diagram implementation, could be mapped to knowledge *importing* and *observation*. Knowledge *importing* involves *elicitation* of knowledge from domain experts and manuals, while *observation* is performed through visiting the environment and watching processes. In step four of the Riva method, linking UOWs and preparing their diagram is accomplished with the support of processes' materials

and case study experts. Visiting, understanding, and observing the work site could also reinforce the development of the UOWs diagram.

Developing the UOWs diagram step in the Riva method paves the way for extracting the first and second-cut PA diagrams in steps five and six. These steps could be considered part of knowledge *exploitation* since they imply using and further developing existing knowledge (liu 2006). They also perform *reductions* at the first cut PA nominated as Riva heuristics to extract the second cut PA. This assures efficiency and real-world representation of processes, part of knowledge exploitation.

5. Methodology

The model of mapping the Riva steps with KMPs demands a real environment to be evaluated. A bank in Jordan was selected to demonstrate this model since it was already utilized as a case study to align knowledge management enablers (KMEs) to Riva process architecture (Sabri and Odeh 2019). Therefore, further development of the BPA using KMPs could be facilitated using the same case study and completing BPA mapping to both KMEs and KMPs. The bank is divided into three cases of PAs: deposits, financing, and treasury units. The bank financing case study will be used to evaluate this model. A mixed-methods approach using quantitative and qualitative methods is applied to evaluate this model. A qualitative approach includes a semi-structured interview with the financing team experts. In contrast, the quantitative approach is based on a structured interview using a Likert scale of five-point type. The main structured questions of the interview are suggested to include the following questions in Table 1.

Table 1: Questions

No.	Question
Knowledge exploration and identification (Riva step one)	
1.	Defining the scope of bank financing requires finding what resources are included.
2.	Missing to define any of the existing resources of the bank financing could be addressed through searching and observation.
3.	Understanding the bank financing field must accurately determine objectives, employee roles and positions, and primary resources.
Knowledge capturing and refinement (Riva steps two and three)	
4.	A team meeting that brainstorms CEBEs supports the identification and documentation of any missing CEBE that represents bank financing business.
5.	Bank financing EBEs have further descriptions and restrictions that differ from CEBEs
6.	Inspecting bank financing UOWs requires filtering many various EBEs
Knowledge Creation and Exploitation (Riva steps four, five, and six)	
7.	It is indispensable to ask banking financing experts how UOWs are related to each other in their domain.
8.	Visiting the bank work environment and watching the workflow facilitate understanding the interaction between different UOWs
9.	The development of the first cut PA corresponds to the UOWs diagram and perform by its utilization.
10.	Further modifications that transform first-cut PA into second-cut PA make PA more efficient and reflective of the real environment.

6. Conclusion and Future Work

This paper highlights the role of knowledge management processes in a significant area of an organization, the business process architecture. Linking knowledge processes to core business processes makes their role more obvious and effective in business development. They also establish a benchmark to assess the critical processes. Riva method is one of the BPA approaches that have clear steps to develop a PA. These steps could correspond to a sequential group of KMPs. The KMPs include exploration and identification, which are mapped to step one. Then, capturing and refinement are mapped to steps two and three, and creation and exploitation are mapped to steps four, five, and six.

A future case study of a bank financing unit in Jordan will be demonstrated to evaluate the model of mapping BPA with KMPs. Further studies could include mapping KMPs with different business process modeling in addition to their roles as an evaluation model.

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A Conceptual Model of the Product Development Process using Tacit Knowledge of People with Disabilities

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Abstract: Knowledge management (KM) in an organization has always been an important element of creating its value and ensuring its development. Economic entities and market organizations that strive to ensure a competitive advantage must care for the best use of their knowledge, both explicit and tacit. Tacit knowledge may constitute up to 80% of all knowledge accumulated in an organization, but its nature is much less accessible to codification. The aim of the conducted research is to present a conceptual model of product development for the disabled, which assumes the functioning of the value network (VN) based on information technologies (IT). These people are the best source of knowledge necessary to formulate the framework defining the parameters of the developed product. The presented model considers the specific requirements of a given social group, which is characterized by a large dispersion and diverse needs. This is the biggest obstacle to extracting the knowledge necessary in the design and testing process. The article is an introduction to the discussion on the acquisition of tacit knowledge for personalization and adaptation of products to the needs of a given social group. The research into the conceptual model is the initial stage of research work that focuses on the analysis of literature and the creation of the concept of tacit knowledge management in the product development model based on the value network. The management of dispersed tacit knowledge is to systematize specific information in the field of product adaptation to the needs of the disabled. The concept of using tacit knowledge is always a challenge in the organization's knowledge management. The disabled often face difficulties in everyday life. Especially in the current situation in Ukraine, where military operations lead to an increase in the number of injured people for whom later adaptation in society will require appropriate knowledge and resources managed within the value network.

Keywords: Knowledge management, Product development, Value network, IT, Modelling

1. Introduction

Satisfying the demand for custom products requires enterprises to respond quickly and efficiently. This has become particularly important at a time when the markets are placing more and more demands in terms of competition and struggling with turbulence in the global economy (Kolberg *et al.* 2016). The struggle of companies has led to the growing importance of information and communication technology (ICT) used in relations between customers and enterprises. The importance of customer participation (CP) in product development processes has increased significantly, where this share is defined as the amount of involvement in the process (Fang 2008). Identification of needs and solutions that guarantee satisfaction initially became the mainstream of customer-business relations. However, over time, this has evolved to much greater customer participation in all stages of the New Product Development Process (NPDP) (Morgan *et al.* 2018). Changes in the approach to NPDP were already emphasized in the literature many years ago,(von Hippel, 2003)(Nambisan 2002) where the concepts of virtual communities, toolkits for clients or lead users were presented. The success of a new product depends on the identification and understanding of factors that are a key source of managerial knowledge. They strive by all means to reduce risk and uncertainty by engaging CP in creating innovation and matching the product to the market (Poetz and Schreier 2012). These activities were initially motivated only by economic reasons, this concerned primarily self-service technologies where employees were replaced with customers (Bendapudi and Leone 2003). Currently, NPDP takes into account CP by assigning it different roles in the subsequent stages of product development, they can be involved in the work as sources of information, co-creators or innovators (Cui and Wu 2016).

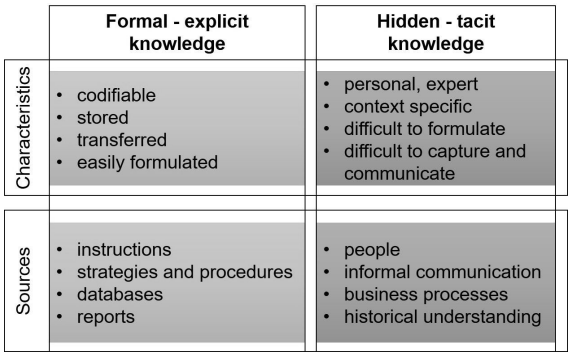
The client's involvement in the company's internal processes may have a different impact on the final effect, both positive and negative, which is emphasized in the literature (Mahr, Lievens, & Blazevic, 2013) (Menguc, Auh, & Yannopoulos, 2014). This allows for the conclusion that there are certain conditions in which CP may have a more or less favorable effect on NPDP (Naeem and Di Maria 2020).

2. Literature Overview

2.1 Tacit Knowledge Management in the Organization

The importance of tacit knowledge has been gaining popularity in recent years, especially in the sphere of organizational behavior. Research and measurements are a challenge for organizations and researchers who strive to formalize and structure it (Fernie *et al*, 2003). Literature defines two ways of classifying the types of

knowledge, where structural and organizational knowledge is distinguished (Edvinsson and Malone 2014). Structural knowledge is characterized by the possibility of recording and reproducing (e.g., reports, instructions), it is the effect of the accumulation of information collected in databases. Organizational knowledge is the result of a learning process within an organization. It is characterized by elusiveness and individuality in terms of human perception. Tacit knowledge as a concept was formulated in 1966 by Polanyi (Polanyi 2009). He described it as knowledge that is difficult to measure and conceptualize, which is difficult to articulate. Also, Nonaka and Takeuchi (1995) argued that codified or structured information is explicit and formal knowledge, and unstructured knowledge that is difficult to codify is tacit knowledge (Fig. 1). It is also defined as the knowledge that explains differences arising in management effectiveness, leadership, or team performance (Ryan and O'Connor 2009).



Source: Nonaka & Takeuchi, 1995

Figure 1: Types of Knowledge in the Organization

Tacit knowledge is characterized by its uniqueness and difficulty in formalization and transmission. It is usually assigned to specific organizational units or persons in a given position (Patalas-Maliszewska and Kłos 2017)(Piotrowska 2012). The acquisition and systematization of knowledge therefore requires the involvement of employees who are the basic source of tacit knowledge. Their experience is particularly important, through which the acquired knowledge is shaped, and it is acquired individually during (Mendryk 2011):

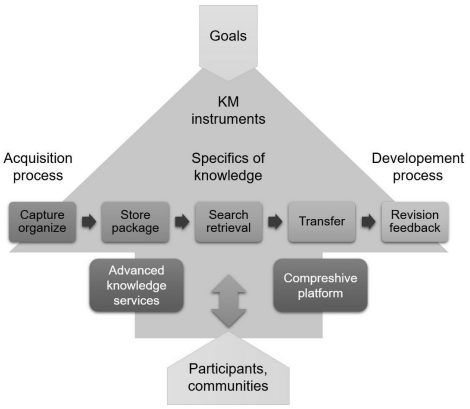
- independent activities while implementing projects and tasks,
- feedback with the client,
- tests and research,
- analysis of complaints,
- joint meetings in teams - brainstorming, multifaceted approach.

Organizations usually focus on explicit knowledge because it is much more accessible and identifiable. Achieving goals through knowledge management poses new challenges to them in the form of converting tacit knowledge into formal knowledge, which leads to the development of implementation activities and the enforcement of tacit knowledge acquisition processes. (Wang and Noe 2010). In their research, Chergui, Zidat and Marir proposed an ontological model, which in its construction is to facilitate the acquisition, storage and transformation of tacit knowledge. It is also important that they also show actions taken to share knowledge in the future, creating a kind of information base (Chergui et al. 2020). Moreover, each member has their own personality traits, which makes managing a group of people complicated, especially if conflicts arise (Mezghani et al. 2016).

2.2 Significance of ICT in Knowledge Management

The increase in importance of the field of knowledge management (Brzozowska and Szymczyk 2017) would not be possible without the development and support of ICT. Technology is a key element for increasing the efficiency and productivity of activities by providing tools and methods to acquire, understand and share knowledge. (Dieng *et al*, 1998). ICT is the basis for communication in organizations, where opportunities for joint learning and searching for knowledge dynamically translate into knowledge management processes (Abubakar *et al*, 2019). The dynamics, amount of data and complexity of knowledge becomes almost impossible to manage without the appropriate tools. Knowledge management systems (KMS) (Ruggles 1996) defined in the literature are identified as tools supporting activities such as generation, codification, and transfer of knowledge. These tools improve decision-making processes in terms of ensuring the entire knowledge process. The role of technology, which is a factor enabling the achievement of KMS objectives (Fig.

2), is significantly increasing, where the main goal of KMS is to facilitate the implementation of the knowledge process through its creation, structuring and sharing (Tyndale 2002).



Source: Maier & Hädrich, 2006

Figure 2: Characteristics of KMS

IT tools enable faster communication, help to clarify complex relationships, find tacit knowledge as well as create and organize the course of activities. This nature of IT creates a platform for the automation of certain knowledge-based activities that are intended to relieve people and enable the efficient conduct of the knowledge process. KM digital tools allow for performing all management operations: capture, storage, and distribution. The diverse types of IT tools include knowledge maps, knowledge repositories, intranet, chats, push technology, full-text indexing tools, document management, profiling, expert directories, Web 2.0 tools (Zouari and Dakhli 2018).

Tacit knowledge is inherently unstructured, its acquisition is usually supported by ICT that provide communication and data entry capabilities. Some of these technologies (e.g., e-mail, videoconferencing, teamwork systems) are used to manage tacit knowledge. On the other hand, knowledge acquisition, decision support or expert systems are used to transform tacit knowledge into explicit knowledge (Nemati *et al*, 2002). This transformation requires systems that include both unstructured and structured information processing tools. The problem was solved using decision support techniques and artificial intelligence (Mitri 2003). Kucharska, Erickson emphasize in their research that the creation and sharing of tacit knowledge is important in the context of emerging innovations. It is important to create the right working conditions for knowledge sharing where knowledge awareness and employee interaction effectively contribute to increasing innovation (Kucharska and Erickson 2023).

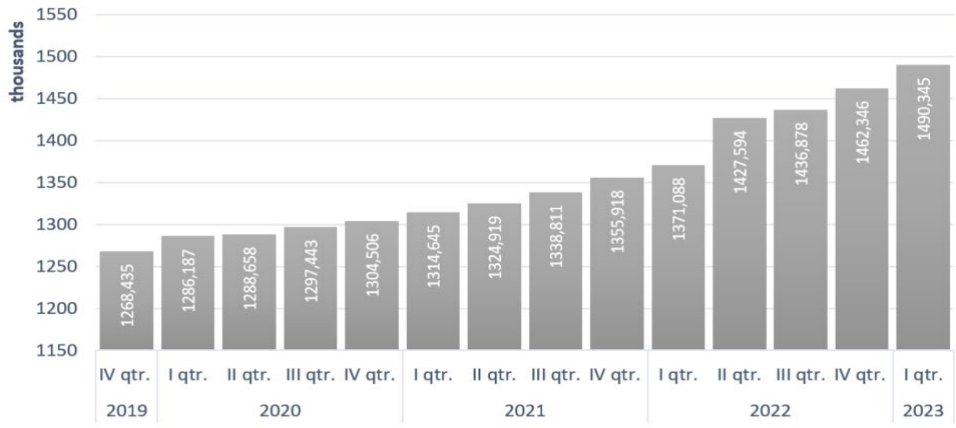
2.3 Knowledge Transfer in the Value Network

The value network (VN) is defined in the literature as a set of entities (actors), customers, suppliers, intermediaries, cooperating and integrating their own resources and knowledge to co-create value as integrated solutions. This network no longer refers only to the creation of value within the company's borders, but to a broader and more extensive link between market entities (Pinho *et al*, 2014). In this approach, knowledge constitutes the basic source of value (Bagheri *et al*, 2016). The dynamic cooperation of VN entities is based on the transfer of knowledge and ICT. This provides the possibility of quick response and flexible approach to customer needs. Knowledge is the source of value creation and competitiveness (Schoneveld and Weng 2023), while ICT provides appropriate technological solutions for knowledge transfer and ensuring the functioning of networks (Bagheri *et al.* 2014). Knowledge transfer in VN is complex and often disrupted, therefore the implementation of these processes is based on the use of the latest generation of KMS systems. They are called network knowledge management systems (VN-KMS). They consist of internal and inter-organizational computer systems that are often heterogeneous and distributed, but also interoperable (Bagheri, Kusters and Trienekens 2016). The necessary condition for effective cooperation between entities in VN is the transfer of knowledge, which refers to the process of continuous interactions between actors. This resulted in the change in the knowledge transfer objective from improving product innovation and operational efficiency to integrated solutions in enhancing the customer experience (Vargo and Lusch 2017).

3. Research results

3.1 Disability – Identification of the Target Group

First of all, it is necessary to identify the research area, which consists of dispersed units, i.e., people with disabilities living in Poland. When considering the complexity of data collection, three main tools for data collection must be distinguished: censuses, surveys, and administrative data and records. According to the results of the National Population and Housing Census 2011, the total number of the disabled at the end of March 2011 amounted to almost 4.7 million (exactly 4,697.0 thousand). Thus, the number of people with disabilities in Poland constitutes 12.2% of the country's population, compared to 14.3% in 2002 (almost 5.5 million people with disabilities in 2002). The percentage of men among the disabled is 46.1% compared to 53.9% among women. Biologically disabled people are those who experience limitations in their age-appropriate (basic) daily living activities. There are three degrees of limitation in the ability to perform basic activities: complete, severe, or moderate limitation. Compared to the results of the 2002 census, the total number of people with disabilities decreased by 759.7 thousand people, which corresponds to 13.9%, and the number of people with legal disabilities decreased by 1,316.6 thousand to 29.6%. On the other hand, the number of people with only biological disabilities increased by 559 thousand, i.e., by 55.5%. The National Population and Housing Census 2011 was conducted using a different method than before, compared to 2002, where an administrative database was used. Moreover, data on disability were collected as part of a representative census, which means that not all Poles were asked about their disability. Representative census data were generalized to the entire population (BPRdsON 2023).



Source: Own study

Figure. 3: Number of Disabled People in Poland with Locomotor Impairment

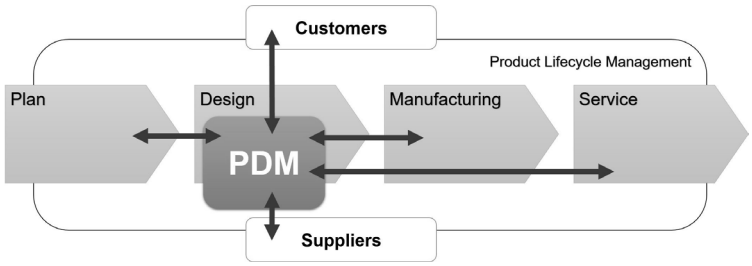
The published quarterly data (Fig. 3) from the period 2019-2023 clearly indicate an increase in the number of the disabled with locomotor impairment. They represent on average about 29% of all the disabled.

According to the results of the European Health Interview Survey (EHIS)(EHIS 2023), in 2014, in Poland, there were 7.7 million (exactly 7,689.8 thousand) people with biological disabilities, i.e., those who showed limited ability to perform activities that they do on a daily basis (in accordance with the unified EU definition used in the study, both severe and less severe restrictions were taken into account, resulting in the inability to perform the above activities for at least the last 6 months). Among them there are 2464.8 thousand with severe disability and 5,225 thousand with less severe limitations. It should be noted that depending on the adopted criterion of biological disability (more precisely, the degree of limitation), the population of the disabled in Poland may vary from 4.9 million to 7.7 million (Ministry Council of Poland 2020). According to the data of the Central Statistical Office, in 2021 the number of the disabled in Poland amounted to 5,447.5 thousand in total, in 2022 it was 4,758.5 thousand and in the first quarter of 2023 already 4,852.8 thousand.

3.2 Development of Assumptions and Concepts for the Knowledge Acquisition and Management Model

The effective implementation of the product development strategy requires effective information management in the production process. It depends on providing the right information to the right person at the right place and time. An important role in the proper synchronization of information flow is played by database management systems (DBMS) (Simon 2014) and product data management systems (PDM) (Klonowski 2004). PDM is used to integrate data recorded and generated by computer systems (Fig. 4).

Without the appropriate level of integration, these data will appear in different formats and various applications. This results in data redundancy, duplication of work and communication problems between systems. That is why PDM systems have evolved where data on the structure of products, design documentation and their manufacturing processes are collected and possibly further processed in the environment of data exchange systems in an electronic form. PDM systems are used in the basic approach to storing product data updates, but the extended approach also covers the issue of managing the ongoing design process, which means that the integration of computerized systems can be seen as a development trend.



Source: Duda and Stadnicki, 2011

Figure 4: Integration Role of PDM Systems in Product Development Management

Data management in the product development process is a significant factor influencing the competitiveness of companies. PDM enables quick exchange of data on documentation related to product design, considering the participation of the client as well as engineers responsible for production or project development. The flexibility of systems and subsystems is the key to improving manufacturing and design. By using PDM, companies can ensure that projects are available to those who need them (Huhtala *et al.* 2014).

3.3 Conceptual Model of Product Development

The NPDP process involves several key stages, including customer needs identification, product concept development, design creation, product testing and launch. At each of these stages, many functional areas of the organization are involved - including research and development, marketing and production where effective communication and cooperation are essential, which are the basis for successful product development. It is also important to recognize the needs of the client and their participation in the process. Successful product design is primarily based on understanding customer needs and then developing products that meet those needs. The importance of the customer's opinion and their impact on the structure of the final product is very important from the point of view of the final success. In addition to knowing the customer's requirements, the information collected must be translated into specifications and integrated with the product concept.

The structure of the process and its stages assume a certain algorithmization of decisions, considering the participation of the client and the condition of profitability of the product implementation. In addition, the model assumes the use of PDM and KMS systems that support the flow of information in the ICT structure.

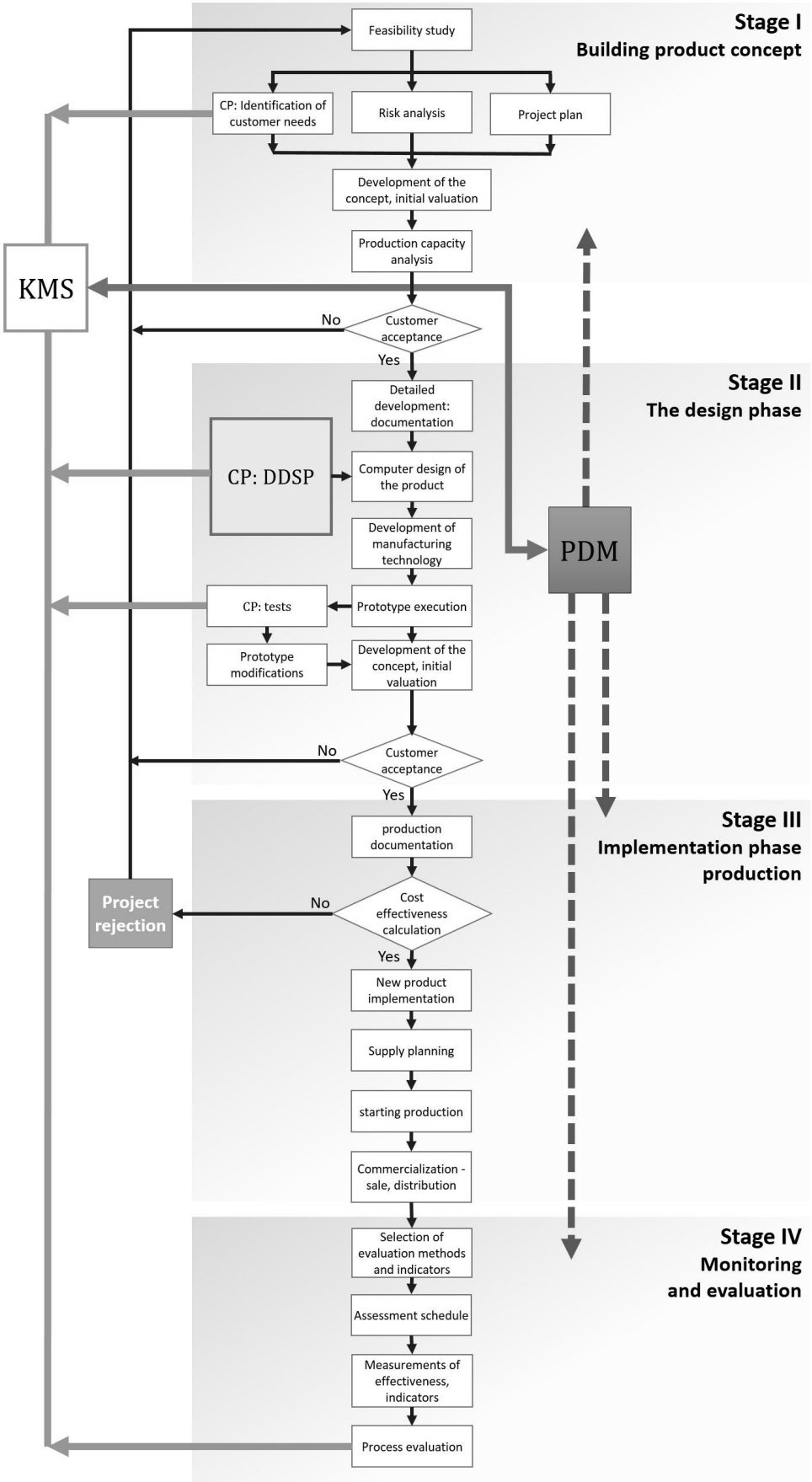
The NPDP concept developed based on the literature analysis assumes four stages of product development (Fig. 5).

- Stage I - Building the product concept.

The initial stage of development in which activities focus on acquiring as much information as possible in the field of: customer needs, risk analysis, planning and concept development, up to the analysis of production capacity. This stage is completed when the client accepts the proposed product concepts.

- Stage II - Design stage.

This is the stage in which the launch of a digital platform supporting design is assumed. Its task is to actively involve the end user in the product design process. The next steps concern the creation of design documentation and the development of production technology for the prototype. The participation of the client as a tester for the proposed design solution is included, but it is not required. The stage ends with the valuation and final acceptance of the client.



Source: Own study based on Kazimierska & Grębosz-Krawczyk, 2017; Olkowicz, 2006

Figure 5: Conceptual Product Development Model

- Stage III - Implementation stage, production.

The activities of this stage assume the launch of production after accepting the previous design assumptions. This involves the preparation of design documentation, supply planning, but above all, the calculation of the product profitability. Sale and distribution are the final stage, which also opens the last stage of NPDP.

- Stage IV - Monitoring and evaluation.

Evaluation is an essential element of any complex process where performance assessments must be made. In most cases, ratio analyzes based on production data and customer opinion surveys are performed. This allows for verifying disruptions and errors that occurred during the entire process.

Increasing the customer's participation in the product design process significantly increases the chances of its future implementation and commercialization. For this purpose, it was proposed to introduce an additional tool, which is digital design support platform (DDSP). Its task is to enable people with disabilities to actively participate in product design, also for individual needs. The functionality of the platform is intended to allow the user to select components proposed and designed earlier with the participation of customers. As a rule, they are to meet the requirements of the end user, ensuring a high level of satisfaction. The essence of the development of the DDSP concept is the possibility of using tacit knowledge hidden in the minds of people with physical disabilities and dispersed over a large area. The research verifying the relationship between the market situation and the development of a new product and the level of innovativeness of the company in the field of technology. It creates a wide range of technological and commercial barriers (Bond and Houston 2003)(Ju *et al*, 2013).

When measuring the effectiveness of projects and new product development processes, an important role is played by technical and technological aspects, examined against the background of the prevailing market situation in the industry. The research indicates that the advantages, such as technological synergy and knowledge of the current state of the market, are of decisive importance when introducing and developing a new product in enterprises (Pattikawa *et al.* 2005). The company's motivation to develop technological and knowledge resources also affects the cost and time of the implementation of the project of launching a new product to the market (Sisodiya and Johnson 2014). The aspects of communication and interaction are important when launching new product development projects (Felekoglu *et al.* 2013). Researchers focus mainly on issues related to: communication of employees during the selection of ideas for new products (Lechler and Thomas 2015), creation of specialized project teams, possession of appropriate project manager skills, quality of the process of management of the new product development project (Sheng *et al.* 2013). The latest research points to a problem resulting from a lack of trust, understanding and different perception of the requirements for new products (Liebert and Trzeciak 2016).

4. Conclusions

The objective of the conducted research was to develop the conceptual model of product development for the disabled, which assumes the functioning of the value network based on information technologies (IT). The article is an introduction to the discussion on the acquisition of tacit knowledge for personalization and adaptation of products to the needs of a given social group. People are the most important link in the acquisition of tacit knowledge. Supporting these processes using IT and generally progressing social digitization, prompt discussions on the creation of new channels for the flow of knowledge. The proposed conceptual model aims to show the structure of the new product development process, assuming the use of tacit knowledge of the disabled. The use of direct participation of future customers in the design and testing stage, creates much greater opportunities for better product development as well as increases the chances of its commercial success. DDSP also creates an opportunity to collect knowledge gained in a given NPDP and use it to build a value network. The results of the research will be used as a tool in the methodology of further research conducted as part of project activities with the economic environment in Poland. The next stage of research work will focus on the creation of a database in which the knowledge of the disabled will be collected for the purposes of creating the DDSP.

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Knowledge and Skills Development for Implementing the Industry 5.0 Concept

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Abstract. The dehumanisation of the industry due to focusing only on the implementation of Industry 4.0 technologies has resulted in numerous concerns among workers, governments and societies regarding new working conditions and the role of humans in industry and the economy. Hence, the European Commission proposed the new concept of Industry 5.0. Industry 5.0 complements and extends the characteristic features of Industry 4.0. It highlights aspects that will be decisive factors in industry placement in future European society. Numerous scientific studies indicate the need to take into account, in the assumptions of the future industry's development, the crucial role of human beings. The humanisation of the technological Industry 4.0 environment was one of the first factors in the evolution of Industry 4.0 towards the Industry 5.0 concept. The new approach in the fourth industrial revolution focuses on the interaction between humans and intelligent machines. The fifth industrial revolution will continue the push for more advanced human-machine interfaces using artificial intelligence (AI) algorithms. It will mean better integration, enabling faster, better automation combined with the power of human brains, but it will also mean changing the demands placed on managers and engineers. Hence, the article aims to identify the critical knowledge and skills of engineers responsible for implementing the Industry 5.0 concept. The presented achievements and results in the article are from surveys conducted among experts representing companies with experience in implementing Industry 4.0 technologies and with a high level of knowledge and engineering and managerial competencies. The research results presented in the paper are dedicated to researchers and practitioners implementing the Industry 5.0 concept in smart organisations (smart factories).

Keywords: Industry 5.0, Human-centric, Humanisation of industry 4.0. knowledge and skills, Managerial skills, Personal management

1. Introduction

The Widespread digitalisation of the economy, which is the result of the fourth industrial revolution and the Industry 4.0 concept implementation, implies the need to analyse the effects concerning the changes in the economy and society. The changes affect all areas of human life to an unprecedented extent. The emerging smart factories, smart cities, and smart homes use cyber-physical systems (CPSs) and open social engineering systems. CPSs use increasingly sophisticated artificial intelligence algorithms that operate on large data sets collected and processed in real-time, affecting physical processes across the entire network of relationships with limited participation of humans (Demir and Cicibas 2017).

The fourth industrial revolution, characterised by the widespread automation and digitisation of industry, weakened the social role of industry as an employer and a generator of commonly understood prosperity. The emergence of smart factories understood as "factories without people" based on digital technologies eliminating man from the production process, has caused significant concerns in the production environment about the role of man in the future industry (Cellary 2019).

Human orientation is a new trend in the development of the fourth industrial revolution. So far, focusing on implementing digital technologies has resulted in the dehumanisation of CPS and the marginalisation of humans in the manufacturing process. This has caused significant concerns among workers, governments and societies about new working conditions and the role of humans in future industries. The result of widespread dissatisfaction with the process of dehumanisation is the evolution of views on the implementation of new technologies and consideration of man's key role. (Brousell, Moad and Tate 2014). The new concept of industry called Industry 5.0 draws attention to aspects that will be decisive for the location of industry in the future European society. The environmental and social part significantly develops the strongly developed aspects of digital technologies affecting economic efficiency. According to the new approach, the use of technology must not violate the fundamental rights of workers, respect for the right to work and earn a living, respect for independence and human dignity (Di Nardo and Haoxuan 2021).

The concept of Industry 5.0 focuses on the interaction between people and machines. The new approach emphasises more advanced human-machine interfaces that use employees' knowledge and skills and artificial intelligence (AI) algorithms (Sachsenmeier 2016). The use of digital technologies related to creating cyber-physical systems based on intelligent machines and devices communicating with each other in real-time in terms of the Industry 5.0 concept requires the use of new knowledge and skills of engineers and management staff. It

means better human integration with the digitised system, enabling faster, better automation of production processes supported by the power of human minds.

Hence the need to research to identify the requirements for future industry employees. Accordingly, the following research questions were posed:

- What are the key areas of required knowledge and competencies of industrial employees for successful implementation of the Industry 5.0 concept?
- What groups of competencies should be developed for the Industry 5.0 implementation?

The article aims to identify the critical knowledge and skills of engineers responsible for implementing the Industry 5.0 concept.

2. Industry 4.0 Idea Towards Industry 5.0 Concept

The Industry 4.0 idea means digital technologies implementation such as Additive Manufacturing, Augmented Reality, Modeling and Simulation, Autonomous Robots, Systems Integration, Industrial Internet of Things, Big Data, Cybersecurity Technologies, and Cloud Computing (Ghobakhloo 2020). The development and implementation of the Industry 4.0 idea have been made possible by widespread digitisation and digital technologies. Digital technologies uch as, Data Mining, Big Data Analytics, and ICT allow machine-to-machine and machine-to-human communication in real-time regardless of the geographic location of resources. The development of ICT networks has made it possible to create a fully integrated system of suppliers, manufacturers and customers operating in open virtual networks. According to this concept, ICT-based solutions integrate all subsystems within a single value chain with a particular customer orientation. Therefore, newly designed ICT systems will integrate entire supply chains, creating Cyber-Physical Systems (CPS) and open social engineering systems. CPS systems should provide for the collection of large amounts of data, its processing and its impact on the physical processes of the entire enterprise network through an unlimited number of network connections at the same time (Jamwal et al. 2021, Xu et al. 2021, Bai et al. 2020).

The Industry 4.0 concept caused a paradigm shift from standard (mass) production to non-standard (personalised) production tailored to personal customer expectations. Changes in the production organisation, employment structure, and the use of new and smart technologies often replacing employed workers allow customers to offer highly personalised products at low prices (Zhou and Jiao 2013, Młody 2018). The goal of the Industry 4.0 concept is to achieve the highest level of integration between customer and producer and to ensure low prices. It requires significantly increased productivity and efficiency by using digital technologies. Significant increases in manufacturing efficiency become possible through the design of smart factories and the use of material, production, and labour resources in cyber-physical systems of collaborative intelligent resources (Wang, Wan and Zhang 2016).

The currently observed dynamic increase in the implementation of Industry 4.0 technologies and the orientation of companies towards the dehumanisation of production systems have resulted in many concerns of employees, society and even governments. In Industry 4.0, the work environment is determined by integrated and advanced production technologies equipped with sensors to track the work of machines and communication systems to report data and perform advanced simulations. The role of existing employees is very rarely mentioned. Numerous scientific studies (Romero et al. 2015, Longo, Padovano and Umbrella 2020) emphasise the need to include the crucial role of the man in the assumptions of industry development. In this regard, from 2 to 9 July 2020, the Industry 5.0 concept was discussed amongst participants from research and technology organisations organised by the Directorate "Prosperity" of DG Research and Innovation EC. In the EC document, one can find the assumptions for the Industry 5.0 concept. The essence of this document is critical directions of change to make the industry more sustainable and human-centred. The EC document (Industry 5.0 2021) identifies six challenge areas for Industry 5.0:

1. Human-Machine Interaction;
2. Biotechnologies and smart materials;
3. Digital twins and simulation;
4. Data (iv) technologies for data transfer, storage and analysis;
5. Artificial Intelligence;
6. Technologies for energy efficiency, renewables and renewable energy.

The Industry 5.0 concept assumes the return of the human factors to the industry, i.e. increasing cooperation between people and intelligent production systems. Combining the best features of the two worlds - speed and

accuracy guaranteed by automation with cognitive skills and critical thinking of people- ensures the success of Industry 5.0 (Yordanova 2021, Doyle-Kent and Kopacek 2019).

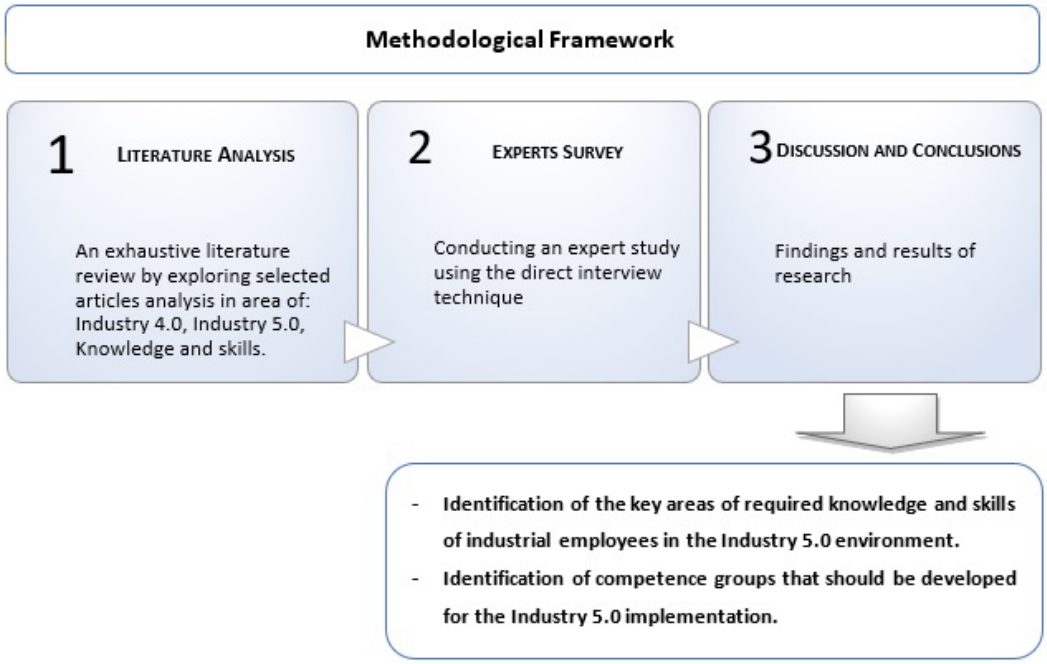
Industry 5.0 goes back to the origins of sustainability, emphasising that a purely profit-driven business is becoming increasingly difficult to sustain in a globalised, highly volatile, and unpredictable environment. Underlying the development of the new concept are social and environmental needs. The industry must include societal and ecological aspects to become a provider of true prosperity. The symbiosis of the three segments: technological, social, and environmental, is the essence of Industry 5.0 (Elfar et al. 2021).

Industry 4.0 puts technology at the centre, while Industry 5.0 focuses on manufacturing workers who perceive progressive automation as threatening lost jobs. Industry 5.0 recognises the power of technology for industrial (business) development but combines the achievement of business goals with social goals in the workplace and beyond (social and environmental responsibility). Cyber-physical systems intertwined with social and ecological frameworks are the basis of the production process. Nowadays, CPSs functioning in smart factories lead to economic growth and put people at the centre of cooperation with intelligent resources and a more robust perception of sustainable development (Sachsenmeier 2016, Demir, Döven and Sezan 2019).

3. Material and Methods

The first stage of the research was a literature analysis. A research gap was identified based on a systematic review of the literature and its critical analysis. Then (in stage 2), using expert survey was conducted among 44 Polish companies. The research was conducted with a group of experts hailing from the automotive and food sectors. They were made up of a diverse range of professionals, including 16 mid-level managers, three CEOs, and 15 engineers who specialized in implementing digital technologies and IT systems. Additionally, 10 experts were brought in from the Research and Development department to contribute their expertise. Together, this team of experts worked diligently to provide valuable insights and data for the results of the research.

Interviews were conducted between 01 May and 31 August 2021 using a questionnaire comprising 15 questions (closed, filtering, complex, conditional and tabular) and a metric. The questionnaire was validated, and a pilot survey was conducted among eight experts knowledgeable about the fourth industrial revolution. The companies were selected purposively, and each company had implemented at least two Industry 4.0 solutions in the last three years. The third stage of the research was the analysis of the results. The methodological framework of research adopted in the paper is shown in Figure 1.

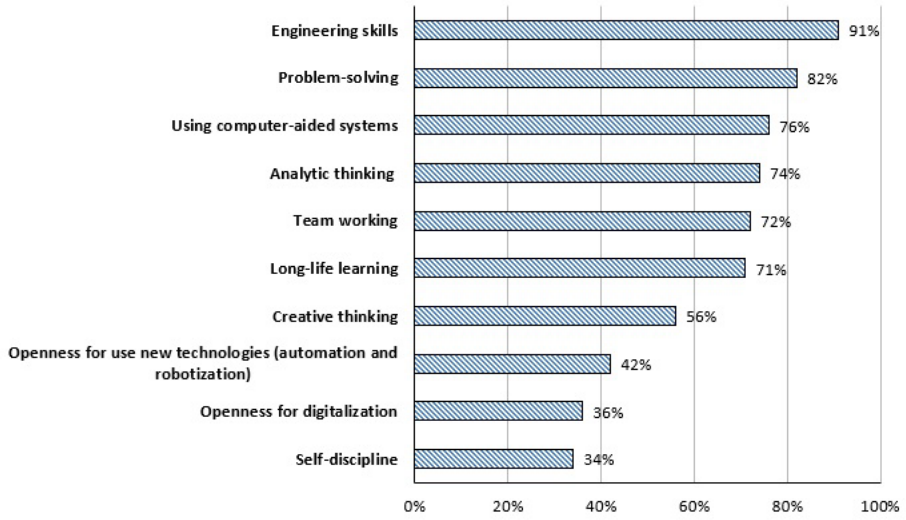


Sources: Own elaboration

Figure 1: Research Methodology Model

4. Results

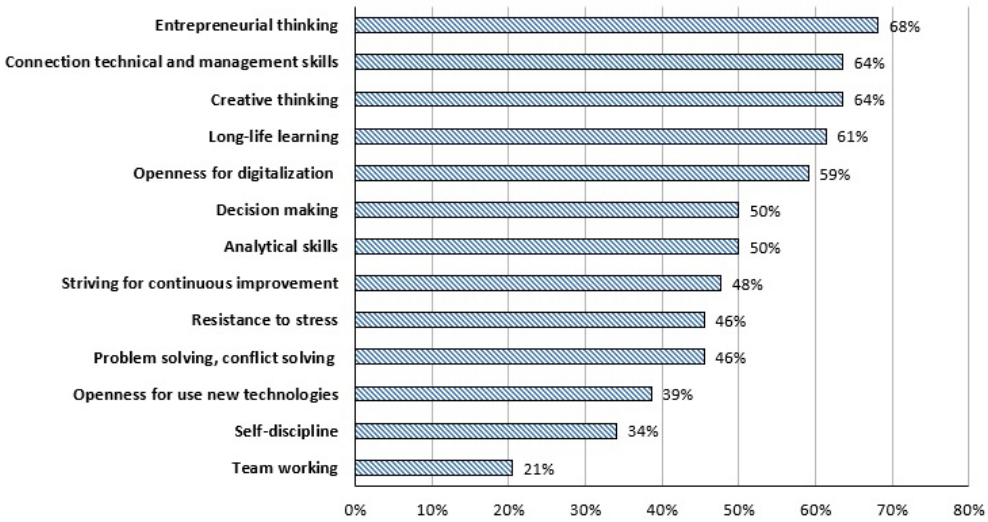
The demand for employees in industrial enterprises that declare willingness to implement the Industry 5.0 concept is closely related to the specific skills that enterprises expect. A significant level of expectations concerns problem-solving skills (82% of experts), skills in using computer-aided systems (76% of respondents), analytic thinking (74% of respondents), team working (72% of respondents). Experts have stated the required engineering skills in 91% of employees working as engineers. For experts representing companies, the motivation for long-life learning (71% of respondents) and creative thinking (56%) are noteworthy. Experts also pay attention to openness to new technologies (automation and robotisation) (42% of respondents). Figure 2 shows a chart with the remaining expectations of the respondents.



Sources: Own elaboration

Figure 2: Required Skills for Industrial Employees (Engineers) in an Industry 5.0 Environment

The experts also pointed to managerial skills as necessary for properly implementing the Industry 5.0 concept. Apart from the required skills for managers, i.e. entrepreneurial thinking, they also indicated the ability to connect technical and management skills (64% of experts). At a similar level, there is creative thinking (64% of experts) and long-life learning (61% of respondents). Experts also indicated the required openness for digitalisation (59% of experts), decision-making ability, and analytical skills (50% of respondents). The rest of the mentioned are standard abilities of every manager, which determines their suitability for managerial functions. Figure 3 presents detailed results of the declared required skills of managers.



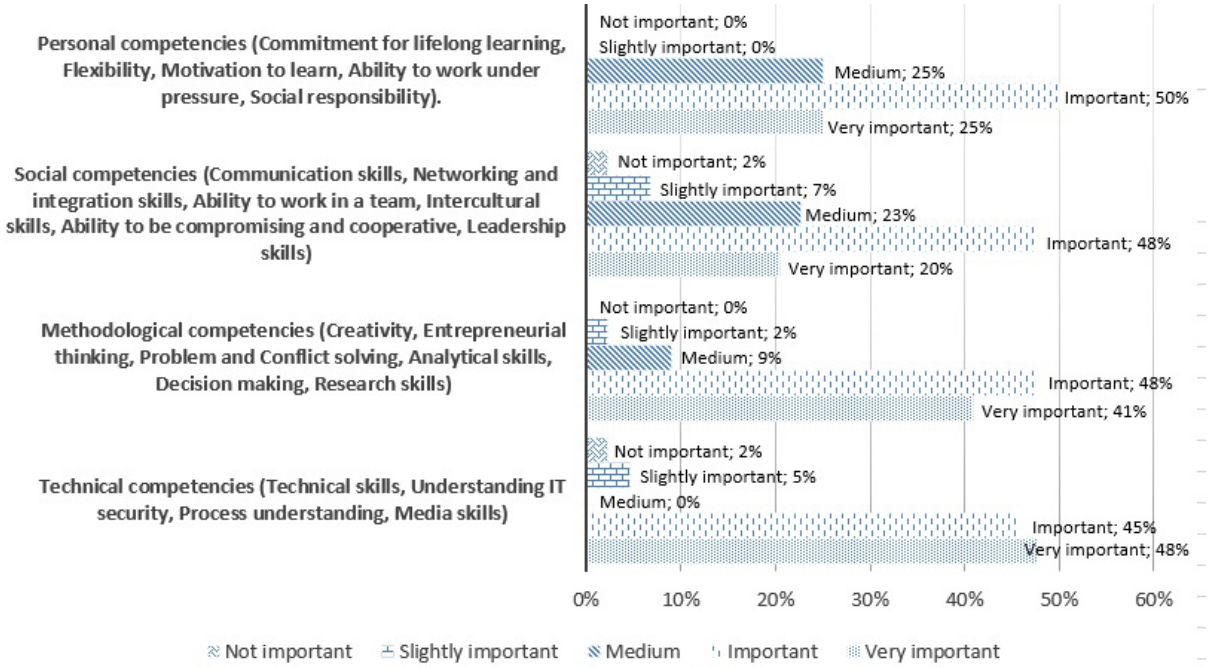
Sources: Own elaboration

Figure 3: Required Skills of Managers in the Industry 5.0 Environment

The experts have indicated on a 5-point Likert scale the importance of four groups of competencies to be developed for the Industry 5.0 implementation:

- Personal competencies (commitment to lifelong learning, flexibility, motivation to learn, ability to work under pressure, social responsibility) - are assessed by experts as important (22), very important and of medium importance (11);
- Social competencies (communication skills, networking and integration skills, ability to work in a team, intercultural skills, ability to be compromising and cooperative, leadership skills) - this group of competencies, according to most experts, is moderately important (10), important (21) and very important (9);
- Methodological competencies (creativity, entrepreneurial thinking, problem and conflict solving, analytical skills, decision making, research skills) - similarly as above, most experts rated this group of competencies as important (21) and very important (18);
- Technical competencies (technical skills, understanding IT security, process understanding, media skills) - were rated by most experts as very important (21) and important (20).

Figure 4 presents the percentage share of declarations for each group of competencies.



Sources: Own elaboration

Figure 4: The Percentage Share of Declarations for each Group of Competencies

5. Discussion

The Industry 5.0 concept is a massive challenge for enterprises not only because of the application of modern technologies (such as the Internet of Things, Big Data Analytics, Cloud Computing, etc.) related to creating Cyber-Physical Systems.

There is a need for a completely new, more modern and innovative approach to production and business management that will dramatically increase flexibility, productivity and customer orientation. Industrial workers and managers are expected to have additional knowledge and practical skills.

According to experts, the skills needed to implement the Industry 5.0 concept are mainly related to the digitisation of the production environment, collection and analysis of large data sets, ensuring data security, and the effective creation of cyber-physical networks of intelligent resources of cooperating enterprises. Experts participating in the survey declared that employees employed in technical positions mainly require engineering skills, problem-solving skills, analytic thinking, teamwork skills and using computer-aided systems, which seem necessary for enterprises' digitalisation.

Experts indicate that an essential feature of a modern employee should be motivation for long-life learning, openness to new technologies, and creative thinking. This attitude of the employee affects the development of competencies during employment. In general, the development of technology and frequent changes force the lifelong learning process on employed workers.

The demand for new skills stems primarily from the growing need for complex information integration and transparency, increased automation of production systems, increased autonomy of operation, self-management and self-decision-making by facilities, digital communication, and a more flexible workforce (Ahrens and Spottl 2015).

Nevertheless, implementing the Industry 5.0 concept is also challenging for management science. It requires research in the following areas: strategy and analysis, planning and implementation, collaboration and networks, business models, human resource management, change and leadership (Schneider, 2018). Employees also need knowledge and skills in decision-making, process management, and combining engineering and managerial expertise (Kazancoglu and Ozkan-Ozen 2018).

An essential aspect of successfully implementing the Industry 5.0 concept is an appropriate set of managerial skills that guarantee successful the Industry 5.0 concept implementation. The experts emphasised the manager's importance of having such qualities as openness for digitalisation, decision-making, and analytical thinking. The most relevant experts included entrepreneurial thinking, connecting technical and management skills, creative thinking, and long-life learning.

Experts in the study emphasised developing technical and methodological competencies, which is unsurprising. However, it is interesting to indicate the high importance of developing personal competencies (very important - 25% of experts and important - 50% of experts). Similarly, experts attach great importance to the social competencies of the future engineer (very important - 20% of experts and important - 48% of experts). According to experts, a modern engineer must be educated in interdisciplinary.

Also interesting are the experts' opinions on the level of competence currently represented by engineers in their preparation for performing their duties at the company. The experts have poorly assessed engineers' social and personal competencies. Technical and methodological competencies were rated better. According to the experts, no group of competencies can reach a very high level. Regarding personal competencies, as many as 20% of experts indicated a deficient level. Each group of competencies declared level can be considered average and need development, which is confirmed by the previous observations.

Based on expert opinion, knowledge, and skills of industry employees who are involved in the implementation of Industry 5.0 requires development in the following areas:

- the workforce needs expertise and a new skills paradigm resulting from digitisation, which should lead to the increased overall productivity of production systems, the efficiency of operations management, and the efficiency of production and support processes;
- there is a need to recruit highly skilled personnel characterised by openness to change, ability to transfer knowledge, and teamwork;
- it is essential to combine learning in the area of information and production technologies in the Industry 5.0 environment with management sciences, especially in the areas of strategy development and case analysis, planning and implementation, collaboration and networking, business models, human resources, change and leadership;
- there is a definite increase in the importance of lifelong learning in the Industry 5.0 environment, which requires: promoting a climate of innovation and education, changing the ways of learning (e.g., remote learning), new approaches to the talent development of the workforce;
- there is a need to combine different groups of technical, methodological, social and personal competencies to educate future engineers.

The research results confirm that employees' knowledge and competencies are becoming important factors of competitiveness for the company. The company's ability to make rapid technological and organizational changes and implement operation methods related to achieving high profitability and customer satisfaction, as well as financial benefits for shareholders or shareholders, is of great importance. In the competitive race, it is primarily intelligent companies that are ahead, capable of innovative and quick adaptations, digital technologies of the fourth industrial revolution. The direction of development of enterprises is based on the so-called resource-based view, well-known from strategic management, whose main task is the thesis that only the knowledge

contained in the so-called vital skills or competencies can provide a sustainable competitive advantage and, thus - long-term development of the company.

6. Conclusion

The approach to implementing the technologies of the fourth industrial revolution is changing. Although the Industry 4.0 concept was introduced more than a decade ago, in 2011, it has already evolved, and research is currently being conducted on its new iteration called Industry 5.0. Industry 5.0 is a concept that pays more attention to the role of the human being in the production system and critical phenomena for current trends in the economy, such as sustainability and resilience to disruptions in production processes caused by various crises, such as COVID-19 or the war in Ukraine. The Industry 5.0 concept is not a new revolution but only an evolution of the trends exhibited in the Industry 4.0 concept. Today's challenge for companies is to apply technological innovations that take into account the social and environmental priorities indicated by the European Union. Special attention is being paid to the comprehensiveness of technology implementation and combining individual technologies into areas to affect all three critical pillars of the Industry 5.0 concept, i.e. human-centric, sustainability and resilience. Among the highest priority areas of the industry 5.0 technologies to be developed and implemented are human-centric solutions, technologies for energy efficiency, digital twin and simulation, cyber security and data analytics, and artificial intelligence.

Implementing and maintaining new technologies related to Industry 5.0 requires interdisciplinary knowledge and a combination of technical, organisational and social competencies and skills. The results of the study confirmed that in an Industry 5.0 environment, there is a need for employees with interdisciplinary knowledge and technical and management skills.

From the considerations carried out, combining technical, methodological, social and personal skills and competencies is necessary, especially in applying human-centred solutions. Recruiting highly qualified employees with openness to change and the ability to transfer knowledge and work in a team is required.

This exciting observation has particularly relevant to adjusting the vocational training system and educating students. It means changes in the way education is provided, which should be directed toward the development of such professions as a production engineering manager, data analyst, cyber security specialist, logistician, project manager and ICT specialist, among others. Engineers' knowledge should be supplemented with environmental protection aspects, environmental pollution problems and energy consumption. This awareness is essential for understanding the need for intelligent solutions to increase productivity and reduce waste. In the Industry 5.0 concept, developing soft skills necessary for collaboration, communication, and interpersonal relationship-building skills is also essential.

Currently, the education system, especially in vocational education and universities, needs to prepare for changes in training future industrial workers who will operate in a cyber-physical world and the widespread use of technologies identified with the fourth industrial revolution. The direction of further research should be an in-depth analysis of the impact of the development of interdisciplinary competencies of engineers and the implementation of digital technology solutions on sustainability, industrial humanisation and resilience.

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Effectiveness of the Lessons Learned Process in the European Space Agency (ESA) Directorate of Operations (OPS)

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Abstract: The European Space Agency (ESA) Directorate of Operations (D/OPS) has the need to continuously challenge for improvement the working practices, the deployed resources, the delivered products and services. Since 2007 D/OPS has put in place the process of Lessons Learned to address proposed changes coming from the performed experience. The positive outcome of this process over the years is visible in the implemented organisational improvements and in the general learning-based culture accumulated. As part of EN9100-based QMS, it is essential to have evidence that the process is effective, i.e. whether it is carried out according to expectations of the process owner. The paper will present the introduction of Key Effectiveness Indicators (KEI) on the Lessons Learned process, their measurement and the analysis of the collected data for identification of possible improvement actions. Some pre-conditions for definition and implementation of KEIs (for any process) need to be satisfied. Then it is possible to identify few strategic points in the process where expectation on the discipline of the organisation can be translated in a quantitative target. A typical measurement of effectiveness is the duration in performing a specific step of the Lessons Learned process (i.e. in terms of timeliness). The paper will present: The identified KEIs for the Lessons Learned process The identified homogeneous environments where the instances of the process are running The (current) targets set by the process owner The time scope of effectiveness measurement. The analysis of collected data has demonstrated weaknesses in the process to be corrected but also highlighted the current strengths. This initiative confirmed that the continual improvement of the organisation relies also on the effectiveness of the Lessons Learned process itself, and not only on the contents to be learned (i.e. the performance indicators on the organisation itself).

Keywords: Lessons learned, Improvement, Process, Effectiveness, Indicators

1. Background

In the European Space Agency (ESA) the Directorate of Operations (OPS) has the need to continuously challenge the working practices for their possible improvement, the deployed resources for their efficient use, the delivered products and services for their performance and delivery. Since 2007 the OPS Directorate has put in place the process of lessons learned to address proposed changes coming from the performed experience. The positive outcome of this process over the years is visible in the implemented organisational improvements and in the general learning-based culture accumulated in the entire OPS workforce.

For sake of clarity the meaning of a lesson learned in OPS is a recommendation for a change, justified by an unexpected experience, either negative or positive.

2. Current Need

The OPS Directorate has realised that it is not sufficient to have a formal process to identify and manage improvement, as described in the OPS Quality Management System. For the OPS managers it is also necessary to have clear evidence that the process itself is under control.

This need is in parallel solicited by a specific ISO9001 / EN9100 requirement (committed by OPS), specifically point c) in the clause 4.4.1.

> *4.4.1: Quality management system and its processes*
>
> *The organization shall establish, implement, maintain, and continually improve a quality management system, including the processes needed and their interactions, in accordance with the requirements of this International Standard.*
>
> *The organization shall determine the processes needed for the quality management system and their application throughout the organization, and shall:*
>
> *c) determine and apply the criteria and methods (including monitoring, measurements and related performance indicators) needed to ensure the effective operation and control of these processes.*

For OPS the lessons learned process, as any other process in the OPS QMS, needs to be associated with indicators measuring its effectiveness. Investing in a proper process management will contribute to cope with the continuous struggling between limited resources available to improve the organisation and the increasing number of activities to manage and perform.

3. Process

For OPS a process is a documented description of a series of actions jointly taken by various players to achieve a predefined result. The process moves from a clear starting point to reach a defined ending condition, with all necessary intermediate steps and milestones.

The process owner of the lessons learned in OPS is the Product Assurance and Safety Office. The responsibility of the process owner is to maintain and adapt the process description and resources according to any needed evolution. Changes to the process may come from recommendations from the internal players, from requests from interacting entities (e.g. other ESA directorates) or from new requirements in the applicable international standards.

The context of the OPS process of lessons learned is represented by a turtle chart, reporting:

- need of the organisation,
- input to the process,
- resources used by the process,
- players of the process,
- rules followed by the process,
- process indicators,
- the expected output.

The structure of the lesson learned activities in OPS is organised in 3 levels, each one representing a dedicated sub-process:

- Improvement at organisational level
- Improvement at team level
- Individual lesson learned life-cycle.

Each sub-process is described with a flow-chart involving the necessary players. Each sub-process adapts the basic concept of Plan-Do-Check-Act.

4. Key Effectiveness Indicators

The process owner wants to determine the quality of the implemented lesson learned process via specific process indicators. The adopted definition of Key Effectiveness Indicators (KEI) is: *a quantifiable measurement of the actual progressing execution of a process with respect to the expectations of the organisation (i.e. the process owner).*

The owner of the lessons learned process has then to identify strategic points in the steps of the process where a quantitative parameter provides evidence of the ongoing correct execution. As an example, the target time to execute a specific step of the process may significantly drive the overall effectiveness of the process.

The necessary condition to allow for the identification of KEI of the lessons learned process is the presence of accessible data. When the process is supported with records documenting its progress, then the KEI can automatically exploit them with suitable queries and formulas.

On the other hand the lack of recorded data on the execution of the lessons learned process prevents the identification of KEI to be immediately calculated. Hence it is not recommended to invest in manual collection of process data, as the organisation needs immediate visibility of the execution of the process and the possibility to quickly react to unfavourable trends. When convenient, it is recommended instead to invest in a careful expansion of the process data to enable the collection of strategic KEI (e.g. adding new fields in a database of lessons learned).

The main category of KEY is about completion of intermediate individual steps of the process. The sub-process “Individual lessons learned life-cycle” has 3 KEI identified for this first category. The peculiarity of these 3 KEI is that each one is referring to a separate instance of process implementation:

- "Time to assess", it is relevant to any new lesson;
- "Time to evaluate", it is relevant to validated lessons escalated at higher level;
- "Time to implement", it is relevant to lessons enforced by the OPS Review Board.

A second category of KEI is about open-end indicators: these indicators are measuring a step of the process which is not yet completed (e.g. current delay for records left not yet assessed). They are meant for real time monitoring purpose, specifically to identify forgotten records.

A third category of KEI is about embedded/overlapping indicators: these indicators are covering tasks embedded in each other (e.g. the overall completion of the record life-cycle is aggregating the measurements of the intermediate steps). Here the measurements of these indicators imply dependency between each other: bad performance in one point of the process can be easily propagated in other affected indicators. Such dependency will add complexity in the subsequent analysis of the collected measures. It is also evident that KEI measuring the end of the process (e.g. overall life-time of a single lesson learned) do not allow for possible immediate reaction, as the relevant activities are over.

The following table lists all KEI relevant to the sub-process of "Individual lesson learned life-cycle". The KEI category is specified in the associated index. KEI with thresholds are highlighted in bold.

KEI\Instances	**Lessons for Team**	**Lessons for OPS**			**Lessons for ESA**
		Proposed LL	Validated LL	Enforced LL	
Delay to assign (2)		x			x
Time to assign (1)		x			x
Delay to assess (2)	x	x			x
Time to assess (1)	x	x			x
Delay to evaluate (2)			x		
Time to evaluate (1)			x		
Delay to implement (2)				x	
Time to implement (1)				x	
Time to close/reject (3)	x	x	x	x	x

Another category of KEI is the frequency of a repeated step in a re-iterated process: these indicators are responding the need of the organisation to have tasks performed with a regular pace. For the OPS lessons learned process at organisation level these are:

- Frequency of meetings with Domain Responsibles,
- Frequency of Review meetings with LL Review Board.

Here the measurements of these indicators can be of three types: historical accumulation of measures, or interval with respect to the last step performed, or delay for new upcoming step. The first measure does not highlight the recent behaviour of the team: it considers only completed steps. The second measure does not address the behaviour of the team in the previous years. The third measure is an open-end indicator (i.e. delay in having the next meeting).

The following table lists all KEI relevant to the sub-process of "Improvement at organisational level". The KEI category is specified in the associated index. KEI with thresholds are highlighted in bold.

KEI\Instances	**LL Review Board**	**Domain Responsibles**
Cumulated frequency (1/3)	x	x
Last meeting interval (1)	x	x
Delay to next meeting (2)	x	x

Note that the OPS QMS procedure for lesson learned does not prescribe how to process internal lessons within each team: no KEI for their processing steps. However, it is expected that generated lessons are not forgotten and that they always complete their (autonomous) life-cycle.

Similarly, no KEI can be defined for process activities performed outside OPS, such as the processing of lessons escalated at ESA level. The received feedback however allows to measure how long ESA takes to assess the escalated lessons from OPS.

It is highlighted also that in OPS the escalation mechanism, when positively assessing a proposed lesson, is splitting the logical life-cycle of the lesson learned in two separate records: the original record that will be closed/rejected at the completion of the assessment step, and a new cloned escalated record. This is why the overall KEI "Time to close/reject" has two different data sets for the lessons to be learned by OPS (i.e. the original and the escalated ones) and as well for the lessons to be learned by ESA (i.e. the original and the escalated ones).

Now, once the KEI are identified, the next step is to associate acceptability thresholds to the collected values for the indicators important to analyse and report. The thresholds reflect the expectation by the process owner in the proper execution of the process. In OPS the classical traffic light approach is adopted:

- GREEN, acceptable KEI measures within a specific threshold;
- RED, unacceptable KEI measures beyond a different specific threshold;
- YELLOW, intermediate KEI measures between the GREEN and the RED ranges.

The setting of these thresholds usually is based on the experience on how the process has been executed in the past. It may also be tailored or re-visited according to the applicable organisation strategic objectives. In OPS for example the implementation on an enforced lesson is expected to be completed within 3 months (GREEN range), and not beyond 6 months (RED range).

5. Other Indicators

Beside the quality of the process it is always possible to measure the quality of the product as result of the process execution. In the specific case of the lessons learned process the "product" is the improvement. In OPS two Key Performance Indicators (KPI) are currently identified:

- Improvement identification rate, i.e. the capability to identify improvement by a specific team. The target is 1 lesson generated per year per 10 team members. The objectives is also to visualise which teams in OPS are not willing to identify possible improvements.
- Process improvement rate, i.e. the implemented changes in the way of working in specific OPS domains. The target is to have 1 improvement implemented per year per OPS core process. The objective is also to visualise which OPS core process is not impacted by the improvements from the lessons learned process.

Finally, also indicators on the quality of the process data can be identified: Key Records Indicators (KRI). They are meant to measure aspects such as the completeness of recorded information and the quality of the contents of the records.

6. Measurement and Reporting

The needed presence of process data implies the deployment of a tool able to store records. The records are to be organised per separate instances of the process implementation. For example, every team in OPS shall have available a dedicated repository for lessons learned. In parallel also at organisation level a central repository allows the OPS management to process the escalated lessons and assign the appropriate actions. A separate repository is needed for the escalated lessons to the outside world. The tool supporting the lessons learned process shall be able to interact with the outside world:

- importing capabilities shall allow to manage lessons received from outside (in a preferable format) meant for OPS to learn
- exporting capabilities shall allow OPS to submit proposed lessons (in a selected format) to collaborating entities.

Beside the repository for lessons learned supporting all needed instances of the organisation, suitable technology shall be developed/procured to perform the KEI/KPI/KRI measurement from the process data. In OPS three levels of data processing have been implemented:

- KEI measured at organisation level (queries on all lessons from the various repositories of each active team)
- KEI measured within the records belonging to a team (queries on lessons generated by a team)
- Select KEI measured within the individual record itself (direct calculation within the single record of lesson learned).

The measurement of process indicators implies a minimum of statistical processing, with sophistication adequate to the available data. Note that the data population is limited for the lesson learned process in OPS: all records within any selected scope shall be addressed, not just a random sample of them. In OPS it is selected to calculate:

- the average derived from individual values in the queried records
- the associated standard deviation.

The average represents the KEI indicator with respect to the selected scope of instances of the process. The resulting average is to be compared with the given acceptability thresholds.

The standard deviation indicates the distribution of the individual values of the record population, with the possibility to identify significant deviations in the execution of the process.

The scope of the measurement can be a fixed calendar period (e.g. from Jan. 1st to Dec. 31st) or a relative calendar period (e.g. last 12 months from today). The reporting can be regular (e.g. once per year at the Management Review Meeting) or/and an on-line dashboard providing real-time measures.

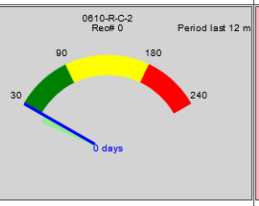
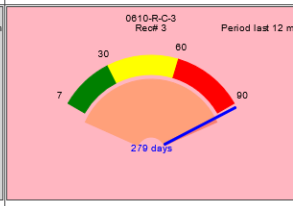
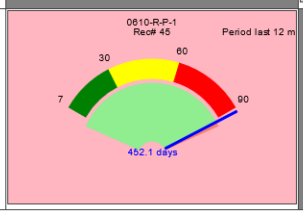
It is essential that the measurement of process indicators is properly validated: queries shall be able to handle any status of the records, in particular in case of empty fields. Independent data collection can be used as well to validate the results of the automatic calculation: e.g. using direct queries on the process data or a separate tool.

In OPS the results of KEI measures are displayed with a gauge to be configured with the following settings:

- KEI Identifier
- Instance identifier
- Relevant units
- Time scope of the measurement
- Min. and max. values of the scale in the gauge
- Clockwise or counterclockwise direction of the values from good to bad
- Boundary value from GREEN range to YELLOW range
- Boundary value from YELLOW range to RED range
- Average calculated indicator of the sample, with value classified in the available ranges
- Symmetric standard deviation range at each side of the average value, to indicate the statistical distribution of the record population.

As an example, the three KEI of the “Individual lesson learned life-cycle” have the following recorded measurement.

KEY EFFECTIVENESS INDICATORS - LESSON PROCESSING

Area- KEI	0610-R-1 Time to assess a proposed lesson	0610-R-2 Time to evaluate a validated lesson	0610-R-3 Time to implement an enforced lesson
OPS central			
OPS proposed lessons			

Example of dashboard of measured KEI for lessons learned in OPS.

Example of measurement at individual lesson learned record. In this case the assignment to an expert was done in 2 weeks (no threshold applied for this indicator), the assessment by the expert took more than 1 month (i.e. beyond the expected good practice), and the overall processing of the record was about 2 months (again no threshold applied for this indicator).

Effectiveness Indicators	
Time to assign	15.2 days
Delay to assign	Undefined
Time to assess	48.0 days
Delay to assess	Undefined
Time to evaluate	Undefined
Delay to evaluate	Undefined
Time to implement	Undefined
Delay to implement	Undefined
Time to complete/reject	63.2 days

Example of measurement at individual lesson learned record, escalated in the central OPS repository. In this case the Review Board took more than 2 months to evaluate the escalated lesson (still within the expected good practice), however the assigned implementation action took several months to complete (i.e. beyond the acceptable threshold), leading to an overall life-cycle of more than 1 year (no threshold applied for this indicator).

Effectiveness Indicators	
Time to assign	Undefined
Delay to assign	Undefined
Time to assess	Undefined
Delay to assess	Undefined
Time to evaluate	71.1 days
Delay to evaluate	Undefined
Time to implement	306.9 days
Delay to implement	Undefined
Time to complete/reject	378.1 days

7. Analysis of Data

The OPS process of lessons learned is always evolving. The analysis of the collected measures shall consider various evolving aspects: players may change (e.g. replacement of domain expert), new teams can appear (e.g. new mission/project) and disappear (e.g. end of mission/project), etc. So the meaning of the data can change according to the selected scope of the measurement. Each measurement will reflect a specific historical baseline in time of the process. Fluctuations in measured data are normally expected over the different years for the specific process of lessons learned.

The analysis of data focuses on the main indicators of the process and the collected average values.

If the resulting averaged measures of process indicators are GREEN, this means that in this moment all the expectations by the process owner are met and the process is well under control. In particular,

- for KEI the lessons learned process is correctly and timely executed by all involved players.
- for KPI the teams demonstrate willingness to improve and the various practices are becoming more efficient.
- for KRI the process data are containing all the necessary valuable information.

At this point the process owner, together with the OPS management, may assess whether the assigned thresholds should become more stringent. This positive conclusion confirms the expectation by the process owner.

Instead, when the resulting average measure of a main process indicator is RED, there is a non-conformance to the OPS lesson learned process. An analysis of the RED measurement shall be done to understand what the problem is and where it is located. Each gauge chart will be associated with the chart of the values selected for the sample: the graphical distribution of individual values will help in identifying those mostly contributing to the unwanted deviation from the acceptable threshold. This supporting chart will also indicate the contributions to the calculated standard deviation (e.g. presence of spikes). For the considered main KEIs some individual values are linked to individual responsibilities of staff (e.g. lesson assessment, action implementation), whereas others are due to the organisation of the process (e.g. meeting frequency).

As a RED result represents a deviation from the expectation, the identification of the causing individual values will determine if immediate corrections are needed and by whom.

In a second step the analysis will then attempt to identify the root cause(s) of such deviation:

- the direct root cause, i.e. who introduced this deviation in the process (and when);
- the indirect root cause, i.e. who did not notice the presence of this deviation in the process (and starting from when).

Complex situations may lead to the identification of several independent root causes and relevant contributing factors.

An example of analysis is the result of the minor KEI “Time to assign”. During the year 2022 the staff generated 32 lessons to be learned by OPS and by external parties. The resulting KEI measurement (to complete the lesson assignment task) is an average of 86 day, with standard deviation of 64 days. Although acceptability thresholds are not formally defined for this indicator, the measured averaged value is not appreciated by the process owner. Moreover, the value of the standard deviation indicates that there were some individual cases of lessons not assigned for assessment within 3 months. The root cause is a lack of frequent regular monitoring during the year by the Lessons Learned Officer: lessons were not assigned for assessment because the Lessons Learned Officer was not aware of their generation.

8. Improvement of the Process

The next step after the analysis of collected data is to define corrective actions to remove the identified root causes. Most of the actions could be within the frame of re-training people (e.g. domain experts) and teams on specific steps of the lessons learned process. Other actions may require escalation to higher authorities (i.e. line management) to remind assigned duties and responsibilities of the involved staff. An evident example was the request to a head of division to push a domain expert to assess the assigned lessons (due to unacceptable time to assess). New technological solutions may help in preventing other issues.

The effect of the implemented corrective actions may only be seen at next collection of process indicators. The availability of historical trends of measured KEI will help in assessing the effectiveness of the process improvement, assuming most of the context conditions are stable.

Please note that some time iterations and discussions on possible corrective actions may generate opportunities for improvement on the process itself. An example has been the introduction of a variant in the process to deal with minor validated lessons learned, as triggered by the struggling of the domain experts in specific assessment conditions.

Continuing the example above, a corrective action to ensure the immediate detection of new generated lessons learned is to systematically implement a mechanism for automatic notification to the Lessons Learned Officer from every team repository. This mechanism makes the Lessons Learned Officer immediately aware of any new lesson generated by the staff.

9. Conclusion

The OPS directorate of the European Space Agency has implemented a programme of Key Effectiveness Indicators (KEI) in the lessons learned process. The identified indicators are measured at three levels: within a single record of lesson learned, at level of single team, at organisational level. In parallel the corresponding QMS procedure has been updated to reflect the adoption of these process indicators. Data are collected both in real time and at specific points in time (e.g. at the end of each year). A formal reporting is issued at the annual Management Review, with associated analysis of the possible weaknesses of the process. The access to the collected data of OPS KEI for the lessons learned process is public within ESA.

With this implemented KEI programme the OPS Directorate can measure the effectiveness of the lessons learned process implementation and identify possible weaknesses. The objective of an effective lesson learned process is to make the organisation more efficient, thanks to the improvements directly derived from the experience.

In summary:

- The adoption of strategic KEI is focused on the quality of the OPS lesson learned process.
- The compliance to the expectation of the process owner is based on the correct behaviour of all involved players and on the joint willingness to improve the organisation and its interfaces.
- Technological solutions are needed to implement the KEI programme, also ensuring transparency on the collected results.

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Beyond Knowledge Transfer: Why Building Information Modeling Requires More Than Just Knowledge for Success

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Abstract: The German design industry is poised to take the next step in its development when it introduced building information modeling (BIM). The German Bundestag is requiring that public construction projects be completed with BIM. Over forty training providers offer a variety of BIM training courses, yet implementation is slowing. Small and medium-sized businesses (SMBs) are facing the challenge of implementing BIM. This study explores how SMBs' digital skills can be improved to implement BIM effectively. To this end, interviews with experts from nine companies were conducted and evaluated using the grounded theory. The interviewees express the view that investments in employee training can help build skills. All the same, SMBs only commit to BIM and training in response to growing demand. The interviews reveal that SMBs' low level of knowledge is attributable to their lack of practical experience with BIM. SMBs without any prospect of a pilot BIM project do not invest in training. A major finding is that SMBs do not consider BIM training expedient – even when it is free - because they do not anticipate any demand for BIM services in the short or medium term. Public clients must consequently develop BIM expertise. The study shows how knowledge and change management research can be drawn on to establish widespread acceptance of BIM.

Keywords: Knowledge transfer, Training, Building Information Modeling (BIM), Empirical study

1. Introduction

The German Federal Ministry for Digital and Transport (BMDV) has observed an increase in costs and delays in major construction projects in Germany. The German design industry is poised to take the next step in its development. Digitalization of the entire construction sector is especially confronting SMBs with a wide range of challenges. The reform commission (by order of the BMDV) has adopted the internationally used, digital process of 'building information modeling (BIM) to reduce costs and delays. "BIM […] is a digital representation of physical and functional characteristics of a facility; through visualization it eliminates uncertainty at various stages of construction" (Bhatija, Thomas, & Dawood, 2017, p. 65). Studies have found that using BIM in project management shortens the duration and improves the schedule and quality of projects (Kotiranta, 2019, p. 21).

BIM can consequently be instrumental in reducing risks during construction in Germany too in the future. It will also improve tracking of expenditures and minimize delays in construction operations. (Püstow, May, & Peitsch, 2015, p. 87). The BMDV has issued a staged plan to progressively implement BIM. The final stage when the implementation of BIM would be rolled out as a new standard for newly designed structures for Germany's transportation infrastructure was scheduled to start at the end of 2020.The BMDV largely initiated major projects to test BIM. SMBs, on the other hand, largely produce designs for municipal clients. Since such projects have smaller budgets, the pilot projects in the BMDV's staged plan will probably not have any direct impact on SMBs' business activities. It is consequently feared that SMBs will play a negligible role in the development of expertise in the use of BIM in pilot projects. Education and training is intended to foster digital skills in the design and construction industry, while public relations and informational activities will increase the industry's attractiveness

2. Literature Review

Wahbeh (2019) identifies technological developments' outpacing of people's ability to keep their knowledge up to date as an obstacle to the adoption of BIM in Switzerland. Tautschnig, Fröch, & Gächter, 2017, p. 18 fear that the trend toward BIM predominantly being used by large companies could cause SMBs to miss out on technological developments or need outside companies to provide their BIM services. Given the wide range of training programs in Austria, Schranz et al., 2021 consider the introduction of certified BIM training courses a solution for more BIM expertise in SMBs. Fechner, Witten, Gillen, & Pfeiffer, 2022 observe that the employees at the German companies surveyed do not seem to have basic knowledge of BIM yet.

Sesselmeier and Blauermel (1998) note that modern human capital theory developed in the early 1960s by Schultz (1961) and others was originally intended to explain the effectiveness of capital investments in industrialized and developing countries before it was also used to explain various real phenomena, such as professional qualifications (Sesselmeier & Blauermel, 1998, p. 65). The useful skills and knowledge people acquire are consequently a form of capital that is largely a product of deliberate investment (Schultz, 1961). This also includes ongoing training. People usually invest in their own professional development after considering the costs and benefits (Becker, 2018, pp. 314–318). Becker demonstrates that employers proceed similarly. They also analyze their investment in ongoing training. They factor in business interests and give employees (human capital) the opportunity for training, assuming that effective training will boost performance and the company's productivity in the long run. The investment in human capital must be smaller than the anticipated long-term benefit (Becker 2018, pp. 314–318).

Academic research has identified numerous obstacles to BIM adoption and BIM team development in the past few years, which are related to the dearth of experts and experience as well as an incapacity to adapt (Milivojević, 2020, p. 18). A few studies combine ideas of knowledge management with BIM, albeit literature on BIM adoption stresses knowledge issues in the industry (Milivojević, 2020, p. 24).

Since SMBs preparing to introduce BIM particularly lack sufficient expertise in BIM, which can be passed on to employees through informational events, working groups or even on-the-job training, they are dependent on third parties to impart knowledge in training courses. Over forty providers offer face-to-face and online BIM training courses in Germany.

3. Methodology

This paper builds upon and expands a master's thesis with research from the field of knowledge management. Since research studies have been unable to fully explain why German design SMBs lack expertise in BIM, this study employs a qualitative research approach to identify the causalities of this phenomenon empirically. Interviews with experts were the method chosen to gather crucial facts, “expert” denoting interviewee with the expertise being researched (Gläser & Laudel, 2010).

Grounded theory, developed by Anselm L. Strauss and Barney G. Glaser in the 1960s, was the basis for data collection and analysis and theory building. Strauss (1994) considers it an analysis of qualitative data geared toward the development of a theory. This methodology is not confined to specific data types, research directions or interests. Grounded theory in which data collection constantly alternates with analysis and theory building following Strauss and Corbin (1996, pp. 43–165) does not permit defining the exact number of interviewees required in advance. This study was intended to be limited to design SMBs (companies) working in transportation infrastructure. Altogether nine interviews were conducted.

Since the questions in the interview guide should not be viewed as concepts with verified theoretical relevance consonant with grounded theory (Strauss & Corbin, 1996, p. 152), they are tentative and the findings have to be scrutinized as the analysis proceeds. Following the first interview and the analysis of the data collected, sections of the original interview guide were revised for the next interviews. The interview guide was reviewed before every subsequent interview and revised whenever necessary. Afterward, the audio recordings of the interviews were transcribed and analyzed based on grounded theory using MAXQDA software.

4. Empirical Study Findings

The cross-case findings of this empirical study of the process of developing skills for BIM expertise in SMBs are the lack of demand for BIM services. The empirical analysis’s main finding are an apparent lack of capabilities among clients too, and the resultant lack of demand for training to develop BIM expertise, especially in microbusinesses. Respondents across the cases feel that investing in training their employees (human capital) can contribute to skill development in their companies.

As the findings demonstrate, renewed commitment on BIM and training in microbusinesses will be contingent on a sustainable and positive development of demand and utility expectation. Experiences with BIM are gained in pilot projects. SMBs without any prospect of a pilot project nor a use for BIM that boosts efficiency do not invest in training. Small and medium-sized businesses only took paid training courses after being awarded the contract for a pilot project. This opened prospects of being able to position themselves for growing demand. As the interviews reveal, the low level of BIM knowledge in SMBs is largely attributable to their lack of practical experience with BIM. Wahbeh’s (2019) findings, on the other hand, pertain to designers already using BIM.

Our findings clearly demonstrate that capability to acquire pilot projects grows as the number of employees in companies increases and BIM is introduced, whereas microbusinesses neither use BIM nor invest in training. In Germany, on the other hand, certified training providers have been offering BIM training and organizations and associations have been offering free training since 2018. Our findings clearly reveal, however, that BIM training curricula for must be geared specifically toward companies' relevant service profiles.

A major finding is that SMBs do not consider BIM training expedient – even when it is free– because they do not foresee any demand for BIM services in the short and medium term. Companies and clients' lack of capabilities is consequently another important obstacle.

Only additional pilot projects can improve SMBs digital skills for BIM. Opportunities to harness knowledge acquired from training courses and certifications and experiences from initial pilot projects in specific projects with new BIM use cases must follow. Without follow-up BIM projects, companies' BIM capabilities will be reallocated to conventionally design projects. High investments in human capital intended to produce the efficiency increases for the company expected from BIM will not be made. Clients will consequently need to train their own BIM teams strategically. Municipalities, SMBs main clients, ought to ascertain the need to plan projects based on BIM.

BIM capabilities will presumably be developed and expanded by training employees and as demand grows. The interview findings indicate that efficiency will increase as experience from completed projects grows. Such efficiency increases are also attributed to additional process automation. SMBs will probably be unable to afford the research and development required for this. As the findings of the study indicate, commercially available BIM software still holds significant potential. This will require increased efforts from software providers to design the BIM workflow to be user-friendly.

5. Discussion from the Perspective of Knowledge and Change Management

A significant finding from our analysis is that the companies' continued development of BIM expertise is considered expedient in order to future proof themselves. There is no demand for outside knowledge, though, even when it is offered for free. Other research studies contend that BIM will only have a chance of being used widely if companies see an opportunity to benefit from it economically. The return on investment and the communicated benefits of BIM implementation and are impetuses for businesses to adopt BIM (Kotiranta, 2019, p. 22).

Other research studies see the lever for establishing BIM in the dissemination of knowledge. Milivojević (2020), for instance, identifies the following challenges to BIM and knowledge use in a literature review: lack of training in organizations, a lack of understanding of BIM practice, investment in training, problems with knowledge transfer and professionals' failure to adjust to the complex and ever-evolving nature of software tools (Milivojević, 2020, p. 59). The entire focus group in Bhatija et al.'s study (2017), agreed there is a need for a knowledge management adoption strategy is that would help the construction industry in the UK as it moves toward implementing level 2 BIM. Roughly 90 % of respondents see a need for knowledge sharing among clients, consultants, contractors and other project stakeholders. (Bhatija et al., 2017, p. 68)

Milivojević (2020) identifies altogether seventeen critical success factors for the establishment of BIM in companies in her research. Four pertain to knowledge: structured organized training, experiential learning, the opportunity for reflection of learned things and shared experience and learning (Milivojević, 2020, p. 287). She proposes combining formal training with learning by doing (Milivojević, 2020, p. 292). The evidence indicates that social learning enhances team flexibility more than structured organized learning does (Milivojević, 2020, p. 293).

Our findings indicate that the issue is more complex than disseminating knowledge to companies. As with any change, resistance is identifiable whenever BIM is introduced, as different research papers compiled by Milivojević (2020, p. 25) corroborate. The research field of change management can be drawn on here. Change management research has identified latent barriers to change in teams and organizations. Finke and Will (2003) propose an intervention paradigm that activates sustained motivation. Four motivating causes and four ensuing domains of intervention are identifiable. Transparency and communication facilitate "awareness", the motivational component that drives change. Training provides team members the skills they need to manage change. Transformations require management commitment (liability), which the team must accept. The appropriate intervention is leadership. Finally, change also requires individual "commitment" from the team, the relevant intervention being involvement. (Finke & Will, 2003)

Nearly half the BIM introduction success factors identified by Milivojević (2020) in her research relate to change management and the intervention levels identified by Finke and Will (2003). The success factors "communication digital and non-digital information exchange" and "'opportunity for reflection" are part of the *communication* level. "Structured organized training", "experiential learning" and "shared experience, shared learning" are part of *training* intervention. The factors "vision and clarity of requirements" and "establishing top-support, structure and providing skills and resources" are part of the *leadership* level. The factor "'openness to new ideas" relates to *involvement*.

Change management primarily analyzes change processes within organizations. One of the main challenges identified in our study was enabling the sustained use of knowledge in practice once it has been acquired. Construction projects using BIM are normally interorganizational because of the different parties involved. Prioritizing knowledge transfer in an organization, e.g., a company, is consequently shortsighted.

Haugbølle (2016) proposes an analytical framework for knowledge in construction with five levels: "1) construction as a system, 2) firms as key players, 3) projects as the focal point, 4) communities of practice in groups and professions, and 5) individuals as bearers of skills." (Haugbølle, 2016, p. 59) Haugbølle (2016) localizes knowledge in four different interactions between the political-institutional apparatus and business or users, between companies and their customers, between knowledge institutions and all the different business actors, and within each of these units (Haugbølle, 2016, pp. 61–62). More than just knowledge transfer from training providers to companies is needed. Haugbølle (2016) identifies three dimensions of knowledge transfer, networks outside companies, between projects in companies and between all partners in projects.

Knowledge management research has been around for many years but really took off in the 1990s, primarily because of the importance of the resource knowledge in our knowledge society. Knowledge management research is often dominated by a corporate view intent on optimizing the availability of the resource knowledge within organizations (see Davenport, 2011; Mertins, Heisig, & Vorbeck, 2003). One of the few approaches to linking individual, organizational and interorganizational knowledge transfer processes is Nonaka's SECI model. The four modes of knowledge conversion are *socialization (S)*, which involves interaction, knowledge sharing, shared time and joint learning from experience, *externalization (E)* in which tacit knowledge is crystalized, articulated and rendered explicit, *combination (C)*, which involves merging, integrating and systematizing explicit knowledge, and *internalization (I)*, which involves putting explicit knowledge to use and turning it into tacit knowledge (Nonaka & Toyama, 2003, p. 5) This spiral process connects individual and organizational and even interorganizational knowledge.

Transferred to an interorganizational BIM use case, the SECI process could proceed as follows. "Knowledge creation starts with Socialization, which is the process of converting new tacit knowledge through shared experiences in day-to-day social interaction." (Nonaka & Toyama, 2003, p. 4). Since research has shown that requiring tacit knowledge transfer can be challenging (Chugh, Wibowo, & Grandhi, 2015), companies need to consider their approach to socialization carefully. A public client and several design and construction companies partnered in a joint construction project would collaboratively create new knowledge while developing the shared BIM model. "Such tacit knowledge is articulated into explicit knowledge through the process of Externalization." (Nonaka & Toyama, 2003, p. 5) By merging client specification with contractors' design information, such as materials required, agreed costs, three-dimensional drawings and completion dates, collaboration on a shared BIM model of the construction project constitutes externalization. The BIM model produced embodies the explicit knowledge. New explicit knowledge can be combined as project partners, e.g., subcontractors, continuously enrich the model with information. "Explicit knowledge is collected from inside or outside the organization and then combined, edited, or processed to form more complex and systematic explicit knowledge through the Combination process." (Nonaka & Toyama, 2003, p. 5) Along with the actual BIM model, an explicit base of knowledge on BIM use can be created in joint construction projects and enriched with examples of good practice. Processes, experiences in the project and experiences using the tools for developing the BIM model could be saved in a joint project wiki, for instance. Other project partners can access this base of knowledge and the BIM model later on in a project to effectively reuse the explicit knowledge. "Explicit knowledge created and shared throughout an organization is then converted into tacit knowledge by individuals through the Internalization process." (Nonaka & Toyama, 2003, p. 5) This process can be repeated on other levels, for instance, by enabling project partners to share the experiences from other projects by collaborating (socialization). Outside knowledge could also be contributed to other projects in exactly the same way through standard training programs by outside trainers, either by socializing in collaborative on-the-job training or by combining and incorporating explicit knowledge in existing bases of knowledge (combination).

This knowledge must be transferred to the entire industry in the medium term and such SECI processes must take place on completely different levels. Our analysis reveals a need among public clients in particular to invest in BIM expertise in order to be able to include BIM in public requests for bids and to enable SMBs in particular to use theoretical knowledge in practice. As the SECI process reveals, all project partners benefit from knowledge transfer since it ideally does not stop at the confines of an organization. A study by the German Bundeswehr found that organizations need to find the right enablers to share and create knowledge (Kreutzmann, Koller, Andresen, & Schulte, 2016).

Change management and knowledge management research has yielded enough points of reference to establish widespread acceptance of BIM. BIM will only experience wide acceptance once political decision-makers understand and put the relationship between change and knowledge management into action. As this study has demonstrated, establishing widespread acceptance will necessitate more than merely "supplying" explicit knowledge in publications or transferring implicit knowledge from training providers to the future users.

6. Recommendations

As Haugbølle (2016) observes, establishing widespread acceptance of BIM will necessitate following a systemic approach. It must include the construction industry 's complete system with all the organizations (private and public contractors and companies) that interact in projects. Since individuals developing BIM skills work on projects and in organizations and are more or less in dialogue with each other in different communities, knowledge transfer must be facilitated and initiated on all these levels. Moreover, change management must be transferred to the entire construction industry. Applying Finke and Will's (2003) approach to the construction industry will bring all four intervention levels into play.

The benefits and practicality of BIM must continue to be communicated openly and widely on the *communication* level. Several good approaches in Germany, such as the Mittelstand-Digital Construction Center funded by the Federal Ministry for Economic Affairs and Climate Action, can be expanded and enhanced. The Mittelstand-Digital Construction Center is a strong partner that helps SMBs in the construction and real estate industry transition to a digital and sustainable future. It teaches digital skills and facilitates the implementation of practicable digital solutions.

Municipalities are advised to study expedient uses of BIM for the design facilities in their purview comparatively with conventional design. To do so, they will have to ascertain their own needs.

Enough programs appear to be available on the *training* intervention level since the companies surveyed would not take advantage of any other training programs – not even free ones – on their own initiative. These authors feel that such programs, free or not, ought to be continued so that SMBs are also quickly able to acquire outside knowledge they are unable to provide themselves whenever demand for BIM services rises. SMBs are advised to study BIM implementation, factoring in their customers' demands and their own service profile, possibly by taking part in pilot projects.

Training providers ought to gear their curricula increasingly toward municipalities as well and contribute to skill building in municipalities that have identified a need for BIM. Training providers could additionally develop solutions for working groups grounded in practice, which enable SMBs working on their first BIM projects to share experiences. The SMBs surveyed in this study displayed strong interest but also reservations stemming from the potential transfer of expertise to their competitors. Training providers' job would consequently also entail establishing conditions that ensure collaboration based on trust.

The staged BIM plan and legal standards established the basis for using BIM in Germany on the *leadership* level. The status quo will not change much, though, as long as largely public clients do not (or cannot) implement these standards. The government must set an example and not only establish the conditions for implementing pilot projects in the future but also for completing BIM projects routinely.

We recommend that the German government open online training courses intended for federal employees to municipal governments as well. This would facilitate the training of municipal employees and also make BIM expertise a standard requirement when contracting BIM services.

Involvement is usually achieved when the benefits of innovation are recognized. These can be personal and organizational benefits. Performance expectancy is "[…] the extent to which a person believes that using a particular technology will enhance her/his job performance". (Venkatesh, Morris, & Ackerman, 2000, pp. 36–37) If this way of thinking is maintained at the organizational level and beyond, it will permeate the entire industry (Bhatija et al., 2017, p. 64). Targeted communication and training can communicate benefits but

personal experience in real projects will be most effective. Increasing the number of BIM projects will be the best place to start here.

7. Conclusion

Since research studies have been unable to explain fully why German design SMBs lack expertise in BIM, this study employs a qualitative research approach to identify the causalities of this phenomenon empirically. The interviewees express the view that investments in employee training can help build skills. All the same, SMBs only commit to BIM and training in response to growing demand. The interviews reveal that SMBs' low level of knowledge is attributable to their lack of practical experience with BIM. SMBs without any prospect of a pilot BIM project do not invest in training. A major finding is that SMBs do not consider BIM training expedient – even when it is free – because they do not anticipate any demand for BIM services in the short or medium term. Public clients must consequently develop BIM expertise.

This study shows that knowledge management research on the SECI process can be applied to understand the relationships between knowledge transfer mechanisms and different parties in a specific industry. The authors also demonstrate that change management research can be drawn on to establish widespread acceptance of BIM. They propose using Finke and Will's intervention model to plan strategic actions and make specific recommendations for different parties in the German construction industry.

The methodology and procedures of grounded theory constitute potential limitations. The theoretical sampling employed differs fundamentally from statistical sampling (Strauss and Corbin 1996, p. 148). The selection of the initial sample and the achievement of theoretical saturation are crucial to grounded theory. Despite intensive efforts, interviewees could not be recruited from every domain of transportation infrastructure design, including subsoil testing, surveying and landscaping contractors. Since this study's sample is limited to some interviewees' middle management, these companies' interests may be under- or overrepresented.

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The Effects of Demand-Side Policy on Firm Innovation: The Mediating Role of R&D Activities

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Abstract: Today, innovation is seen as the engine of economic growth. As a result, governments foster innovation activities in both the public and private sectors by using policy tools such as measures, regulations, and incentives. There are two main approaches in government innovation policy: supply-side policy and demand-side policy. Supply-side policy instruments primarily stimulate technological development and diffuse innovation capabilities. On the other hand, demand-side policy supports specific demand and minimizes technological and trade uncertainty at all stages of production. Moreover, a demand-driven procurement policy is one of the main drivers of high-tech industries. At the same time, in line with the growing importance of the knowledge economy and societal concepts, knowledge or technology has become the major determinant of innovation. In this way, companies are encouraged to undertake research and development activities in order to create innovation and advance their technologies. Moreover, the government's support for investing in research and development (R&D) activities has become an effective solution for the firm's innovation outputs. These R&D activities are of particular importance in transition and catch-up economies such as the Czech Republic. Therefore, this article aims to analyze the impact of demand-driven policy on business innovation through R&D activities in the Czech Republic. Data from the Community Innovation Survey and partial least squares structural equation modelling are used to achieve the purpose of this article. Our findings show that demand-driven policy (procurement for innovation) significantly and positively affects firm product and process innovation through R&D activities. The findings of our research also have practical implications for firms and policymakers in the Czech Republic. These results could also apply to Central and Eastern Europe, where we can observe similar characteristics of firms, for instance, because of their innovation performance.

Keywords*:* Supply and demand-side policy, Product and process innovation, R&D activities, Czech Republic

1. Introduction

Innovation policy refers to government policies and initiatives which promote innovation for regional development. In government innovation policy, there are two major approaches to the measures used, supply-side and demand-side policy (Borrás & Edquist, 2013). Supply-side policy instruments include more direct interventions to provide financial incentives (such as grants, subsidies, or tax incentives) for research and development (R&D) activities undertaken in private sector firms (Leyden & Link, 2015). According to (Guo et al., 2016), government supports firms to reduce market failures, improve innovation efficiency, and enhance social welfare. Numerous literatures have done empirical studies of the supply-side policy (such as government subsidies) to improve the innovation performance of firms (for example, Guo et al., 2016; Wu et al., 2020; Zuo et al., 2022). However, there are some limitations of supply-side policy such as crowding out effect of R&D subsidies (Bong et al., 2020), the inefficient use of the government budget (Kundu, James & Rigby, 2020), and high level of uncertainly to investing in R&D (Chaminade & Esquist, 2010).

Therefore, the government approach has changed significantly towards demand-side policy recently (Edler et al., 2012). Interest in public procurement which is utilized in the innovation policy framework has increased (Crespi & Guarascio, 2019; Uyarra et al., 2020). This is called the public procurement for innovation (PPI), the concept of demand-pull innovation. Theoretical reviews have been done in demand-side policy to develop innovation in firms (see for example Chicot & Matt, 2018; Miller & Lehoux, 2020). Lately, public procurement as a demand-side policy tool has been recognized as an important driver for encouraging innovation (Knutsson & Thomasson, 2013; Uyarra et al., 2014) and it supports products and services much more efficiently and effectively, as well as provides citizens with better services (Edler & Yeow, 2016). Moreover, it is a powerful tool for supporting private-sector innovation through innovation demand (Edquist & Zabala-Iturriagagoitia, 2012) and can be used strategically to promote ecosystem innovation (Rainville, 2017). In addition, procurement can be served as a substantive tool because government interference in the procurement process can result in more innovations than government R&D subsidies (Demircioglu & Vivona, 2021).

A study conducted by Demircioglu & Vivona (2021) found that procurement activities are positively related to innovation within public organizations. They further mentioned that R&D procurement has a significant and meaningful impact on new technologies and services. Likewise, Dai et al. (2021) revealed public procurement significantly increases firms' R&D investment, promotes high-tech product sales, and enhances firms' access to

external finance in China. Moreover, another scholar Stojčić et al. (2020) suggested that PPI has a large effect on innovation and output, and the highest additionality is sometimes achieved when firms receive both financial support and innovation-oriented public procurement. Looking at the above works of literature, most of the studies are literature reviews and less attention to empirical analysis. In addition, majority of them are qualitative and single-case analyses with limited generalizability (Obwegeser & Müller, 2018).

Government procurement is a significant driver for certain high-tech industries (e.g., defense and aerospace industries) (de Freitas Dewes et al., 2015). These industries are identified by the development of high value-added and technology-intensive products to address complex issues and current business risks (Coad & Rao, 2008). As a result, R&D activities have become an important part of resolving complex technical issues in these industries. R&D activities can assist industries in identifying and investigating new technologies, materials, and processes that can be used to develop innovative products, services, and solutions (Prokop & Stejskal, 2019). These R&D activities are particularly important in transition and catch-up economies like Czech Republic. The country is weaker in innovation and lacks development within local and regional innovation networks (Prokop et al., 2019). Hence, to the best of our knowledge for filling the gap from previous research, the aim of this research is to analyse the influence of the demand-side policy on firm innovation mediated by R&D activities.

The rest of the paper is structured as follows: The next section presents the theoretical background. The third section defines the methodology part including data analysis and sample. The fourth section presents the results of the analysis, and the fifth section describes the discussion. Conclusions are dedicated in the last section.

2. Theoretical Background

Demand can be considered as the market size and users' sophistication (Guerzoni, 2010; Zahler et al., 2022) and is recognized as one of the innovation policy approaches of the national innovation system, but the demand-side approach has been neglected for a long time in many OECD countries (Edler, 2009). Policymakers have paid less attention to a demand-side policy that can stimulate the creation and diffusion of innovation. However, in recent years, researchers have turned their attention to the demand-driven approach to innovation. According to Edler et al. (2016), demand-side innovation policy aims to stimulate innovation or accelerate innovation diffusion by increasing demand for innovation, characterizing new business requirements for products and services, and promoting user involvement in innovation production. Demand-side innovation policies seek to encourage the adoption of new technologies and can address global and societal challenges such as climate change and aging populations (Boon & Edler, 2018; Reyes-Mercado et al., 2020). Under the demand-driven approach, there are three forms of innovation-based public procurement, performance-based regulations and standards, and technology-based regulations and standards. Among them, innovation-oriented public procurement is one of the most popular and powerful demand-driven and underused innovation policy tools. Public procurement is a powerful tool that enables national and local authorities to achieve sustainable development goals while purchasing needed goods and services (Edquist & Hommen, 2000). Public procurement of innovation occurs when a public agency places an order for a product or a system that does not exist at the time, but which could probably be developed within a reasonable period (Edquist & Zabala-Iturriagagoitia, 2012).

In addition, some empirical studies described the potential of innovative public procurement (IPP) in driving innovation and economic growth in recent years. In a study conducted by (Dai et al., 2020), public procurement significantly boosts firms' R&D investment, encourages the sale of high-tech products, and improves firms' access to external finance. Innovative public procurement is crucial in the application and dissemination of sustainable manufacturing technologies (Ghisetti, 2017). Public procurement can provide critical support to investments in innovation and complement other types of finance (Georghiou et al., 2014). Public procurement for innovation can contribute to the transformative processes of (1) the articulation of societal demands to direct challenge-driven transformation; (2) the development and production; selection; and (4) the diffusion and use of new technologies to meet these societal demands (Wesseling & Edquist, 2018). Public procurement can encourage business innovation by supporting the formation of markets for new products, technologies, and services (Bleda & Chicot, 2020). Innovative public procurement has a strong and significant impact on turnover from new products and services. The impact is obviously attributable to innovations of an incremental nature rather than market innovation (Czarnitzki et al., 2018).

Moreover, by using demand as a tool for innovation, governments can encourage firms to invest in R&D and develop new solutions to societal challenges (Lember et al., 2015). It can stimulate R&D investments, encourage innovation, and lead to the development of new products and services. A study conducted by

Selviaridis (2021) found that public procurement stimulates collaboration and R&D interaction and also allows small businesses to gain access to relevant innovation ecosystems, expand their knowledge and capabilities, and explore potential routes to market. Furthermore, innovative procurement can encourage collaboration between public and private sector entities, resulting in knowledge sharing and the development of new technologies (Thai, 2015). Furthermore, innovative public procurement can help to improve the efficiency and effectiveness of public services and reduce costs (Edler & Yeow, 2016). It means that firms are likely to invest in R&D activities to advance their technology in the manufacturing process to offer quality service to the public sector.

Based on the above argument, we develop the following hypothesis;

H1: Demand-side innovation policy positively and significantly affects firm product and process innovation in the Czech Republic.

H2: Demand-side innovation policy has a positive and significant indirect effect on firm product and process innovation in the Czech Republic.

3. Data Collection and Method

Data is collected from Community Innovation Survey (CIS) 2012 – 2014. CIS provides innovative public procurement variable which is used as demand-side policy. CIS is a harmonized survey that is also a component of the EU's scientific and technological statistics. It is conducted in EU Member States every two years. CIS is frequently used to examine a firm's innovation efforts. Previous recent studies (for example; Stojčić et al., 2020; Caravella, & Crespi, 2021; Odei & Hamplová, 2022) used the CIS (2012-2014) to analyse the effect of demand-side policy on firm innovation. 5198 firms from the Czech Republic are analysed in the paper. Structural equation modelling (PLS-SEM) is used to capture our hypothesis. SEM is a helpful technique for assessing complex theoretical relationships between numerous variables, particularly in social science research (Hair & Alamer, 2022). PLS-SEM allows researchers to build and predict complex cause-effect relationship models that include both latent and observed variables (Hair & Ringle, 2017). The PLS-SEM method improves the explained variance of endogenous constructs and functions similarly to multiple regression analysis (Hair et al., 2011). The Explanation of the Variables is Described in Table 1.

Table 1: The Explanation of the Variables is Described in the Following Table

Variable description	
Independent Variables	
Firms especially undertake innovation activities as part of a contract to provide goods or services to a public sector organization (PBINCT)	(Stojčić et al., 2020)
Mediation Variables	
Firms undertake Research and development activities to create new knowledge or to solve scientific or technical problems (RRDIN)	(Sein & Vavra, 2020)
Firms undertake in-house training for personnel specifically for the development of new or significantly improved products and processes (RTR)	
Firms undertake in-house activities for the market introduction of new or significantly improved goods or services, including market research and launch advertising (RMAR)	Prokop et al. (2018)
Firms undertake in-house activities to alter the shape, appearance or usability of goods or services (RDSG)	Duarte et al. (2022)
Firms undertake in-house activities to implement new or significantly improved products and processes such as feasibility studies, testing, tooling up, industrial engineering, etc. (RPRE)	
Dependent Variable	
Firms introduce new or innovative products to the market based on customer's needs (INPDGD)	Zhylinska et al. (2020)
Firms introduce new or significantly improved production or delivery method, including changes in techniques, equipment in manufacturing process (INPSPD)	

4. Results

4.1 Factor Analysis

All outer loading values are greater than 0.4 shown in Table (2). Outer loading above 0.4 can be considered acceptable (Hair et al., 2019). Moreover, the Variance Inflation Factor (VIF), shows that the VIF values are lower than 5. Hence, the model shows no collinearity problem in all values shown in Table (2).

Table 2: Outer Loading and Collinearity Validity (VIF)

Variables		Product Innovation		Process Innovation	
		VIF	Outer loading	VIF	Outer loading
INPDGD	Product Innovation	1.000	1.000		
INPSPD	Process Innovation			1.000	1.000
PBINCT	Demand-side policy (Procurement)	1.000	1.000	1.000	1.000
RDSG	R&D Activities	2.114	0.808	2.114	0.796
RMAR		2.177	0.821	2.177	0.812
RPRE		2.387	0.851	2.387	0.859
RRDIN		1.698	0.788	1.698	0.780
RTR		1.920	0.785	1.920	0.805

The reliability and validity of variables constructs measurement are shown in Table (3). Cronbach's Alpha, rho_A, Composite Reliability values greater than 0.6 and Average Variance Extracted (AVE) greater than 0.5 can be said that model is consistent.

Table 3: Construct Reliability and Validity

	Product Innovation				Process Innovation			
	CA	RA	CR	AVE	CA	RA	CR	AVE
Product Innovation	1.000	1.000	1.000	1.000				
Process Innovation					1.000	1.000	1.000	1.000
Demand-side policy (Procurement)	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
R&D Activities	0.870	0.874	0.906	0.657	0.870	0.873	0.906	0.657

CA = Cronbach's Alpha; RA = Rho_Alpha; CR = Composite Reliability; AVE = Average Variance Extracted

The Heterotrait-Monotrait (HTMT) ratio of the correlations is used to access the discriminant validity of the model shown in Table (4). According to Henseler et al. (2015), HTMT ratio is less than 0.85 or 0.9. Hence, discriminant validity has been established between two reflective constructs in the model.

Table 4: Heterotrait-Monotrait Ratio (HTMT)

	Product Innovation	Demand-side policy (Procurement)	R&D Activities	Process Innovation	Demand-side policy (Procurement)	R&D Activities
Product Innovation	-					
Process Innovation				-		
Demand-side policy (Procurement)	0.070	-		0.073	-	
R&D Activities	0.707	0.138	-	0.592	0.138	-

The Saturated and Estimated models measure the relationship between all concepts. SRMR values that are less than 0.095 can be assumed as good functioning of the model. NFI values should be between 0.0 and 1.0 with values closer to 1.0 indicating a good fit. Therefore, the model shown in Table (5) can be assumed a good fit model.

Table 5: Model Fit

	Product Innovation		Process Innovation	
	Sat. Model	Est. Model	Sat. Model	Est. Model
SRMR	0.062	0.062	0.060	0.060
Chi-Square	1507.628	1507.628	1221.379	1221.379
NFI	0.903	0.903	0.915	0.915

Legend: Sat. = saturated, Est. = estimated, SRMR—standardized root mean squared residual, and NFI—normed fit index.

4.2 Path Analysis

For path analysis, the study applied bootstrapping techniques using PLS-SEM to assess the hypothesis. The results show that demand-side policy is not significant and doesn't have any impact on firm product innovation with P Value (0.336) and has no impact on process innovation with P Value (0.564) in the Czech Republic in Table (6). Therefore, H1 is rejected. Moreover, the statistical value shows the relationship between demand-side policy and R&D activities with P Value (0.000). Another statistic value shows the indirect relationship between demand-side policy and firm product and process innovation mediated by R&D activities with P Values (0.000). Hypothesis H2 is accepted and therefore, the demand-side policy has a significant and positive on firm product innovation in the Czech Republic through R&D activities in Table (6). Besides, the demand-side policy has a positive and significant effect on R&D activities and R&D activities have a positive and significant effect on product and process innovation.

Table 6: Results of Path Analysis

Product Innovation		
	T Statistics	P Values
Demand-side policy -> Product Innovation	1.462	0.144
Demand-side policy -> R&D Activities	7.330	0.000***
R&D Activities -> Product Innovation	61.151	0.000***
Demand-side policy -> R&D Activities -> Product Innovation	7.192	0.000***
Process Innovation		
	T Statistics	P Values
Demand-side policy -> Process Innovation	0.048	0.962
Demand-side policy -> R&D Activities	7.672	0.000***
R&D Activities -> Process Innovation	44.691	0.000***
Demand-side policy -> R&D Activities -> Process Innovation	7.543	0.000***

*** significant at p<0.01; ** significant at p<0.05

5. Discussion

Most previous studies focused on supply-side policy on firm level innovation and few studies emphaised on direct relationship between demand-side innovation policy on firm level innovation in the context of the Czech Republic. These studies neglected the mediating role of R&D activities. Therefore, the aim of this paper is to analyse the influence of demand-side innovation policy on firm innovation mediated by R&D activities in Czech Republic.

In our analysis, demand-side innovation policy has no significant direct effect on firm product and process innovation in the Czech Republic. Therefore, Hypothesis H1 is rejected. Our results against the findings of Stojčić et al. (2020) and Czarnitzki et al. (2018) who found that demand-side innovation policy (public

procurement for innovation) has a significant effect on firm's innovation output (product and process innovation) and drives the success of firm's innovation. However, our finding supports the result of Gyamfi et al. (2019), who found no significant effect on firm product innovation. Our results can indicate that demand-side innovation policy is not likely to be a main driver of firm innovation directly. Some factors such as resources, and competition can influence on firms to innovate (Porter, 1990). In addition, government may have some specific requirements and standardized specifications which can limit some extent of firm's innovation.

Secondly, demand-side innovation policy has a positive and significant indirect effect on firm product and process innovation mediated by R&D activities in the Czech Republic. Therefore, H2 is accepted. This is the study that performs the mediating role of R&D activities between demand-side innovation policy and firm's product and process innovation. Based on the previous works of literature, there is no empirical argument regarding such a relationship. The results of our analysis where R&D activities serve as a mediator between demand-side innovation policy and the firm's innovation. In this case, the full mediator role of R&D activities made the previous studies such as Stojčić et al., 2020; Odei & Hamplová, 2022 which conducted a direct relationship between demand-side innovation policy and firm's innovation insignificant.

Our analysis indicates that government or public agency creates a demand which contains some specific functional requirements. In this case, firms are required to meet a specific condition such as developing new technologies or providing innovative solutions. This condition encourages firms to invest more in R&D to meet these government or public agency standards and win public contracts. An increase in R&D investment could stimulate innovation within the firms and result in the development of new products, processes, or services. Moreover, firms are likely to be encouraged to collaborate with other research institutes or universities to fulfill procurement requirements. This interchange of ideas and skills can result in the development of new knowledge, technological improvements, and innovation. Moreover, the analysis results showed that R&D activities have a positive and significant effect on firm's product and process innovation in the Czech Republic.

6. Conclusions

The aim of this paper is to analyze the effect of demand-side policy on firm product and process innovation mediated by R&D activities in the Czech Republic. Our analysis showed that demand-side policy has no direct significant effect on firm product and process innovation in the Czech Republic (H1). However, the demand-side policy has a positive and significant effect on firm product and process innovation in the Czech Republic. Looking at our analysis results, government policies are vastly effective only when firms have strong readiness to engage in R&D activities to improve new products and technology.

Therefore, the implications are that firms should strongly emphasize undertaking R&D activities to develop new and improved products and processes. Engaging in R&D activities in firms not only can attract government incentives but also can survive in a competitive market. There are some limitations in our paper. Due to the availability of data, only data from 2012-2014 was used. Only one sample country was conducted for analysis. In the future, the latest data and many countries, and different analysis methods can be used for analysis.

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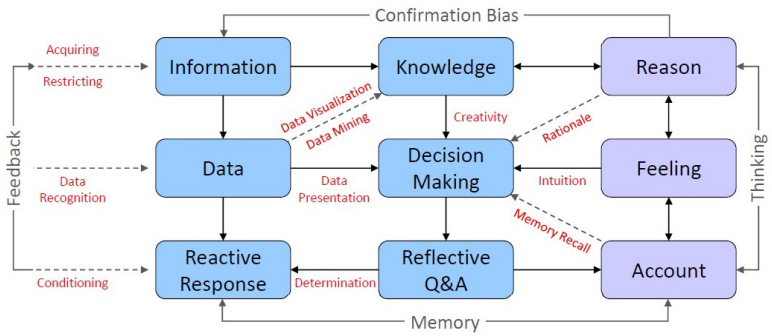
Abstract: *Purpose:* This paper reviews the elegant and practical concepts developed by John Lewis in *The Explanation Age*® by expanding the summary from Sisson's 2023 Unified Theory of Knowledge Management dissertation literature review. *Approach:* The integrated concepts are discussed individually, as well as in relation to their implications. *Contents: The Explanation Age* redirects thinking with Option Outlines™, providing a means to develop and document *why* answers into decision-making with transparency. It introduces the unified Innate Lesson Cycle™ change model, which explains the difference between conditioning and determination to develop better answers. Based on neuroscience, Story Thinking™ recognizes that everything is in a story (unlike storytelling, which communicates only about the past and envisions the future). Story Thinking provides an approach to better execute the innate lesson cycle. The 8 Degrees of Reason™ and The Symbiotic Table of Knowledge™ provide underpinnings for the accepted endpoints for answers. *Findings: The Explanation Age* and Story Thinking support Lewis's viewpoint of Knowledge Management as learning. Story Thinking can lead to transformational leadership results through collaboration. Lewis's constructs provide an alternate view to the forensic *knows*, Aristotle's causes, and Sisson and Ryan's (2015; 2017) "11 things we know" (Sisson, 2023, figure 6-2). *Research limitations:* Since their 2008 inception, new implications of Explanation Age concepts continue to surface. *Practical implications:* Lewis's concepts provide useful constructs for thinking and understanding learning from a KM perspective. Option Outlines provide a way to document *why*. "The Innate Lesson Cycle describes the phases of lesson-based learning, for both" experiential (Kolb) and rote (Skinner) learning (Lewis and Sisson, 2016; Sisson, 2023) making their concepts more useful. Story Thinking—as a practical operational strategy—extends the implementation capabilities of the Innate Lesson Cycle and provides an approach for transformational leadership. *Social implications:* Story Thinking as an operational concept provides new ways to identify innovative ideas and facilitate change. Sensemaking and transparency in decision-making (missing in the fundamental models used by institutions, such as agile, education, healthcare, and policy) are the basis for this (the only complete) descriptive model of change.

Keywords: Knowledge management, Learning, Industrial revolution, Storytelling, Knowledge, Degrees of reason

1. Introduction

"'Unlike most Knowledge Management (KM) people, [who] start with *knowledge*, [Lewis starts] with lesson-based learning' (Lewis and Sisson, 2016)" (Sisson, 2023). Lewis (2010) began explaining what is needed to move from the Information Age to the Explanation Age. Murray and Lewis (2011) suggest the internet's "'WWW' today actually stands for the *World Wide What*." With "1,000 exabytes of digital data produced in 2010," more information is not needed. What is needed is "the reasoning behind the data"—why. Lewis developed Option Outlines to document *why*. Lewis envisions data, information, and decision-making as "the building blocks of an explanation" (Figure 1). The account is the story—summaries, the story, options and choices, the innate lesson cycle, learning, morals, and characters (old and new). An Option Outline documents why. Lewis provides new KM building blocks clarifying knowledge with his 8 Degrees of Reason. (Lewis, 2012a)

Information and Explanation Age® Focus



Managing the Reactive and Reflective Systems Explanations

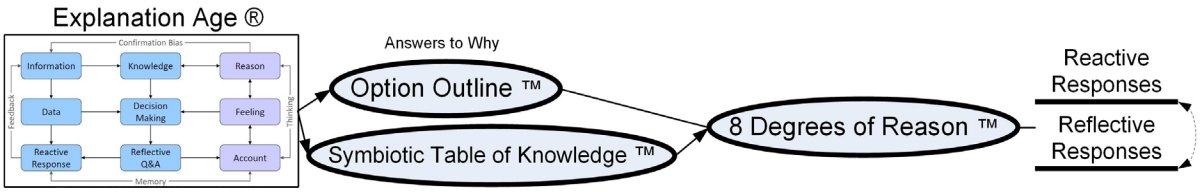
Source: Combined (Lewis, 2012b; Lewis, 2013)

Figure 1: The Explanation System

De Bono (1985) introduced six "thinking hats." In supporting decision-making, Lewis (2012b) adds two more in the development of the explanation system model. The development of the Innate Lesson Cycle goes beyond the traditional descriptions of learning. Lewis sees the cycle as a driver for innovation, recognizes the importance of past, present, and future stories, and further extends the cycle with a practical example of Story Thinking as an operational strategy using a transformational leadership model.

2. Explanation Age Concepts

Figure 2 relates four parts of the initial Explanation Age concepts. An Option Outline shows *why* based on consequential choices and reasons. Reasons are based on knowledge. The fifth part—"the Innate Lesson Cycle™, [a knowledge development-evolution model]—extends traditional education, training, drill and practice, [and conditioning] learning models incorporating responding to disruptions with investigation, ideation and new solution development" (Sisson and Ryan, 2016a) for more effective change development and implementation. Its repeating steps extend the traditional learning approaches (fast-track learning) with reasoned improvements (slow cycle learning) that can better support innovation.



Source: Modified and extended part of Sisson (2023, figure 2-11 CC-BY-NC)

Figure 2: Explanation Age® Base Concepts

2.1 8 Degrees of Reason

"Learning is the gaining of knowing – satisfied with some degree of reason" (Lewis, 2013). There are only eight types of reasons: reactive, prescriptive, entity, state, sequence, responsibility, reasoning, and question (Lewis, 2013, table 10.1; Lewis, 2015a, internet archive).The questions are broken into questioning and resolution in Lewis's figure 9.1. Option Outlines are heavily populated with reasons. (Lewis, 2012a)

Lewis (2013) shows each of the reasons, provides a description and example terms, examples, famous reasons, and associates them with a person and their influence, as well as providing an inference model of innate reason. For example: 1) Questioning is "what one thinks from"; 2) Responsibility could be, "it's the cat's fault by coming into our yard"; 3) Reasoning: "Either Pluto is not a planet, or we have hundreds of planets"; 4) Reactive: "B. F. Skinner – Behavioural Psychology." The Inference Model of Innate Reason leads to the Symbiotic Table of Knowledge differentiating between *why* and *wherefore* (Lewis, 2012b). Lewis (2013) continues with *what* you know and *how* you know (Figure 3).

Reason Degree	**What You Know**	**How You Know**
8 Questioning	Fact (Conviction Questioned)	Theory (Curiosity Questioned)
7 Reasoning	Concept	Proof
6 Responsibility	Principle	Evaluation
5 Sequence	Process	Pattern Recognition
4 State	Case	Synthesis
3 Entity	Definition	Analysis
2 Prescriptive	Methodology	Application
1 Reactive	Routine	Rote

Source: Copied words from Lewis (2013)

Figure 3: What You Know and How You Know

2.2 Symbiotic Table of Knowledge

As Wiig states, "Knowledge is multidimensional and complex!" (1993). It is "a multifaceted concept with multilayered meanings" (Nonaka, 1994) and is "on a continuum" (Nissen and Jennex, 2007). "Knowledge is

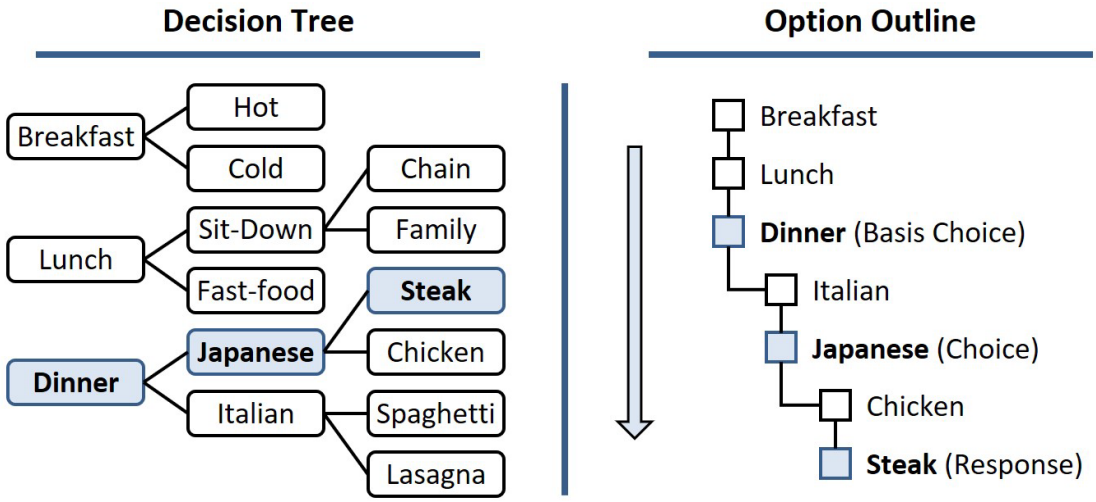
constructed" (Bodner, 1986; Lowenthal and Muth, 2008; Jakubik, 2011) "each time it is [retrieved]" (Sisson and Ryan, 2017). Knowledge is what we know: it enables a capacity for informed action (per Peter F. Drucker in The New RealitiesStankosky, 2003).

Sisson and Ryan (2016b) construct and display a knowledge concept map relating many aspects of knowledge. Then, Sisson and Ryan (2017) expand upon the knowledge as an object representation, while Sisson (2023) goes on to discuss knowledge as a process, resource, asset, commodity, science, practice, reality, social construct, and energy. Lewis (2015c, internet archive) points out, "…simply having knowledge is no longer the primary advantage. The primary advantage comes from asking the right question. This means that *Knowledge is no longer the ultimate power. Questioning is power.*" "Imagine the symbiotic table of knowledge being used as a balanced scorecard to determine if an education consisted of memorizing for conviction, or if the education also provided an ability to understand from curiosity" Lewis (2015c, internet archive) providing a table that aligns question forces, operations, and types to develop descriptive and prescriptive kinds of concise, contextual, consequential, and conceptual types of knowledge answers.

2.3 Answers to Why (Option Outlines)

The eight reasons, coupled with the table of knowledge, are needed foundational skills for determining *why*. There are tools that help document *what*, *when*, *where*, *who*, and *how*: word processors; clocks, watches, and calendars; maps and GPS; contact lists, social media, and expert finders; and checklists and process maps (Lewis, 2012b). Some help with answering *which*. Option Outlines help record consequential "choices and reasons made that often are either not captured, or were buried" (Lewis, 2013). Figure 4 shows the difference between a decision tree and an option outline.

> *Decisionmakers in business use visualization tools to help them every day. When they ask "where," they use a map, compass, or GPS unit to see where they are and where they want to go. When they ask "how," they use a process map to see what step they are on. When they ask "which," they use a decision matrix to see the criteria and weights that help them make a single decision. But when they ask "why," to visualize multiple decisions, there are currently no commonly used tools.*
>
> *An Option Outline™ [Figure 4] allows us to see an entire train of thought before being asked to provide our opinion on individual choices which are taken out of context.*
>
> *(Lewis, 2013)*



Source: (Lewis, 2013, figure 4.1)

Figure 4: Decision Tree Versus Option Outline

Option Outline: Work Project – Why Solution 2	
We would rather program the code in-house	↓
We would rather focus on our core competencies	(Choice)
Contract the work to custom programmers	↓

Option Outline: Work Project – Why Solution 2	
Use the supported off-the-shelf software	(Choice)
Select vendor W, W, or Y	↓
Select vendor Z (Link to Weighted Decision Matrix)	(Choice)
Wait for missing low priority feature in the next version	↓
Add custom code for missing low priority feature	↓
Missing low priority will have temporary workaround	(Choice)
"Now I have extra work, so Z was a bad decision"	(Opinion)

Source: Adapted from Lewis (2013, figure 4.2); (Lewis, 2015b, internet archive)

Figure 5: Sample Option Outline

It is reflective thinking and to a degree indicates (truth) as shown by the validity and dispositional scales: "sentiment, persuasion, belief, and conviction" and "feeling, thinking, believing, knowing" (Sisson and Ryan, 2017 figure 6).

> *This approach adds visualization and sense-making to activities now occurring in all organizations, but happens as box-checking, without understanding and transparency. There are currently tools to help humans with how, where, when, etc., but few ubiquitous tools [are] found for why. "The most important question is the least supported." Transparency International has demonstrated that transparency (into decision and process corruption) [indicates] "how well people will live." (Lewis, 2013; Lewis and Sisson, 2016; Sisson, 2023)*

Few tools help us answer the basic question of "why" when asking to see, in one snapshot, the multiple options and decisions that have led to the current situation. Projects end with choices made that were either not captured or were buried somewhere within the prose of many documents (Lewis, 2013). It is possible to envision an option outline for the choices evaluated in a large government solicitation that would render protest futile. Policymaking is a mental exercise. The societal implications of Option Outlines may be the Explanation Age's most significant potential impact.

2.4 Innate Lesson Cycle

The acronym ADIIEA lists the six steps for the Innate Lesson Cycle: automation, disruption, investigation, ideation, expectation, and affirmation (Figure 6). "ADIIEA does not assume that learning is based on a cyclic conversion between tacit and explicit knowledge (SECI model), but that learning is based on knowing if something works" (Lewis, 2014, figure 3): does work, won't work, and could work. Questioning and reflective and reactive answers from the 8 Degrees of Reason help in the ADIIEA steps.

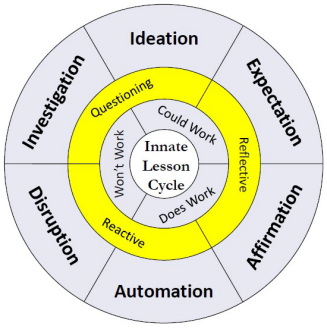
Innate Lesson Cycle ™	**Related 8 Degrees of Reason ™**
	**Questioning →? ←** **Reasoning → . ←** **Responsibility → . ←** **Sequence → . ←** **State → . ←** **Entity → . ←** **Prescriptive → . ←** **Reactive -→ ! ←**
Source: (Lewis, 2012b)	*Source:* (Lewis, 2013)

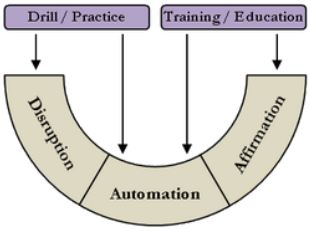
Figure 6: Innate Lesson Cycle and Reasons: Note Punctuation Marks

Punctuation tracks across languages. Spanish poses a question by placing a question mark at the beginning of a sentence. *Reactive* can result from conditioning or determination. The Innate Lesson Cycle promotes reasoned determination.

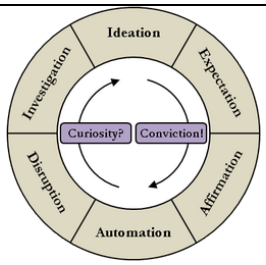
> *"Learning is no longer something that is said to be the core function of an organization; [now] learning is something that can be shown as the core function of an organization. The purpose of ADIIEA is to replace the current 'box-checking' models with a 'sense-making' model to help prepare organizations for the knowledge economy" (Lewis, 2014).*

Traditional education, training, practice, and drills alone produce half-pipe learning. Training, practice, and drills condition responses for useful habits, however, investigation, ideation, and expectation phases of the full pipe produce better system-level understandings (Figure 6). Lewis's table 1 (2014), compares the ADIIEA phases to Six Sigma DMAIC (define, measure, analyze, improve, and control), PDCA (plan, do, check, and act), and "Making a Law Steps" models. Automation, the old status quo, now has both codification and control and follows affirmation. The full-pipe cycle learning provides for "curiosity?" and "conviction!" (Lewis, 2019a, internet archive).

Figure 7 shows how formal training and education focus on "half-pipe" learning. Figure 8 shows the complete model: analyze and discover for investigation, design and plan for ideation, etc. The model provides a detailed plan for systems innovation and Knowledge Management Systems implementation. Learning moves from "add-on" work as education or individual training to "an integrated framework for business processes and organizational learning." (Lewis, 2014). Lewis (2013) goes on to discuss forward thinking and how the Innate Lesson Cycle can be used in strategic planning, talent management (Figure 8), innovation maturity, and learning organization roles. "It suggests creating an Integrated Framework for Business Processes and Organizational Learning built around [the concept]" (Sisson, 2023).



Source: Adapted from Lewis (2014, figure 5); Lewis (2019a, internet archive)

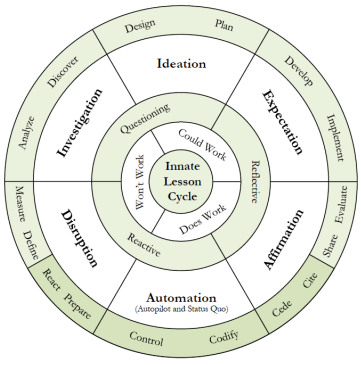
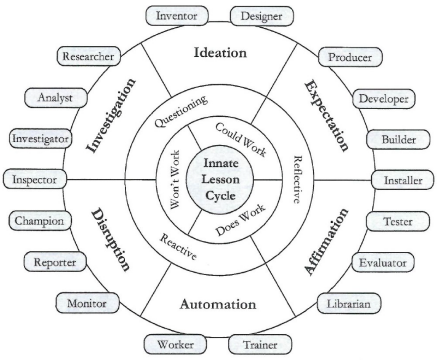


Source: Adapted from Lewis (2019a, internet archive)

Note: Leadership is similarly described, transactional or transformative (Lewis 2022a). (Bass, 1990)

Figure 7: Education and Training Versus a "Minds Natural Model of Change and Learning"

Change is constant (Lewis, 2022b; Kirk, 1951). The Innate Lesson Cycle is a well-enabled, unified model providing an excellent approach for change management and innovation.

Innate Lesson Cycle™	**Talent Management Learning Organization Roles**
	
Source: (Lewis, 2014, figure 4)	*Source:* (Lewis, 2013, figure 5.10)

Note: The bottom of the cycle is darker to highlight those sections. *Cite* as a starting point cedes authority, and learning gets stuck in the half-pipe.

Figure 8: Innate Lesson Cycle™ and Application

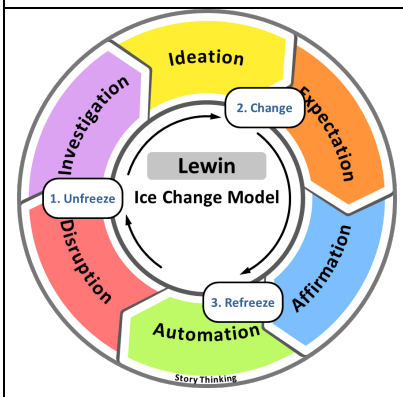
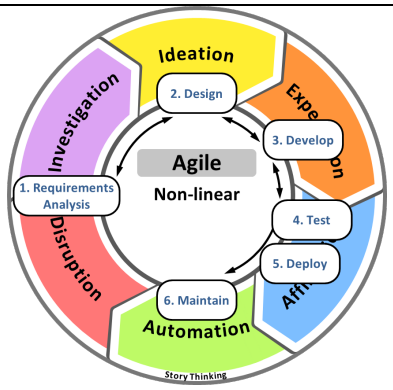
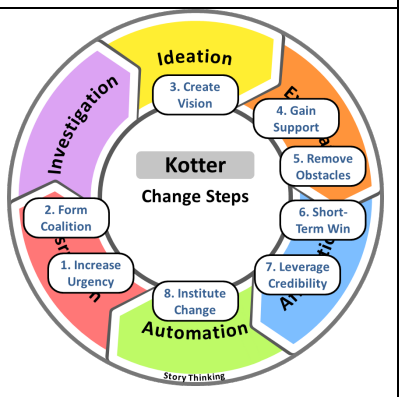
3. Storytelling

We are wired for stories.

Storytelling is used for past, [present.] and future stories.

Story Thinking brings story structure into now-time to challenge current prescriptive models for change, work, and learning. (Lewis, 2022b)

"'We think in story. It's hardwired in our brain. It's how we make strategic sense of the otherwise overwhelming world around us' (Cron, 2012)" (Lewis, 2022c). "Storytelling is a communication strategy." Story Thinking as a practical operational strategy extends the implementation capabilities of the Innate Lesson Cycle. Leaders tell stories about past successes as examples of how the organization succeeded for "historical context and lessons learned." Lewis's (2022c) present-time stories address "working and learning models." Leaders should tell stories about the future they envision and strategies to achieve them. This "natural, storytelling pattern which 'aligns to Kolb's learning cycle but with more detail.' It 'also aligns with the latest in neuroscience' (Lewis and Sisson, 2016) as described by Nobel Prize winner Kahneman (2011) in *Thinking Fast and Slow,*' and begins descriptive as opposed to other models that begin prescriptive (Lewis, 2014). (Lewis and Sisson, 2016)" (Sisson, 2023). Current present-time stories address planning (do, check, and act), defining (measure, analyze, improve, and control), analyzing (includes design, develop, implement, and evaluate), and unfreeze (change and refreeze), and more from the Innate Lesson Cycle shown in Figure 9. The Innate Lesson Cycle becomes the Story Thinking Cycle when storytelling moves to Story Thinking and can be used as an operational strategy. The cycle "allows for 'rocking' between phases, but it begins and ends in our most natural state: automation." One advantage is that the approach addresses often occurring sticking points. Most current models are prescriptive (Lewis, 2022c; Lewis, 2022a, fifty listed on slide; Bennet, Bennet and Turner, 2022).

Describing Change	Facilitating Change	Persuading Change
Lewin	*Agile Methodology*	*Kotter*
		

Note: The Innate Lesson Cycle and Story Thinking not only describe change but also facilitate and persuade.

Source: Extracted from Lewis (2022a)

Figure 9: Change and sustain Management

Emotions can provide clues to which Innate Lesson Cycle phases a person or team may be stuck within. Instead of using a long list of positive emotions and negative emotions, specific emotions relate to each phase. For example, for the Affirmation phase, positive emotions include: Accepting, Trusting, Joy, Pride, and Gratitude. And negative emotions include: Dissatisfied, Disappointed, Sad, Guilt, and Shame. (Lewis, 2022c)

In Story Thinking, quad-loop learning provides five types of feedback: compliant, productive, inventive, perceptive, and goal (Lewis, 2019b, figure 4.2). Storytelling past, present, and future are communication strategies. Story Thinking ™ is an operational strategy.

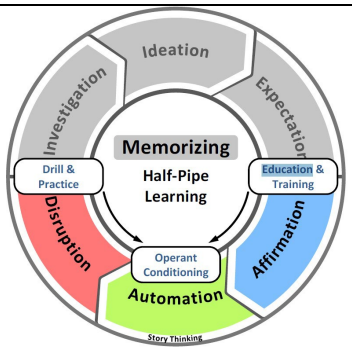
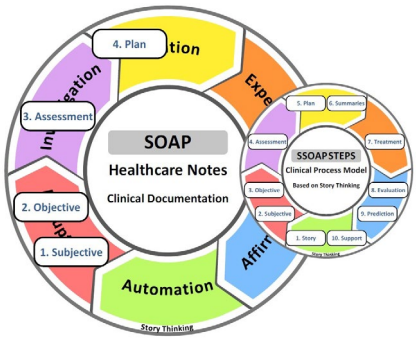
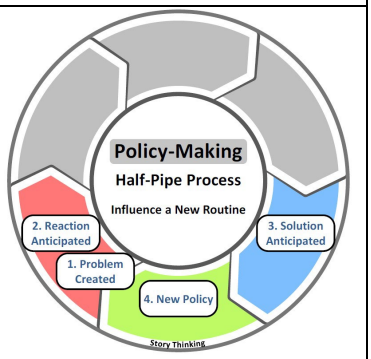
4. Implications

There is a plethora of prescriptive models that are not mapped back to a complete descriptive model—one that maps back to what we are wired for (the way we make sense)—such as the Innate Lesson Cycle. This results in unneeded disruptions to those models' execution, gaps in execution, and often incomplete solutions.

The unified Innate Lesson Cyle underlies all change models (Lewis, 2020). There are multiple ways to view images in Figure 9 and Figure 10. One is Lewin (Lewis, 2022a): the agile methodology and other approaches skip steps and offer silver bullets that provide efficiency in specialty situations. The Innate Lesson Cycle provides a fallback when there are problems. The second view is that "there is no such thing as a silver bullet" (Sheard, 2003; Sheard, Circa 2003; Hijazi and Subhan, 2020, re: maintenance and repair of medical devices) and these earlier solutions are deficient. By example, Kotter seems to skip investigation and pulls solutions from thin air.

Looking at the fifty models compared to the Innate Lesson Cycle from a Story Thinking perspective, three of the images can be used to clearly show the significant implications to society and why the current models are not working as well as users might desire. Memorization/training is half-pipe. Conditioning, such as multiplication tables, is useful, but less so for other skills. CDIO (conceive, design, implement, operate) is a facilitating change for engineeering students. In healthcare, for example, SOAP (subjective, objective, assessment, and plan) is used to develop a treatment plan for a patient. It is not traditional half-pipe, and still only addresses half the needs. Completing the circle facilitates effective change. Policymaking also has a full-pipe facilitating model.

OODA (Observe, Orient, Decide, Act) enables reacting to a change (facilitating model). It is a learning approach that conditions users to enable fast reaction (Lewis, 2022a). It is an exception to the silver bullet rule.

Persuading Change	*Persuading to Facilitating Change*	*Persuading Change)*
Education	*Healthcare – SOAP+*	*Policy Making*
		

Source: Extracted from Lewis (2022a)

Figure 10: Change Methodologies

5. Leading Transformational Leadership

The CoHero leadership framework leverages the Innate Lesson Cycle. It is "more like 'sense making'" than "box checking." The holistic unified model is addressing requirements for change phases, management strategies, and leadership attributes. "Transformational change starts when we move our belief from 'Does Work' to 'Won't Work'" to "Could Work." It leverages ideation, collaboration, project-based, case-based, answer, dashboard, business rules, workflow, risk/decision, business intelligence, and discovery systems at different points in the cycle. (Lewis and Moran, 2015). They explain the ADEIIA phases, their associated management strategies, related leadership attributes for each, needed personas, and questions to drive the phases—making planned innovation achievable.

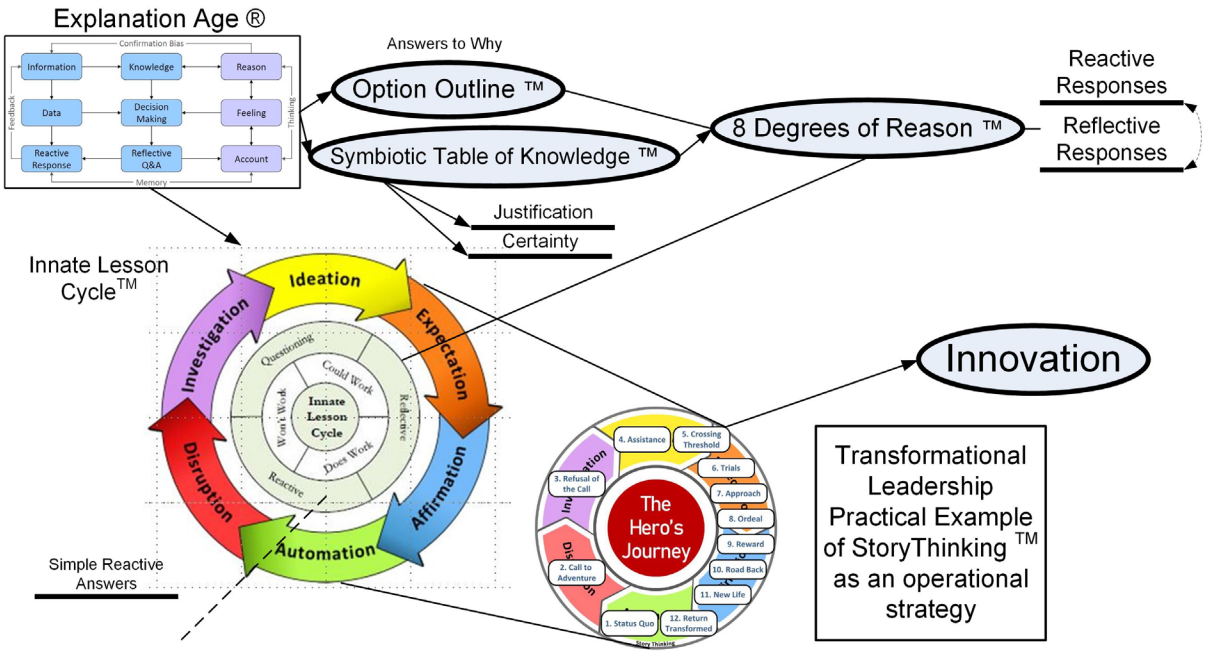
6. Integrated Viewpoint

All the previously mentioned concepts fit together as shown in Figure 11. The 8 Degrees of Reason help ensure reflective responses in the Innate Lesson Cycle. The symbiotic table of knowledge assists with certainty and justification. Option Outlines provide a record. Transformation Leadership encompasses the Innate Lesson Cycle and builds on storytelling to provide a concrete approach to learning.

7. Conclusion

John "wrote Story Thinking because neuroscience shows we are wired for stories. Now we can see 'YOU ARE HERE' within the map of 'story' that produces understanding" (Lewis, 2022c). "There is an inherent relationship between knowing concepts and having the language to describe them" (Lewis, 2013). "OCR [optical character recognition] works because of the 'R.' You recognize where you are in time (when), on a map (where) [now] in an explanation (why)" (Lewis, 2012b). The Innate Lesson Cycle enables full-cycle learning and provides a foundation for Story Thinking ™ as an operational strategy and transformative leadership as an expression of it. Collectively, they provide the new kind of thinking needed for "the fourth industrial revolution based on intelligence and digital connectivity (using a story mental model) (Lewis, 2020)" (Sisson, 2023).

Oliver Wendell Holmes once said, "I wouldn't give a fig for the simplicity on this side of complexity, but I would give my right arm for the simplicity on the far side of complexity." He was describing the elegance found only after having the knowledge of the options and choices considered from each lesson phase which leads to a state of proficient automation (Lewis, 2013). Memorizing what to do (simplicity) is not the same as also knowing the trade-offs involved when creating the prescriptive steps (elegance).



Source: Adapted from Sisson (2023, section 2.2.2.2.5), Innate Lesson Cycle™ reproduced from Lewis (2014), and updated with ideas from Story Thinking™ (Lewis, 2019b).

Figure 11: John Lewis's Explanation Age® Integrated Concepts

"Without a map, we are lost, in geography and epistemology" (Lewis, 2021).

Acknowledgements

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The Meaning of Power Users in the Wikipedia Working Environment

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Abstract: One of the most popular sites to observe collaborative content creation on the Internet is Wikipedia. A significant part of the publication devoted to this encyclopaedia focuses on special forms of collaboration, such as WikiProjects, which allow to effective work sharing. The aim of the paper was to identify power users working in public spaces of Wikipedia, especially in WikiProjects, and to determine their importance for this form of cooperation in knowledge sharing. The research question was: what is the meaning of the Power Users in Wikipedia? The methods used in the paper were content analysis of activity logs of Wikipedians and participatory observation. The author presents the results of his own research on the total number of WikiProject users in the two language versions of Wikipedia: Polish and Korean. The research presented the existence of power users in the Polish and Korean versions. There was a moderately strong relationship between the length of time one remained active on Wikipedia and the time of joining as a Wikipedian, and a weak relationship between seniority and the number of WikiProjects in which the user was active. In turn, participatory observation identified the roles of power users, mainly as initiators of action in Wikipedia. The presented research results could be used mostly for coordinators of online communities, but also for the initiators of the new undertakings in cyberspace.

Keywords: Content analysis, Knowledge management, Knowledge sharing, Variability in online communities, Wikipedia power users

1. Introduction

In the history of mankind, it is possible to point to many projects that have been created by thousands of committed members of various societies, ranging from monumental buildings to the largest internet projects. It was not uncommon for these to be based on the collaboration of a small number of professionals with non-professional volunteers, as was the case with the creation of the Oxford English Dictionary (Stvilia et al, 2008), or the Geographical Dictionary of the Kingdom of Poland (Parucki, 1955). The advent of the internet has greatly accelerated operations and enabled many more people to work together. This includes Wikipedia, which Jemielniak called the greatest project ever created by humans (Jemielniak, 2014).

The speed of content creation and the size of the project, however, do not mean faster knowledge completion. Compared to traditional encyclopaedias, the language versions of Wikipedia elaborate on certain topics at the expense of others that are not described (see: Żurek and Skolik, 2009). This is due to the adopted Bazaar model, in which no initial plans are made, no rigid tasks are set and no time is set for their completion (Raymond, 2001). Over time, the formalization of operating procedures contributed to collaboration between Wikipedians becoming closer to the opposite model, referred to as the Cathedral model (see: Arazy et al., 2019). Such a hybrid approach to the collective management of knowledge sharing processes is particularly visible in WikiProjects. These are special pages dedicated to cooperation within particular thematic areas and they are also the result of the existing division of labour.

The development of Wikipedia was made possible by reaching a certain critical mass. The critical mass theory assumes that there is a shift from the dispersed actions of individualists, to identification with the group and to the realisation of group interests (Oliver, Marwell, & Teixeira, 1985). Since a user entering the community is usually not familiar with the value system of Wikipedians (Wikipedia users), he/she may push his/her own point of view. However, his/her encounter with certain inconsistencies with relation to his/her own values allows him/her to accept a change more easily in terms of his/her own point of view. Experimental studies have shown that this phenomenon occurs if the level of such incompatibilities is moderate (Jirschitzka et al., 2017). The greater one's seniority, the more frequent such experiences are, while it is easier for Wikipedians to adopt a neutral point of view. Some researchers assume that the critical mass is not so much a great number of users, but precisely the core of the community, referred to as power users (Solomon & Wash, 2014).

The aim of this paper is to define the role of power users with relation to collaboration between Wikipedians. As this collaboration can occur in many fields, the research was limited to the space of WikiProjects. WikiProjects are special pages, which bring together teams of people who want to interact with each other in a specific field of knowledge. This publication is also an extension of previous research on WikiProjects, which focused on other aspects of their participants' activities (Skolik, 2022). Then it was noticed that the majority of

people operating in WikiProjects are users who joined Wikipedia prior to 2010. A certain incentive to continue research in this area is also the search for reasons for the regression of WikiProjects, observed by the author for almost a decade. Thus, the question was asked as to whether power users could have an impact on developing or blocking other peripheral initiatives related to knowledge sharing.

The literature review identified the state of research on the phenomenon of critical mass and the different roles of power users in their relationship with the Wikipedia community. The methodological section outlines how the empirical material was collected and formulates the research hypotheses. The quantitative research encompassed both the Polish and Korean versions, while the qualitative research exclusively related to the Polish language version. Thanks to the research conducted, the author at hand initially defined the role that power users can play in the context of developing and maintaining initiatives in Wikipedia.

2. Literature Review

In subject-related literature, power users are defined as individuals who, by engaging with the community, contribute disproportionately to the rest of the community. According to the 'law of participation inequality', in sites that are open to collaborative content creation, 90% of users remain passive consumers (lurkers), 9% are contributors to the site and only 1% are frequent users (Nielson, 2006). Wikipedia has an even more skewed distribution. 80% of changes are made by only 2.4% of users (Crowston & Fagnot, 2018, p. 90). What is more, power users engage in activities in different areas simultaneously (Bright et al, 2020). Users clustered around a narrow topic generally perform less activities than those who try to engage in more than one WikiProject (Skolik, 2022).

The high level of skewness of the distribution of participants' activity implies great inequality in another respect as well. Some participants have a low entry threshold, which means it is very easy to get involved. Others only get involved when they see that a particular venture is popular (Huang, Suh, Hill, & Hsieh, 2015). The ease of engagement may occur amongst people who, by taking many initiatives, become more visible and thus build their prestige. In Wikipedia, this behaviour is referred to as edit counting and sometimes leads to rivalry. Wikipedia users regularly post rankings of the most active people (see 'List of Wikipedians by Number of Edits', 2023). Clear differences between power users and peripheral newcomers can also lead to an imbalance in decision-making. The most active users may pursue vested interests and display 'territorial' behaviour, which in turn may discourage newcomers from getting involved (Brandtzaeg & Heim, 2011).

Whether internet users will engage may be influenced by initial interactions with the community. Advanced forms of supporting the adaptation process are associated with more active Wikipedia users and their increased productivity (Karczewska, 2022). Furthermore, if users try to search for errors at the start, the likelihood of them staying on Wikipedia increases threefold (Crowston & Fagnot, 2018). It may be assumed that the more active individuals are those who try to find a suitable niche for their activities themselves.

With a high level of inclusivity linked to the ease of performing activities in the community, issues of skills and leisure budget are irrelevant (Bright et al., 2020). In such a situation, the number of participants can steadily increase, and power users can motivate more individuals to try out the opportunities to become part of the community. One can speak of positive feedback here. Clear correlations are also noted between the Wikipedia experience and support for open collaborative knowledge creation models (Aibar et al, 2015).

However, learning the new skills necessary to operate in a project takes time. At the same time, the lack of experience does not guarantee that the first edits in the encyclopaedia articles will not be rejected by the community. Thus, power users change their roles from motivators to gatekeepers. This has been experienced, among others, by researchers trying to help develop Wikipedia. The people who communicate with them initially are usually Wikipedians who specialise in tracking changes made and catching vandalism. It is not uncommon to see frustrated users reacting harshly to a lack of knowledge of the rules (see Konieczny, 2021). It is much easier to involve people who will not feel the need to prove again that they have a lot of experience in a particular area of knowledge. Supporting postdocs and young academics (Kennedy, 2021, p. 175) is indicated as a solution to this impasse.

Adaptation to Wikipedia's virtual environment may depend on the length of time it has been online. In the initial stages of development, there are no clear structures of rights and no clear polarization. After about 60-80 months, there is a phase transition in which a linear relationship is observed between the number of editors, editions and new entries. At the same time, the number of new registered users (Castro et al, 2019) starts to fall with this phase transition. This could mean that Wikipedia reaches stability at this point and is no longer dependent on the influx of newcomers, which translates into greater restrictiveness. Great involvement

in organizing the work related to the creation of Wikipedia articles, therefore, leads to limiting the potential of knowledge sharing.

As Solomon and Wash (2014) point out, in the case of Wikipedia and the WikiProjects created within it, group identity is not necessary to achieve a critical mass effect. Indeed, users have a high intrinsic motivation to get involved in the development of the encyclopaedia entries. In order to act longer, it is necessary to accept the rules established within, and therefore to identify with the community's value system. However, far-reaching homogeneity does not serve productivity. If a group is heterogeneous, its members can complement the content by referring to other sources of information, for example. If there is more turnover among users, greater sustainability may be achieved. This, in turn, is more likely to encourage newcomers to join (Dabbish et al, 2012).

The growth of WikiProjects, which are deliberately designed collaborative spaces, is more pronounced when 1) a lot of Wikipedians join initially and 2) the communities that form are more heterogeneous. WikiProjects are also more attractive when those joining can see first and foremost what there is to do on a particular topic and when they can develop WikiProject tasks (see: Solomon & Wash, 2014). Power users can both foster the generation of critical mass in the early stages of the development of WikiProjects and limit diversity by imposing an organisational framework.

The author of this paper assumes that the observed regression in the performance of WikiProjects (see: Luyt, 2018) in the various language versions is linked to a decline in the inflow of new power users who could engage communities in collaboration. In order to determine this, it was decided to identify the existence of power user groups and to investigate the general trends in participation in WikiProjects.

3. Materials and Methods

Both qualitative and quantitative research methods were used in the study. The quantitative research was conducted in 2022, while the selection of language versions for the quantitative study was carried out in several stages. Firstly, versions were selected in which declarations of WikiProject affiliation on Wikipedia pages could be easily identified. A particular category existing in 34 language versions was used for this purpose. In the next step, the language versions of Wikipedia in which a Wikiproject space existed were selected as follows: Spanish, French, Esperanto, Polish, Korean, Japanese, and Romanian. Due to the time-consuming nature of acquiring results, two of them were chosen for further research, namely: Polish (plwiki) and Korean (kowiki). In the following, for the sake of brevity of the paper, the author uses the abbreviations adopted in the Wikipedia community, plwiki and kowiki, respectively. Both versions were selected in previous research projects (Skolik 2022). The usefulness of the research conducted was assumed amongst the same population in the context of referring to previous findings.

At a previous stage, the number of edits made in individual language versions of Wikipedia was examined in February and March 2022. In addition to this, changes in activity among Wikipedians joining at different periods of the project's development were observed by analysing user page ID numbers (Skolik 2022). In order to define the number of editions conducted by a Wikipedian, including the number of editions in the particular types of pages (among others, WikiProjects), while also the time of the first and last edition, in which the XTools were availed of (‘Edit Counter’, 2023). With additional measurement, it was possible to determine the relative time of staying in the project, which allowed further research hypotheses to be constructed. Data was again collected in June and July for 2330 declared WikiProjects participants in plwiki, and in November for 795 WikiProjects participants in kowiki. Correlations between variables were tested using Spearman's ranking due to high skewness, in particular with regard to the number of edits made by Wikipedians.

Qualitative research was netnographic (Kozinets, 2015). These mainly included participatory observation, which has been conducted since 2005 in Polish-language Wikipedia. Participation also meant taking an active part in editing pages, while also undertaking and initiating discussions on collaboration issues, as well as co-creating collaboration strategies. Active participation in these discussions facilitates familiarization with the relationship between particular Wikipedians and the constantly recurring problems. Thanks to quantitative research, a group of the most active Wikipedians who could potentially discover the roles of power users was identified. However, by analysing the content of discussions in which they participated in the past, an attempt was made to define the role for each of them in the context of activities aimed at creating areas of cooperation. The focus was mainly on archival discussions, in which important community initiatives were decided, including those regarding the condition of WikiProjects. The author also considered his own interpersonal relationships with these users.

In order to answer the questions put forward, the following hypotheses were formulated:

H1: In the preliminary years of the development of Wikipedia, Wikipedians who joined are more active than those who joined later.

H1a: Users who opened their account earlier on Wikipedia conducted more editions throughout the period of their activity than users operating later .

H1b. After more than twenty years of the functioning of Wikipedia, the most active users are still those who joined in the first years of Wikipedia existence.

H2. Among the users of the greatest level of seniority and maintenance of a high level of activity, a significant group plays a significant role for the activation of areas of cooperation.

H3: The longer the users remain active in Wikipedia, the greater the number of WikiProjects they take part in.

A positive verification of H1 would facilitate the definition of Wikipedians as potential candidates for power users. The number of editions performed however, does not signify that the user remains constantly active. Taking this into account, it was assumed that the number of editions performed is correlated with the time of joining Wikipedia, while also in the case of users who are still active. The current activity signifies the performance of editions at a maximum of one month prior to the time of conducting research.

For the purpose of verifying H2, information accumulated by the author as an insider conducting systematic and longstanding observation of the participants was used, in which there was a particular concentration on the discussions on the subject of cooperation, while also the creation of regulations, modifications to the interface, etc. This section of research exclusively referred to plwiki. The formulation of this hypothesis was essential as maintaining activity for years is insufficient in order to state that a Wikipedian plays a significant role in controlling the activities of others, while also initiating actions or blocking them. Some Wikipedians focus almost exclusively on editing the content of articles and limit their influence to the principles of knowledge sharing in Wikipedia. In turn, expressing approval or disapproval on the part of those recognised in this environment may have an impact on the decisions of others – among others, engagement in WikiProjects.

H3 is the expansion of a similarly formulated hypothesis in the previous research project, in which the time of remaining active in Wikipedia was not taken into account. This hypothesis was established due to the observation of the phenomenon of declaring participation in many WikiProjects by newcomers while their activity was low. Sometimes the activity of newcomers was limited to copying declarations of participation from other users to their own user pages, and then their activity expired. At the same time, among the most engaged users who have been active in Wikipedia for a long time, a significant number is related to one or two fields of knowledge, while some of the oldest ones do not declare belonging to WikiProjects at all.

4. Results

In parts of the quantitative research, the assumed hypotheses were verified. The formulation of H1 was preceded by a preliminary analysis of the distribution of activities of the users with relation to the time of registration of their accounts. In the scatter graphs (Figure 1, Figure 2), it is possible to note a large number of participants of WikiProjects of very low numbers of ID. The points on both of these graphs created by two clear lines indicate the following: 1) users that are active until the moment of research at the top sections of the graphs, while also 2) users who withdrew from further editing not long after registering their account in the lower sections of the graphs. The concentration in the top left section of both graphs is created by users who could initially be referred to as power users.

In order to verify H1a, the correlations between the number of editions conducted by users and their ID numbers were checked. In the cases of plwiki and kowiki, a negative correlation existed between the ID of the users and the number of editions performed, namely, $p<0.05$, yet the power of the statistical dependency was only slight. In plwiki, Spearman's rho correlation equals -0,244645, while in kowiki -0,143454. H1b assumed that the correlation would exist between the ID of the users and the number of editions performed also in the case of wikipedians who were active in the year of 2022 (during the time of conducting research). In this case, not only did the statistically significant dependency exist between the variables, but the power of this dependency was greater. In terms of plwiki, Spearman's rho correlation equals -0.331070, whereas in kowiki -0.363558.

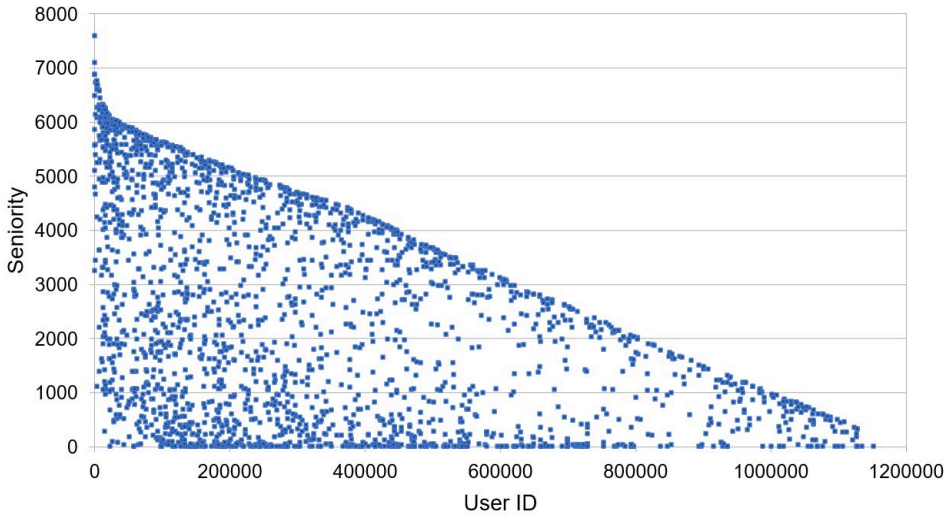


Figure 1: Relationship Between Seniority (number of days between the first and last edit made) and WikiProjects Participant ID Number in plwiki

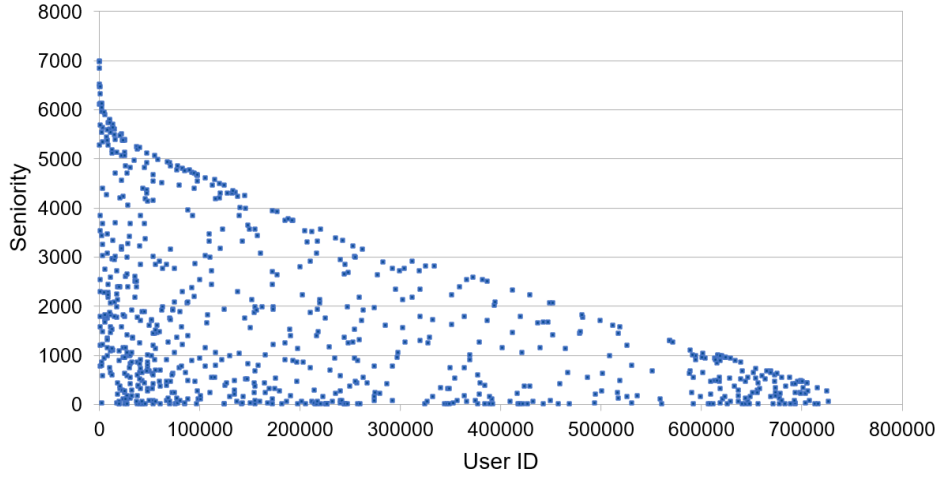


Figure 2: Relationship Between Seniority (number of days between the first and last edit made) and WikiProjects Participant ID Number in kowiki

In order to illustrate the initially observed phenomenon of over-representation of users of a relatively high level of seniority, histograms were also prepared for both versions. They present three categories of users as follows: 1) users who resigned from editing Wikipedia within the first day, 2) users who remain active, while also, 3) inactive users who edited longer than one day. Amongst the wikipedians who left the project the fastest, this time amounted to only several hours (Figure 3), whereas in multiple cases it was a case of only minutes. As regards the participants of the project who edited longer, yet were not active during the course of conducting the research, there were also the majority of users who edited over the shortest time span and their number dropped together with the increasing level of seniority (Figure 4). In turn, in the case of the remaining users, there were certain differences between plwiki and kowiki. In terms of plwiki, there was a prevalence of people who joined after several years following the commencement of Wikipedia, whereas in the kowiki, the majority related to people who had a lower level of seniority, yet it was possible to note the drop in the number of people who joined in the second decade of the 21st century, namely between 1000 and 4000 days prior to conducting the research (Figure 5).

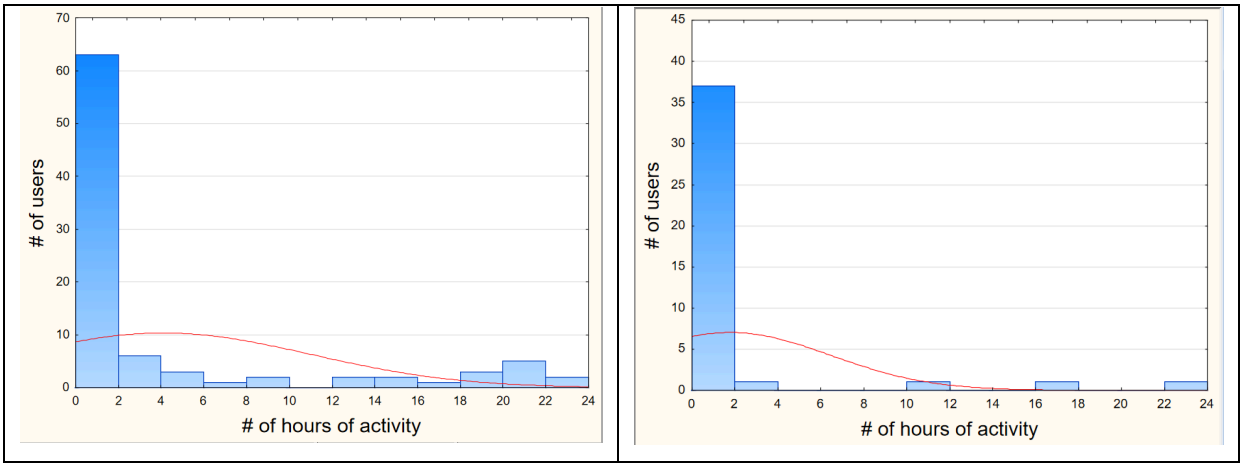


Figure 3: Distribution of Numbers of Users Resigning from Editing with Reference to the time in Which they Were Active. On the Left is the Histogram for plwiki, While on the Right for kowiki

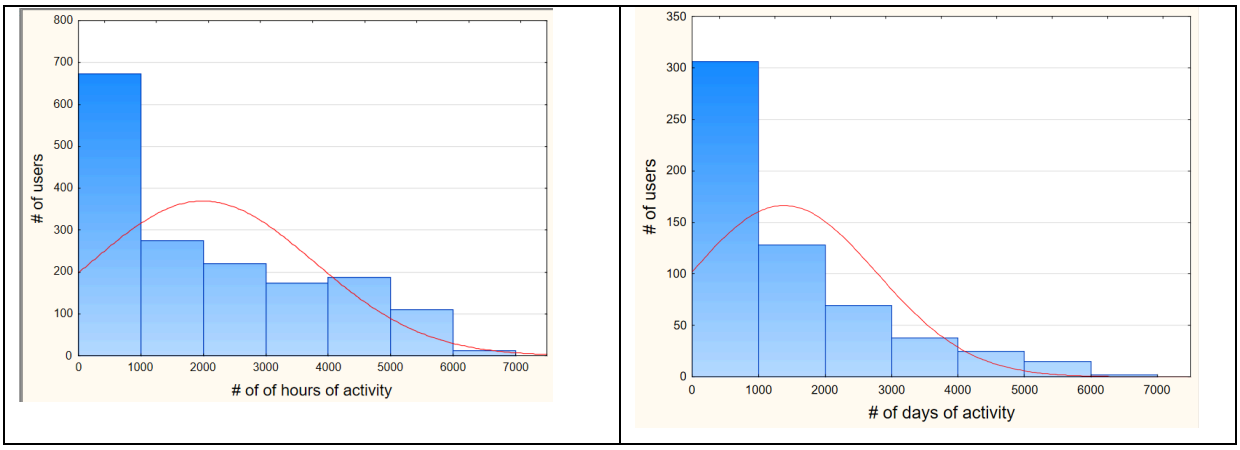


Figure 4: Distribution of Numbers of Inactive Users who Edited Wikipedia longer Than one day. On the Left is the Histogram for plwiki, While on the Right for kowiki

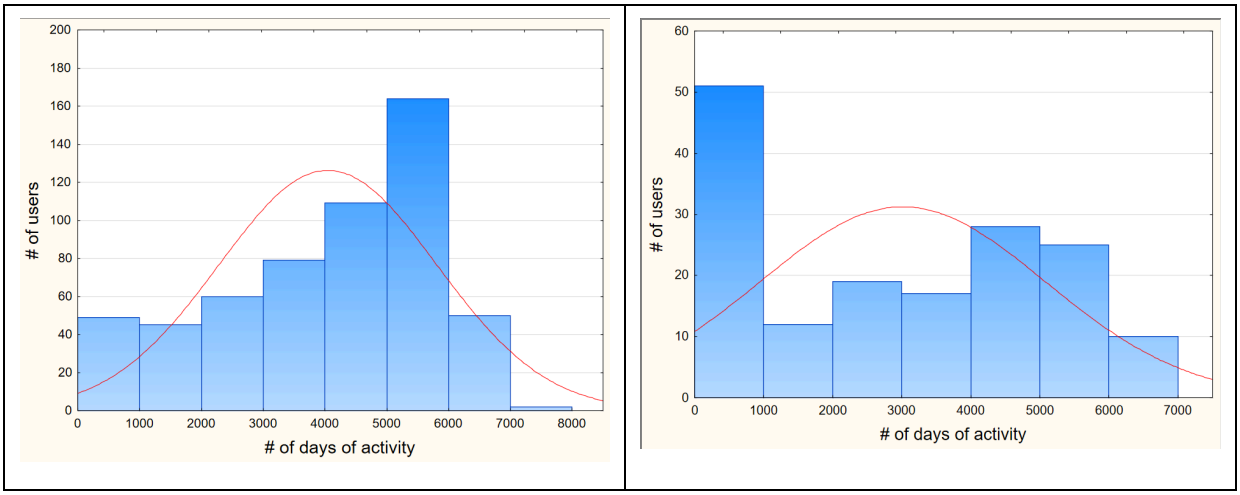


Figure 5: Distribution of Numbers of Users Remaining Active in Wikipedia. On the Left is the Histogram for plwiki, While on the Right for kowiki

It is possible to acknowledge that a clear over-representation of people operating longer in the project among active members of WikiProjects exists in plwiki, whereas in kowiki a stratification is more evident. Users with the lowest level of seniority are more active, while also operating in the preliminary years of the functioning of Wikipedia. Likewise, H1 was verified positively only with relation to plwiki. In both cases, however, it can be assumed that it was much easier for people who joined the formalizing project to lose their enthusiasm for

sharing knowledge. Meanwhile, senior Wikipedians spend more time on their substantive work than on socializing with new WikiProjects members. This may be due to the tiredness of the routine of transferring knowledge about the rules that prevail in Wikipedia.

The verification of H2 was possible for the author due to the systematic observation of the participant, as well as the possibility of interpreting the discourse in the native language. In order to define the role of power users in terms of their impact on the areas of cooperation in sharing knowledge, 128 accounts were first of all selected among the active members of WikiProjects in plwiki. These were accounts of users who started to edit Wikipedia prior to the year of 2007. Subsequently, with regard to each individual (account), their activity was defined with regard to the community and whether these people have an impact on the community by means of participation in general discussions.

Among the chosen accounts, 13 still had a large impact on decision making, while 15 people had a greater impact in the past, yet now only a slight one, whereas the subsequent 16 people had an impact on the activities of others that were restricted to certain areas of the functioning of Wikipedia. Among these groups of users, 25 people had the function of an administrator (authorized to block the possibilities of editing users or deleting pages). This was a very high percentage as the number of people with such authorizations in plwiki at the moment of publication amounted to 95. Furthermore, 36 people belonged to 500 of the most active users in 2022, of which 12 occupied places in the ranking of activity from 13 to 78. As was indicated by previous research projects, 2.4% of users conduct 80% of the modifications (Crowston and Fagnot, 2018, p. 90), whereby the numbers provided above indicate a very high degree of involvement of people with a high level of seniority.

The definition of the role of power users was very intricate. Some wikipedians were for instance, creators of WikiProjects, yet were involved only to a small degree in terms of inviting others to joint editing of slogans. Some organised actions of joining with others from an external environment, but the acceptance of their activities in the community was low. Certain users tried to maintain the *status quo* and blocked new reformatory initiatives, whereas in other cases they adopted the role of sceptical gatekeepers. Of the 39 people who were possible to define as having clear roles associated with influencing cooperation, 27 people previously initiated areas of cooperation or acted on behalf of its promotion, while 32 people were previously or currently engaged in maintaining activities of various types of initiatives, while only 8 blocked new initiatives, or strived towards closing existing areas of cooperation.

To verify H3, editorial seniority (the number of days from the first to the last edit) was compared with the number of declarations of affiliation to different WikiProjects on user pages. Significant statistical relationships were shown in plwiki and kowiki. In terms of plwiki, Spearman's rho correlation equals 0.194268, and in kowiki 0.276423. This could indicate that there is more pressure in kowiki to contribute to WikiProjects or that in plwiki, the effectiveness of WikiProjects is assessed more critically.

5. Discussion

In the cited previous studies, the assumption was made that skills and having a larger leisure budget did not matter for online activity (Bright et al., 2020). However, other publications have pointed out that more difficult activities significantly reduce co-operation. An example of this is the expansion of data tables found in individual articles. Although entries are edited by many different users, in as many as 35% of cases the tables are only developed by the people who created them (Bleifuß et al, 2021). A similar situation occurs when developing keywords to be placed on the homepage as featured. Typically, such an entry is expanded by one user, with others making only minor corrections (Feldstein, 2011). In such cases, it is possible to identify a distinct core and extensive periphery of social networks.

Individual WikiProjects tend to be created by small communities and it would be difficult to define core and periphery. Globally speaking, however, attitudes towards group collaboration are important. In this study, it was shown that there is a category of users who dominate the majority of WikiProject members in terms of seniority and activity. One drawback is that the first declarations of affiliation posted on Wikipedia pages started to appear a few years after the creation of Wikipedia and the first WikiProjects. Thus, the data presented does not include participants in WikiProjects who left before there was an option with the posting of such declarations. On the other hand, there are also quite a few power users who refrain from “decorating” their user pages with declarations.

The statistical dependency between the seniority and activity of Wikipedians turned out to be moderately strong in the case of people who still remained active. Thus, it is a significant premise to acknowledge seniority

as an important factor in terms of identifying power users. In turn, the weak dependency between the seniority and the number of WikiProjects, which an individual engages in may certify to the scepticism of power users with regard to this form of cooperation. After all, they had been able to develop their own collaborative paths for several years prior to the creation of WikiProjects, and this new form was not necessary for them. In addition, the groups creating WikiProjects often set their own guidelines for a particular area of Wikipedia, which was not always in line with the generally accepted policies. In 2011, plwiki started to monitor the activity of WikiProjects more closely and archived those that were no longer active due to not reaching a sufficient critical mass. This may certify to the demobilizing role of power users, yet in the case of wikipedians from plwiki, who actively attempted to "reform" Wikipedia by means of eliminating inefficient areas of cooperation, they were also critical with relation to other forms of cooperation. These were more often than not people who commenced activities later, who became very active and also quickly became burnt out.

Studies cited earlier indicate that there is a phase transition of approximately 60-80 months after the launch of Wikipedia, accompanied by a relative decline in the number of new users (Castro et al., 2019). Perhaps this phenomenon is more common and also applies to WikiProjects. The apparent increase in the number of WikiProjects being set up is from 2005 to 2007, with the plwiki being from 2006 to 2007 (see: 'Wikipedia:Wikiprojekt', 2022). In contrast, the first drop-in activity is seen in terms of those who joined in 2013. If WikiProjects reached a critical mass during this time, they were allowed to continue operating, while others were deactivated. The author's participatory observation allows him to acknowledge that achieving a critical mass became much easier if several power users were involved in the WikiProject and at the same time remained active for many years. The deactivation of Wikiprojects is not so much the result of a decrease in the involvement of power users. Rather, it was the WikiProjects themselves that became the rigid framework that enforced routine operations. Meanwhile, the investigated power users were involved at an early stage not only in terms of editing, but also significantly in the broader free culture movement. This movement, in turn, was focused on the freedom to share knowledge and engage external actors to achieve the effect of critical mass.

6. Conclusion and Limitations

The research carried out indicates that power users may be identified and that there are certain associations between their activity and engagement with WikiProjects. The quantitative research, however, did not clearly identify the roles of power users for the collaborative space on Wikipedia. Nevertheless, qualitative research was restricted to only one language version. This requires additional qualitative research, particularly an analysis of the contributions of individual power users and a discourse analysis of the operation of WikiProjects. What would be particularly valuable would be research conducted by several groups of researchers from different national cultures, which would facilitate a more complete analysis of Wikipedia content in different languages.

So far, a lot of valuable research has been done on Wikipedia as a whole, especially in terms of its English version. However, the spontaneous spaces of cooperation in knowledge sharing, their formalization and the effectiveness of cooperation at the micro-sociological level are still not sufficiently studied. As these phenomena are constantly changing, it is also necessary to develop new methodological approaches in order to be able to obtain enough data for further analysis.

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Protection and Promotion of Traditional Knowledge of Marginalised Communities: A Legal Perspective

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Abstract: Marginalised rural communities, particularly in tropical countries such as those within Southeast Asia, are often aware of the use of indigenous herbs and agricultural products but concomitantly oblivious as to the means of protection and promotion of using their traditional knowledge. It is estimated that around 1,500 plant species have been widely used for traditional medicines in Southeast Asia. The paper will commence with a discussion of the meaning of "traditional knowledge", adopting a utilitarian perspective. The paper focuses on the countries of Southeast Asia and provides a legal analysis of the protection of traditional knowledge provided under international treaties, namely: Agreement on Trade-related Aspects of International Property Rights (TRIPS); International Convention for the Protection of New Varieties of Plants (UPOV), International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA); and the Convention on Biological Diversity (CBD). To date, the World Intellectual Property Organization (WIPO) has been unable to agree on the contents of an international legal instrument relating to intellectual property rights over genetic resources, traditional knowledge, and traditional culture. The legislative responses of the 11 nations of Southeast Asia are analysed. Much of the focus of international treaties is on protecting plant breeders' rights over farmers' rights, and this imbalance should be addressed. Governments should be proactive and amend their patent legislation to require patent applicants to declare their use of indigenous resources and knowledge. Examples of the development and promotion of traditional knowledge are briefly described.

Keywords: Legal systems, Traditional knowledge, Intellectual property, Marginalised communities, Southeast Asia, farmers' rights

1. Introduction

Marginalised rural communities, particularly in tropical countries such as those in Southeast Asia, are often aware of the use of indigenous herbs and agricultural products but are oblivious as to how to protect and promote their traditional knowledge. In the Forward to the 2nd edition of ASEAN Herbal & Medicinal Plants, the Secretary-General of ASEAN estimated that around 1,500 plant species have been used for traditional medicines. With reliable support, the people in the region could benefit from utilising herbal and medicinal plants to improve their livelihood and support healthcare (p. iii) (Sukmajaya et al., 2017).

The Southeast Asian nations are Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar, Philippines, Singapore, Thailand, Timor Leste (East Timor), and Vietnam. All except Timor Leste are members of the Association of Southeast Asian Nations (ASEAN). Timor Leste was granted observer status in November 2022 (ASEAN, 2022). Timor Leste gained independence in 2002, but has yet to develop its corpus of Intellectual Property (IP) law. As a result, WIPO statistics show that there have been no patent or trademark registrations in the country, although there have been registrations by residents abroad (WIPO, 2023d).

1.1 Definition of Traditional Knowledge

There are a variety of definitions of traditional knowledge (TK). A utilitarian definition developed by Balick (2007) considers traditional knowledge as

> *[the] body of information and set of skills developed by a group of people over time [and] in a constant state of change. As each generation matures, skills perceived as immediately useful are gained, while others with a lower perception of immediate value may be lost. Thus the body of traditional knowledge is never static but rather dynamic in its shape and substance (p 280).*

This definition subsumes the terms indigenous knowledge (IK), traditional knowledge (TK) and local knowledge (LK) identified by (Onyancha, 2022). However, the utilitarian definition is more useful, and the (United Nations Permanent Forum on Indigenous Issues, 2019) considers that traditional knowledge is "the knowledge, innovations and practices of indigenous peoples [d]eveloped from experience gained over the centuries and adapted to the local culture and environment". This paper uses traditional knowledge in the broadest sense.

1.2 Geographical Indications

As defined in the *Agreement on Trade-related Aspects of International Property Rights (TRIPS)*, "Geographical indications are, for the purposes of this Agreement, 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 characteristic of the good is essentially attributable to its geographical origin." (art 22.1). The key to understanding the purpose of Geographical indications (GIs) is embodied in the notions of a special tie between the origin and the product, as claimed for drinks such as Darjeeling tea and Champagne, as well as cheeses, for example, Parmigiano Reggiano, and many other products.

2. International Treaty Protection for Traditional Knowledge

2.1 World Intellectual Property Organization (WIPO)

The World Intellectual Property Organization (WIPO) is a self-funding special agency of the United Nations (WIPO, 2023c). All 11 Southeast Asian Nations are Parties to the WIPO Convention (WIPO, 2023b). In 2001 the WIPO General Assembly established the Intergovernmental Committee on Intellectual Property and Genetic Resources, Traditional Knowledge and Folklore (IGC, or IGC-GRTKF). Since then, the IGC has tried to agree on the best way to recognise Traditional Knowledge and cultural expressions (Heilprin, 2022).

In July 2022, the WIPOs General Assembly decided that no later than 2024, the preparation of a draft international instrument on the protection of genetic resources and traditional knowledge and the associated discussions must be completed (Heilprin, 2022). "Proposals to require patent applicants to declare their use of indigenous resources and knowledge, among other measures, have been languishing in a WIPO committee for decades" (para 3).

WIPO established the Geneva Act of the Lisbon Agreement (2015) to provide an international GI registration system. Cambodia and Lao PDR are the only Southeast Asian nations that are party to the Geneva Act (WIPO, 2023a). Kampot Pepper from Cambodia was the first product registered as a Geographical Indication (GI) under the Geneva Act (WIPO, 2021).

2.2 Agreement on Trade-Related Aspects of International Property Rights (TRIPS)

In order to accede to membership of the World Trade Organization (WTO), members and potential members must also accede to the *Agreement on Trade-related Aspects of International Property Rights (TRIPS)* (2017) (art 1.1). Whilst not explicitly referring to traditional knowledge, TRIPS covers two related topics that have a significant impact, namely geographical indications and patents.

TRIPS requires Members of the WTO to provide legal means to protect goods "where a given quality, reputation or other characteristics of the good is essentially attributable to its geographical origin" (TRIPS, art 22.1). In short, they are required to protect the geographical indication of goods. This area is worthy of exploration to protect TK, as knowledge and expression are often tied through culture to a particular area.

Members must ensure patents are "available for any inventions, whether products or processes, in all fields of technology, provided they are new, involve an inventive step and are capable of industrial application (TRIPS, art 27.1). They are, however, able to:

> *exclude from patentability inventions, the prevention within their territory of the commercial exploitation of which is necessary to protect ordre public or morality, including to protect human, animal or plant life or health or to avoid serious prejudice to the environment, provided that such exclusion is not made merely because the exploitation is prohibited by their law (TRIPS, art 27.2).*

Nevertheless, "Members shall provide for the protection of plant varieties either by patents or by an effective sui generis system or by any combination thereof" (TRIPS, art 27.3(b)). A *sui generis* system (literally "of its own kind") refers to the ability of a Member to establish their own system rather than using the patent system, many adopting UPOV (below) based legislation or both patent and plant protection.

All Southeast Asian nations are members of the WTO, and thus parties to TRIPS, except Timor Leste, which has Observer status (WTO, 2022).

2.3 International Convention for the Protection of New Varieties of Plants (UPOV)

The aim of the *International Convention for the Protection of New Varieties of Plants (UPOV*) is to grant breeder's rights to those who have developed a plant variety that is new, distinct, uniform, and stable (UPOV, art 5(1)). All

that is required is for the applicant to comply with the law of the Contracting Party where the application has been lodged and the required fees paid (UPOV, art 5(2)). The right is to be granted for a fixed period of no less than 20 years except for trees and vines, where the period is no less than 25 years (UPOV, art 19). The Contracting Parties must be members of the International Union for the Protection of New Varieties of Plants (UPOV, art 23). It is clear that the aim of the Convention is to protect "professional" plant breeders and not holders of traditional knowledge.

Singapore and Vietnam are members of UPOV (UPOV, 2022a), whilst Brunei Darussalam, Cambodia, Indonesia, Laos PDR, Malaysia, Myanmar, Philippines, and Thailand have observer status (UPOV, 2022b).

2.4 International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)

The *International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)* "seeks the conservation and sustainable use of plant genetic resources for food and agriculture and the fair and equitable sharing of the benefits arising out of their use, in harmony with the Convention on Biological Diversity, for sustainable agriculture and food security" (ITGRFA, art 1.1). Notably, the Contracting Parties must recognise Farmers' Rights, including:

- protection of traditional knowledge relevant to plant genetic resources for food and agriculture;
- the right to equitably participate in sharing benefits arising from the utilisation of plant genetic resources for food and agriculture; and
- the right to participate in making decisions, at the national level, on matters related to the conservation and sustainable use of plant genetic resources for food and agriculture (art 9.2).

In addition, the Treaty requires "the Contracting Parties recognise the sovereign rights of States over their own plant genetic resources for food and agriculture, including that the authority to determine access to those resources rests with national governments and is subject to national legislation" (ITGFRA, art 10.1). Annex 1 lists the plant genetic resources for food and agriculture covered by the Treaty.

Brunei Darussalam, Cambodia, Indonesia, Lao PDR, Malaysia, Myanmar and the Philippines are Contracting Parties to the Treaty; Thailand is a signatory but has not ratified the Treaty; Singapore, Timor Leste, and Vietnam are not signatories (FAO, 2023).

2.5 Convention on Biological Diversity

The objectives of the Convention on Biological Diversity are:

> *the conservation of biological diversity, the sustainable use of its components and the fair and equitable sharing of the benefits arising out of the utilisation of genetic resources including by appropriate access to genetic resources and by appropriate transfer of relevant technologies, taking into account all rights over those resources and to technologies, and by appropriate funding (art 1).*

Unlike the other international treaties discussed above, the *Convention* refers explicitly to traditional knowledge:

> *Subject to its national legislation [each Contracting party shall] respect, preserve and maintain knowledge, innovations and practices of indigenous and local communities embodying traditional lifestyles relevant for the conservation and sustainable use of biological diversity and promote their wider application with the approval and involvement of the holders of such knowledge, innovations and practices and encourage the equitable sharing of the benefits arising from the utilisation of such knowledge. innovations and practices (art 8(j)).*

All eleven countries are Parties to the *Convention* (CBD, 2023).

The *Nagoya Protocol* requires the Contracting Parties to

> *take legislative, administrative or policy measures, as appropriate, with the aim of ensuring that benefits arising from the utilisation of genetic resources that are held by indigenous and local communities, in accordance with domestic legislation regarding the established rights of these indigenous and local communities over these genetic resources, are shared in a fair and equitable way with the communities concerned, based on mutually agreed terms (art 5(1)).*

Only Cambodia, Indonesia, Laos PDR, Philippines, Malaysia, Myanmar and Vietnam are parties to the Protocol (CBD, 2023).

3. Initiatives of the Association of Southeast Asian Nations

The aim of the *ASEAN Framework Agreement on Intellectual Property Cooperation* is to strengthen their cooperation in IP (art 1(1) and "promote cooperation in the field of intellectual property among government agencies as well as among the private sectors and professional bodies of ASEAN" (art 1(2)).

In 2000 ASEAN issued the *ASEAN Declaration on Cultural Heritage.* Their definition of cultural heritage includes "indigenous knowledge systems and practices" (art 1). Further

> *ASEAN Member Countries recognise that traditional knowledge systems and practices, including designs, technology and oral literature, are collectively owned by their local community of origin. ASEAN Member Countries shall ensure that traditional communities have access, protection and rights of ownership to their own heritage. ASEAN shall cooperate for the enactment of international laws on intellectual property to recognise indigenous populations and traditional groups as the legitimate owners of their own cultural heritage (art 9).*

In addition, every person has the right to enjoy the benefits of modern scientific and economic progress and their applications (art 11).

Resources published and or developed by the ASEAN Secretariat include:

- ASEAN Intellectual Property Rights Enforcement Handbook (de Beer, 2021)
- Guidelines on Protection of Geographical Indications in ASEAN Member States (ASEAN, 2019)
- Geographical Indications in the ASEAN Region (ARISE+, 2019)
- Traditional Knowledge Digital Library of ASEAN Centre for Biodiversity – a database "crafted on the codified traditional knowledge, particularly about medicinal plants and formulations". (ASEAN Centre for Biodiversity, 2019)
- Handbook on IP Commercialisation - Strategies for Managing IPRs and Maximising Value (ASEAN Secretariat, 2019)
- Comparative Study on Genetic Resources, Traditional Knowledge and Traditional Cultural Expressions (GRTKTCE) (Janke et al., 2020)

Details of plant treaties to which the Southeast Member States are currently contracting parties are provided in Table 1.

Table 1: Southeast Asian Member States Membership of International Plant Treaties (as of 30 April 2023)

Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Timor Leste	Vietnam
World Intellectual Property Convention										
X	X	X	X	X	X	X	X	X	X	X
Geneva Act of the Lisbon Agreement on Appellations of Origin and Geographical Indications										
	X		X							
Agreement on Trade-related Aspects of International Property Rights (TRIPS)										
X	X	X	X	X	X	X	X	X	obs	X
International Convention for the Protection of New Varieties of Plants (UPOV)										
obs	obs	obs	obs	obs	obs	obs	X	obs		X
International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA)										
X	X	X	X	X	X	X		sig		

Brunei Darussalam	Cambodia	Indonesia	Lao PDR	Malaysia	Myanmar	Philippines	Singapore	Thailand	Timor Leste	Vietnam
Convention on Biodiversity										
X	X	X	X	X	X	X	X	X	X	X
Nagoya Protocol of Convention on Biodiversity										
	X	X	X	X	X					X

Source: The authors. X = contracting party; obs = observer; sig = signatory only

4. Legislative Protection of Traditional Knowledge Within the Southeast Asian Nations

Each of the Southeast Asian nations has used its own approach to protecting traditional knowledge. Some have enacted omnibus legislation, whilst others have developed a whole suite of legislation. The analysis has been undertaken country by country in alphabetical order and focuses on traditional knowledge (*sensu amplo*) only. Where similar approaches have been adopted, only the details of the first country using that approach are described in detail. Because of space limitations, subsidiary laws and regulations are not discussed.

4.1 Patent Protection

For an invention to be patentable in **Brunei Darussalam,** it must be new, involve an inventive step and be capable of industrial application (Patents Order, 2011 s 13(1)). An invention is "capable of industrial application if it can be made or used in any kind of industry, including agriculture" (s 16(1)). A medical treatment invention for humans or animals is considered incapable of industrial application and hence not patentable (s 16(2)). However, the product is patentable for other applications, provided it is capable of industrial application (s 16(3)). Similar provisions apply in the *Patent Act* of **Singapore** (s 16).

In **Cambodia**, the *Law on Patents* prohibits the patentability of medical treatments (art 4(iii)), plants and animals other than micro-organisms (art v), and plant varieties (vi). Pharmaceutical products are unpatentable until 1 January 2033 under the Law on Amendments to the Law on Patents 2017 (art 136). The **Indonesian** *Law on Patents* (art 9) has similar patent prohibitions as Cambodia, except that there is no reference to pharmaceutical products. Under the *Law on Intellectual Property (Amended)* of the Lao PDR, medical treatments (art 21(3)) and plants and animals (art 21(4)) are not eligible for registration. The **Malaysian** *Patents Act* also denies patentability to plants and animals (s 13(b)) and medical treatments (s 13(d)) but allows the patentability of products used in medical treatments (s 13(d)). **Myanmar** also denies patentability to medical treatments, plants and animals under the *Patents Law* (s 14(A)). The **Philippines'** patentability requirements are regulated by the *Intellectual Property Code of the Philippines* (s 22) and are the same as those of the **Malaysian** *Patents Act*. In **Thailand**, as well as naturally occurring organisms (s 9.1) and medical treatments (s 9(4), the compounding of a drug to fill a doctor's prescription (s 36(3)) is not patentable under the *Patent Act*.

Patents in **Vietnam** are regulated by the *Law on Intellectual Property* as amended by *the Law amending the Law on Intellectual Property*. Again, plants, animals and medical treatments are non-patentable (art 59).

4.2 Plant Varieties Protection

Plant breeders are given protection in **Brunei Darussalam** under the *Plant Varieties Protection Order*. Restricted farmers' rights are protected (s 30). The *Law on Seed Management and Plant Breeders Rights* of **Cambodia** is similar concerning the protection of farmers' rights. **Indonesia**'s *Law on Plant Variety Protection* is also similar except for one crucial proviso: local varieties owned by the community are under the control of the Government (art 7(1)), as are their regulation (art 7(4)). The **Lao PDR** *Law on Intellectual Property* has similar plant breeder protections (pt IV). However, it exempts acts done privately and for non-commercial purposes, experimental purposes, and breeding of other varieties (art 86). **Malaysia** has enacted the *Protection of New Plant Varieties Act* to protect plant breeders' rights while protecting farmers' rights (s 31). **Myanmar** approached the development of plant varieties in two directions.

On the one hand, the *New Plant Variety Protection Law* protects plant breeders' rights whilst protecting farmers' rights and the *Seed Law (as amended)* to develop the quality of the existing seed stock. The Philippine Plant Variety Protection Act regulates plant varieties protection in the Philippines and includes limited protection of farmers' rights (s 43(d)). In **Singapore,** the *Plant Varieties Protection Act* only includes limited protection of farmers' rights (s 31(2). **Vietnam** protects plant breeders' rights under the relevant provisions of the *Law on Intellectual Property as amended* (art 157-art 197). At the same time, the *Seed Ordinance* seeks to develop the seed industry as "plant genetic resources are a national property which is managed by the State" (art 101).

Thailand provides the most comprehensive rights for domestic users under the *Plant Varieties Protection Act.* In particular, it allows for the registration of a plant variety that only grows in a particular locality and has not been registered as a new plant variety (s 42). It can be registered by a community that can share in the profits so generated (s 49). In addition, the Act established a *Plant Varieties Protection Fund* to provide funds "for the purposes of assisting and subsidising activities related to the plant varieties conservation, research and development" (s 54).

4.3 Promotion of Traditional Medicine

Both **Myanmar** with the *Myanmar Traditional Medicine Council Law* and **Thailand** with the *Protection and Promotion of Traditional Thai Medicinal Intelligence Act* legislated to control, protect and promote traditional medicine.

4.4 Geographical Indication Protection

GIs can be registered in **Brunei Darussalam** under Trade Mark legislation. It can be "a mark distinguishing the goods or services of members of an association which is the proprietor of that mark from those of other undertakings" (s 50). Alternatively, it can be "a mark indicating that the goods or services in connection with which it is used are certified by the proprietor of that mark in respect of origin, material, mode of manufacture of goods or performance of services, quality, accuracy or other characteristics" (s 52). A similar definition is included in the *Trademark Law* of **Myanmar** (s 2(o)), which covers GIs. The **Philippines** regulates GIs under the Trademark provisions of the *Intellectual Property Code of the Philippines* (pt III). A GI is not defined. Instead, a collective mark is to be used. It is"any visible sign designated as such in the application for registration and capable of distinguishing the origin or any other common characteristic, including the quality of goods or services of different enterprises which use the sign under the control of the registered owner of the collective mark" (s 121.2).

Cambodia uses specific GI legislation – *Law on Geographical Indications*. In **Indonesia,** GIs are regulated under the *Law Regarding Trademarks and Geographical Indications*. **Lao PDR** protects GIs under the *Law on Intellectual Property* (pt III). **Malaysia** has enacted specific GI legislation – the *Geographical Indications Act*. **Singapore** enacted the *Geographical Indications Act* to cover GIs. In **Thailand**, GIs are protected under the *Protection of Geographical Indications Act*. **Vietnam** regulates GIs under the GI provisions of the *Law on Intellectual Property* (art 79-art 83).

5. Practical Examples of Community Engagement

This section provides brief examples of community engagement to protect and commercialise traditional knowledge (sensu amplo) in the agricultural sector.

5.1 Commercialising Traditional Products

- *Plai Oil for Pain Relief* - Walailak University worked with the local community and the subdistrict hospital to identify traditional herbal remedies, prepare guidelines for their use and develop a product for commercialisation (Walailak University, 2021a; Walailak University, 2021b).

5.2 Developing Geographical Indications

- *Khao Khiriwong Mangosteens* – Walailak University worked with the local community to register the mangosteens by defining their unique characteristics and growing conditions (Walailak University Prepares, 2020).
- *Development of Legal Framework in Cambodia* - Agence Française de Développement (AFD) assisted in the administration and development of GIs (AFD, 2019b)
- *Developing the Bolaven Plateau Coffee Industry in Lao PDR* - AFD has supported the Bolaven coffee industry, including its GI registration since 1998 (AFD, 2019a).

5.3 Developing and Commercialising New Products

- *Van Yen Cinnamon (Vietnam) and Mak Mao Berry Juice (Thailand)* - AFD assisted with promotional activities to take advantage of their GI registration (AFD, 2019b).

6. Discussion and Recommendations

There is a tendency within the Southeast Asian nations to protect plant breeders' rights using the UPOV Convention model whilst providing less protection to traditional knowledge and farmers' rights. Whilst some nations provided little or no protection, Myanmar, Thailand and Vietnam developed a more balanced legal framework. This imbalance should be addressed by legislation similar to Thailand's *Plant Varieties Protection Act* and the *Seed Laws* of Myanmar and Vietnam. Whilst ASEAN has undertaken work on recording medicinal herbs, a monumental task remains.

Southeast Asian economies are actively developing GIs, with Thailand particularly encouraging and marketing its GI products. Trademarks are a necessary but not sufficient method for registering GIs. GIs should not just link a product to a region, as is the case with trademarks. They should also relate to the unique properties required to define the quality of the product. It is considered that this inadequacy should be addressed by Brunei Darussalam, Myanmar and the Philippines by amending their legislation to cover GIs as a particular type of IP, as is the case in the other economies. Currently, only Cambodia and Lao PDR are parties to the Geneva Act of the Lisbon Agreement established by WIPO to provide an international GI registration system. Whilst ASEAN has its own GI registration, it could investigate whether there are benefits in its members becoming parties to the Geneva Act. The downside is the small number of parties requiring members to register their products to individual non-members as required.

Research undertaken by the authors indicates that some Universities may be undertaking research that is potentially based on earlier traditional knowledge without acknowledging the source. Governments should be proactive and amend their patent legislation to require patent applicants to declare their use of indigenous resources and knowledge while WIPO negotiations to that end continue.

A suitable IP legislative framework only is only a part of the solution. The suite of legislation must provide coverage for both the protection and the promotion and commercialisation of traditional knowledge. In addition, there must be a suite of legislation and codes of practice addressing items such as good manufacturing practices (GMP), product safety, advertising codes of practice and trade practices.

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Intellectual Capital of Humanities and Art Sciences and the Efficiency of its Formation at Scientific Institutions

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Abstract: In the present situation of the formation of intellectual capital (IC) of humanities and art sciences at scientific institutions (SIs) in Latvia, the theme of the research is highly topical. The object of the research is the formation of IC of humanities and art sciences 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 humanities and art sciences 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 humanities and art sciences at SIs in Latvia in the period from 2013 to 2018. The followingtasks were determined to reach the objective: to study the formation of IC of humanities and art sciences at SIs; to identify the concept of the efficiency of the involvement of academic staff and students in the formation of IC of humanities and art 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 students in the formation of IC of humanities and art sciences at SIs in Latvia. Research methods used in the paper are content analysis, economic analysis ,and economic experiment.

Keywords: Intellectual capital indicators, Social sciences, Scientific institution, Academic staff, Students

1. Introduction

Compared to the previous work by Spica et al (2022) this paper draws a more complete portrait of IC of humanities and art sciences and the efficiency of its formation at SIs in Latvia. Here, the same methodology as in the previous work has been applied.

Every six years, the Ministry of Education and Science of the Republic of Latvia (MoES) organises an international eva-luation 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 the efficiency indicators of academic staff involved in the formation of IC in humanities and art sciences at SIs of Latvia (MoES, 2021), the authors used the output data of findings across the set of evaluation of SIs of humanities and art sciences per period from 2013 to 2018 offered by “Technopolis-group” (TG).

TG developed the above IESIA for the periods from 2006 to 2011 and from 2013 to 2018 using similar methodology. It enables the authors to calculate the IC indicators in humanities and art sciences at SIs of Latvia and to compare their dynamics during the period from 2013 to 2018.

The comparative analysis of efficiency indicators of involvement of academic staff of humanities and art sciences at SIs of Latvia in the IC formation will let them to establish whether and how the technological business environment affects them. The IESIA was organized during the economic crisis caused by Covid-19. 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 humanities and art 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 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, a 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 educational management, 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 elaborated four indicators of the efficiency of the IC formation in a higher education establishment (HEE): (1) the efficiency of the involvement of academic staff in the IC formation per year in percentage (AIK); (2) the efficiency of the involvement of academic staff with a Doctorate degree in the IC formation per year in percentage (DIK); (3) the efficiency of the involvement of students in the IC formation per year in percentage (SIK) and,(4) mutual efficiency of the involvement of academic staff with Doctorate degrees and academic staff without Doctorate degrees in the IC formation per year in times (DE).

3. Methodology

In order to calculate the AIK, DIK, SIK, and DE of a HEE, Spica et al (2017a; 2017b) have developed 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 full-time jobs per year; SS represents the number of students per year.

For the purposes of the study, the authors modified these formulas. Namely, they calculated 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 obtained 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 patents (LPS). The authors calculated mutual efficiency indicators (PE) regarding involvement of the FTE aca-demic and research personnel (PS) and the FTE academic personnel (AS) in 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 personnel (KS), the number of PhDs obtained (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 total number of self-reported outputs (KS) in period from 2013 to 2018 per SI of humanities and art sciences in Latvia. The authors revised the above WS, RS, MS, LPS, and KS for one year.

The number of scientific publications and patents represents the main results of the IC formation at SIs of humanities and art sciences. TG analysed 11 SIs of humanities and art sciences of Latvia. Within the IESIA, output data on 10 public SIs and one private SI of Latvia were collected.

During the period analysed in the IESIA, there were only 11 such SIs in Latvia: Faculty of Architecture and Design and Faculty of Media and Creative Technologies of RISEBA University of Applied Sciences (RISEBA/H); National Library of Latvia (NLL); Latvian Academy of Culture (LAC); Faculty of Architecture of Riga Technical University (RTU/H); Faculty of Translation Studies of Ventspils University of Applied Sciences (VeU/H); Faculty of Humanities and Arts of Liepaja University (LU/H); Daugavpils University Research programme “Regional studies, literature and arts” (DU/H); Art Academy of Latvia (AAL); Institute of Literature, Folklore and Art of the University of Latvia (UL/LFA); Jāzeps Vītols Latvian Aca-demy of Music (JVLAM); and, Cluster of Humanities and Arts of the University of Latvia(UL/CHA).

In this study, one scientific publication or one patent is accepted as one unit of IC. Further, KIK, AIK, PIK, SIK, PE were calculated using the modified formulas 1; 2; 3; and 4. Next, according to the results obtained through the authors 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 to second place in- KIK, AIK, PIK and SIK received 5 points in the ranking, third to fourth place received 4 points, fifth to sixth place received 3 points, seventh to eighth place received 2 points ,and ninth to eleventh place received 1 point.

The above-mentioned assessment system allows to compare the quantitative efficiency indicators of SIs of humanities and art sciences 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 from 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, 9 SIs of humanities and art sciences have corresponding fields of science in Art, 6 SIs have corresponding fields of science in Languages and Literature, 5 SIs have corresponding fields of science in Other Humanities, 4 SIs have corresponding fields of science in History and Archaeology, 3 SIs have corresponding fields of science -in Philosophy, Ethics, and Religion, and, 2 SIs have corresponding fields of science in Media and Communications. In turn, such corresponding fields of sciences as Psychology; Other Social Sciences; Social and Economic Geography; Other Engineering and Technologies; Educational Sciences; Computer and Information Sciences; Sociolinguistics, Psycholinguistics, Contact Linguistics, Cognitive Linguistics, Literary Science 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 humanities and art sciences in Latvia is taken in the largest proportion by the RS - 70,16%, which is followed by the WS 16,22%, the MS -13,55%., and the LPS 0,07%.

To calculate the efficiency of the involvement of academic and research staff in the WS formation, the authors used formulas that have been developed and applied already before and are modified now.

$$AIK = (WS : AS) \times 100 \quad (1)$$

$$PIK = (WS : PS) \times 100 \quad (2)$$

$$KIK = (WS : KS) \times 100 \quad (3)$$

$$SIK = (WS : SS) \times 100 \quad (4)$$

$$PE = PIK : AIK \quad (5)$$

These indicators of SIs and their place in the rating of SIs of humanities and art sciences in Latvia as well as its scores are summarized in Table 1. The table of SIs indicators, ratings, and score was drawn up by the authors. The summarized indicators show that in general, in Table 1, the figure rests in the range from 3% to 450% in respect of a SI in Latvia. The highest indicator is SIK in the NLL, while the lowest indicator is KIK in the AAL. Comparing the figures collected in Table 1, the authors conclude that the highest AIK indicator of 54% goes to the DU/H, while the lowest AIK indicator of 4% belongs the AAL; the highest KIK indicator of 53% is owned by the NLL while the lowest KIK indicator of 3% is held by the AAL; the highest SIK indicator of 450% goes to the NLL while the lowest SIK indicator of 13% belongs to the JVLAM. The PS of the AAL is 11.6 times more efficient in the WS formation while the PS of the UL/CHA is only 0.5 times more efficient.

In Table 1, the authors created the rating and score of the SIs in Latvia based on the AIK, PIK, KIK, and SIK indicators of the efficiency of 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 DU/H; according to the PIK indicator, the first place and highest score is taken also by the DU/H; according to the KIK indicator, the first place and highest score is taken by the NLL; and , according to the SIK indicator, the first place and highest score is taken also by the NLL.

Table 1: The Efficiency of the Involvement of Academic and Research Staff in the WS Formation at SIs of Humanities and art Sciences 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-rageof AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rageof AIK & PIK & SIK score
RISEBA/H	39	3	4	42	7	2	20	4	4	3,0	1,1	0	0	0	2,0
NLL	0	0	0	53	4	4	53	1	5	2,0	0	450	1	5	3,0
LAC	9	7	2	73	3	4	8	9	1	3,0	8,4	49	5	3	3,0
RTU/H	23	4	4	121	2	5	19	5	3	4,5	5,2	58	4	4	4,3
VeU/H	10	6	3	44	6	3	8	8	2	3,0	4,5	36	7	2	2,7
LU/H	19	5	3	52	5	3	14	7	2	3,0	2,7	42	6	3	3,0
DU/H	54	1	5	354	1	5	47	2	5	5,0	6,6	130	3	4	4,7
AAL	4	9	1	41	8	2	3	11	1	1,5	11,6	24	9	1	1,3
UL/LFA	0	0	0	28	10	1	28	3	4	0,5	0	344	2	5	2,0
JVLAM	5	8	2	35	9	1	5	10	1	1,5	6,8	13	10	1	1,3
UL/CHA	49	2	5	22	11	1	15	6	3	3,0	0,5	34	8	2	2,7
Average	23			39			14				1,7	51			

On the other hand, when comparing the average KIK without the SIK, the highest score is obtained by the DU/H, and the comparison of the average KIK with the SIK shows that the highest score goes again to the DU/H.

The authors compared the SIK indicators of all students of HEE in Latvia to SIK indicators of PhDs students of SIs 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 PhD students was held by the NLL and it represented 450%.

When analysing the results obtained by SIs in the IC formation in the field of humanities and art sciences, the same methodology was used as in the field of social sciences. Thus, the quantitative results of SIs in both fields can be compared. One of the main criteria for the quantitative evaluation of SIs is the efficiency of the involvement of the SI staff in the formation of WoS and SCOPUS publications.

The comparison of the results of the two fields of science leads to conclusion that the highest score of the KIK in the field of social sciences is 278 % and it is obtained by the ISMA/S (Spica et al, 2022) while the highest score of the KIK in the field of humanities and art sciences is 53 % and it is obtained by the NLL. In addition, it should be noted that the highest score of the KIK in the field of humanities and art sciences is nevertheless lower than the 58 % received by the SBF/S, which is the lowest score in the field of social sciences (Spica et al, 2022).

A similar trend is observed when comparing the efficiency of the involvement of PhD degree holders in the formation of WoS and SCOPUS publications in the two above-referred fields of science. Here, the highest rate of the SIK in social sciences is 667 % and it belongs to the RAT/BS (Spica et al, 2022) while in humanities and art sciences the highest rate is 450 % and it belongs to the NLL. In turn, the lowest rate of the SIK in the field of

social sciences is 58 % and it is held by the CSSR (Spica et al, 2022), and the lowest rate of the SIK in the field of humanities and art sciences is 13 % and it is held by the JVLAM. This means that the lowest score in the field of social sciences, however, is almost 5 times higher than the lowest score in the field of humanities and art sciences.

In Table 2 the authors have calculated the efficiency of the involvement of academic and research staff in the RS formation, the authors used formulas 6; 7; 8; 9; and 10.

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 (10)

Table 2: The Efficiency of the Involvement of Academic and Research Staff in the RS Formation at SIs of Humanities and art Sciences 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-rageof AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK & SIK
RISEBA/H	527	1	5	567	4	4	273	1	5	4,5	1,1	0	0	0	3,0
NLL	0	0	0	198	6	3	198	3	4	1,5	0	1683	1	5	2,7
LAC	20	8	2	165	7	2	18	10	1	2,0	8,4	110	9	1	1,7
RTU/H	309	2	5	1615	1	5	259	2	5	5,0	5,2	779	3	4	4,7
VeU/H	143	5	3	647	3	4	117	5	3	3,5	4,5	531	4	4	3,7
LU/H	55	7	2	148	8	2	40	9	1	2,0	2,7	121	8	2	2,0
DU/H	186	4	4	1228	2	5	162	4	4	4,5	6,6	451	5	3	4,0
AAL	4	9	1	52	11	1	4	11	1	1,0	11,6	31	10	1	1,0
UL/LFA	0	0	0	96	9	1	96	6	3	0,5	0	1167	2	5	2,0
JVLAM	57	6	3	382	5	3	49	8	2	3,0	6,8	138	7	2	2,7
UL/CHA	201	3	4	90	10	1	62	7	2	2,5	0,5	140	6	3	2,7
Average	98			170			62				1,7	222			

In Table 2, in respect of SIs of humanities and art sciences in Latvia, the figure rests in the range from 4% to 1683%. The highest indicator is the SIK in the NLL but the lowest indicators are the AIK and the KIK in the AAL. Comparing the figures collected in Table 2, the authors conclude that the highest AIK indicator of 527% is held by the RISEBA/H, while the lowest AIK indicator of 4% belongs to the AAL; the highest PIK indicator of 1615% is held by the RTU/H while the lowest PIK indicator of 52% belongs to the AAL, the highest SIK indicator of 1683% is held by the NLL, while the lowest SIK indicator of 31% belongs to the AAL. When comparing the average AIK

and PIK, the highest score is obtained by the RTU/H and the comparison of the average KIK with the SIK shows that the highest score is also obtained by the RTU/H.

In Table 3 the authors have calculated the efficiency of the involvement of academic and research staff in the MS formation, the authors used formulas 11; 12; 13; 14; and 15.

AIK = (MS : AS) x 100 (11)

PIK = (MS : PS) x 100 (12)

KIK = (RS : KS) x 100 (13)

SIK = (RS : SS) x 100 (14)

PE = PIK : AIK (15)

Table 3: The Efficiency of the Involvement of Academic and Research Staff in the MS Formation at SIs of Humanities and art Sciences 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	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK & PIK &
RISEBA/H	54	2	5	59	5	3	28	2	5	4,0	1,1	0	0	0	2,7
NLL	0	0	0	4	11	1	4	9	1	0,5	0	33	5	3	1,3
LAC	24	4	4	198	2	5	21	3	4	4,5	8,4	132	3	4	4,3
RTU/H	21	5	3	112	3	4	18	4	4	3,5	5,2	54	4	4	3,7
VeU/H	7	7	2	30	6	3	6	8	2	2,5	4,5	25	7	2	2,3
LU/H	124	1	5	335	1	5	91	1	5	5,0	2,7	274	1	5	5,0
DU/H	10	6	3	67	4	4	9	7	2	3,5	6,6	24	8	2	3,0
AAL	2	9	1	26	7	2	2	11	1	1,5	11,6	16	9	1	1,3
UL/LFA	0	0	0	15	10	1	15	5	3	0,5	0	178	2	5	2,0
JVLAM	2	8	2	16	9	1	2	10	1	1,5	6,8	6	10	1	1,3
UL/CHA	44	3	4	20	8	2	14	6	3	3,0	0,5	30	6	3	3,0
Average	24			41			15				1,7	54			

In Table 3, according to the AIK , PIK, KIK, and SIK indicators, the first place and highest score is taken by the LU/H.

The authors compared the average AIK and PIK: the highest score is obtained by the LU/H. In addition, also the comparison of the average AIK, PIK ,and -SIK, shows that the highest score is also obtained only by the LU/H.

In Table 4 the authors have calculated the efficiency of the involvement of academic and research staff in the LPS formation the authors used formulas 16; 17; 18; 19; and 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 Humanities and art Sciences 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-rageof AIK & PIK score	PE in ti-mes	SIK (%)	SIK ra-ting	SIK sco-re	Ave-rage of AIK& PIK
RISEBA/H	15	1	5	17	1	5	8	1	5	5,00	1,1	0	0	0	3,3
Average	15			17			8				1,1				3,3

In Table 4, according to the AIK , PIK, KIK and SIK indicators, the first place and highest score is taken by the RISEBA/H.

From the results summarised in the tables 1; 2; 3; and 4, the authors conclude that the average SIK indicators are the highest for all IC forms. They are followed by the average PIK, AIK and KIK indicators.

Table 5: The Comparison of the Results of Qualitative and Quantitative Evaluation of Latvian SIs in the Field of Humanities and Art 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 by IC form (TAAP)	Difference of score (QTG-TAAP)	Difference of score (OTG-TAAP)	Total average score of AIK & PIK & SIK by IC form (TAAPS)	Diference of score (QTG-TAAPS)	Difference of score (OTGTAAPS)
RISEBA/H	2	1	3,3	-1,3	-2,3	2,2	-0,2	-1,2
NLL	4	4	0,8	3,2	3,2	1,4	2,6	2,6
LAC	4	4	1,9	2,1	2,1	1,8	2,2	2,2
RTU/H	3	3	2,6	0,4	0,4	2,5	0,5	0,5
VeU/H	2	2	1,8	0,2	0,2	1,3	0,7	0,7
LU/H	3	3	2,0	1,0	1,0	2,0	1,0	1,0
DU/H	4	4	2,6	1,4	1,4	2,3	1,7	1,7
AAL	4	4	0,8	3,2	3,2	0,7	3,3	3,3
UL/LFA	4	5	0,3	3,7	4,7	1,2	2,8	3,8
JVLAM	3	3	1,2	1,8	1,8	1,1	1,9	1,9
UL/CHA	3	3	1,7	1,3	1,3	1,7	1,3	1,3

From data summarized in tables 1; 2; 3; and 4 the follow-up authors calculated total average score of the AIK and the SIK by IC form (TAAP), and the total average score of the AIK, PIK and SIK by IC form (TAAPS). Then, the authors calculated differences of quality and overall scores by TG and TAAP, and TAAPS calculated by the authors (see Table 5).

Table 6: The Comparison of the Results of Qualitative and Quantitative Evaluation of Latvian SIs in the Field of Humanities and art 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 by IC overall (TAKO)	Difference of score (QTG-TAKO)	Difference of score (OTG-TAKO)	Total average score of KIK & SIK by IC overall (TAKOS)	Difference of score (QTG-TAKOS)	Difference of score (OTG-TAKOS)
RISEBA/H	2	1	3,8	-1,8	-2,8	1,9	0,1	-0,9
NLL	4	4	2,0	2,0	2,0	2,3	1,7	1,7
LAC	4	4	1,2	2,8	2,8	1,4	2,6	2,6
RTU/H	3	3	2,4	0,6	0,6	2,4	0,6	0,6
VeU/H	2	2	1,4	0,6	0,6	1,5	0,5	0,5
LU/H	3	3	1,6	1,4	1,4	1,8	1,2	1,2
DU/H	4	4	2,2	1,8	1,8	2,0	2,0	2,0
AAL	4	4	0,6	3,4	3,4	0,6	3,4	3,4
UL/LFA	4	5	2,0	2,0	3,0	2,5	1,5	2,5
JVLAM	3	3	0,8	2,2	2,2	0,8	2,2	2,2
UL/CHA	3	3	1,6	1,4	1,4	1,6	1,4	1,4

In Table 6 the authors summarised the results of calculation of total average score of the KIK by IC overall (TAKO) and total average score of the KIK and the SIK by IC overall (TAKOS), and its differences of quality score and overall score by TG.

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 2.8 to plus 4.7 points in total. The hypothesis is accepted *pro tem* for other branches of SIs of Latvia.

The study evidences that the KIK, AIK, PIK, and SIK of SIs of humanities and art sciences in Latvia were lower than the results compiled by the relevant TG Panel except for one SI of humanities and art sciences.

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How LinkedIn can Boost SMEs' Digital Marketing Strategies on International Markets: A Case Study of an Apulian Tech-Intensive Company

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Abstract: The use of digital marketing tools, especially social media, could support small and medium-sized enterprises (SMEs) achieving a sustainable competitive advantage. Business-to-business (B2B) SMEs have discovered the potential of social media in identifying new business opportunities and building quality business contacts especially in international settings. LinkedIn, in particular, seems to be a valuable tool for lead generation and networking, thanks to knowledge and insights coming from structured and unstructured data. Despite the growing interest in adopting LinkedIn for marketing purposes, a significant gap persists in terms of the benefits coming from the adoption of digital marketing within B2B firms and SMEs. To address this gap, this study aims to examine how a social network can support a SME's internationalisation process in technology-intensive niche sectors. The study adopts an exploratory method based on a case study of an Apulian company operating in the field of aerospace, which provides services to vertical markets. The study employs the action research methodology, using structured interviews and direct observation for data collection, and an inductive and iterative approach for data analysis. Findings demonstrate that an effective strategy utilising LinkedIn can be a game-changer for high-tech SMEs. This strategy sees the implementation of a data-driven approach that relies on the analysis of data and knowledge from buyer personas to predict their expectations, which are crucial for identifying the ideal target audience. The proposed roadmap composed by several maturity steps to lead the company in the process of potential customer identification, lead generation till customer engagement, provides a useful guideline for company managers involved into a structured and standardised innovative digital marketing strategy. Indeed, by integrating the various digital tools and strategic communication on LinkedIn, SMEs have the opportunity to create a data-driven marketing strategy that can lead them to internationalisation and finally to company growth.

Keywords: Digital marketing, Data, Case study, SMEs, LinkedIn, Internationalisation

1. Introduction

The evolution of marketing brings to a new definition proposed by Kannan and Li (2017), who describe digital marketing as "an adaptive, technology-enabled process by which organisations collaborate with customers and partners to jointly create, communicate, deliver, and sustain value for all stakeholders." There are significant challenges for organisations and marketers in developing digital strategies in today's age of information overload and social media communication. Firms use social media tools and platforms to build deep relationships with customers, increase traffic to their website, identify new business opportunities, create communities, distribute content, gain feedback from customers (Shree et al, 2021). The formation of networks is facilitated by social media sites and happens faster than in the past due to the development of digital technologies.

Adopting digital marketing tools can support SMEs to achieve a long-term competitive advantage (Bocconcelli et al, 2018) and reach new opportunities internationally (Fraccastoro et al, 2021). New digital technologies and social media platforms allow firms to analyse different types of data they can use to extract new ideas and better understand their markets and customers. Furthermore, the literature reveals a growing awareness about the positive relationship between digital marketing practices and SMEs' performance (Brooksbank et al, 1999; Cox et al, 1994; Gilmore 2011; Verhees and Meulenberg, 2004). Dwivedi et al (2020) state that organisations must strategically use social media marketing to attract their target audience. Crucial is the choice of platform according to target users and marketing strategy. The application of social media as communication channels offers the opportunity to potentially improve the business performance of SMEs in several ways (Barashi, 2012; Wamba and Carter, 2014). The ideal approach to take is customer-centric, as the strategy is built on the basis of the users to be reached, identifying their needs and consequently the appropriate communication to establish, to improve networking. In particular, the strategy sees the conveyance of content that has an impact on engagement, thus based on values of authenticity and

transparency, furthermore, communication based on shared values provides a cue for people to engage (Sundström et al, 2021).

Research about digital marketing's use or benefits in B2B SMES reveals a significant gap in knowledge about its application in this type of companies. In order to address this gap, the study uses a case study of an Apulian SME which operates in a niche market. This company works in a high-tech B2B sector; specifically, it offers innovative satellite monitoring services targeting vertical markets such as transportation, utilities, and engineering companies. Using an exploratory approach based on action research methodology, the study aims to understand how the adoption of a digital marketing strategy based on LinkedIn can support the internationalisation of a high-tech B2B SME. This research objective is driven by the desire to understand how this social network can support a company's internationalisation process. Findings provide a standardised framework as a roadmap, composed by several maturity steps, offering a useful guideline for business managers to support them in the implementation of a digital marketing strategy using social media to pursue the internationalisation of B2B SMEs.

The remaining part of the study is structured in section 2 with the literature background, which focuses on the analysis of the existing literature on digital marketing as a driver for SMEs' internationalisation, section 3 explains the research methodology. Section 4 discusses the findings with the proposal of the "LinkedIn-based strategy funnel" and section 5 discusses the "Digital maturity model: A framework for evaluating enabling tools". Finally, section 6 discusses the managerial implications and conclusions, which highlight the importance of LinkedIn as a tool to support internationalisation, and section 7 points out the limitations of the study and provides directions for future research.

2. Literature Background: Digital Marketing as a Driver for SMEs' Internationalisation

Digital transformation represents not only an economic and technological paradigm shift but also, and more importantly, a social change, which impacts industries and businesses from an international perspective (Broekhuizen et al, 2021; Ferraris et al, 2019; Fitzgerald et al, 2014). It is a process that enables companies to make strategic and operational changes due to the opportunities and threats posed by digital technologies (Vial, 2019). SMEs need to understand the benefits of digital transformation (Garzoni et al, 2020). Social media has been identified as a tool to identify entrepreneurial opportunities (Secundo et al, 2020), increase brand awareness, improve customer relationships, and gain market shares (Ahmad et al, 2018).

"The process of digitisation and the adoption of new technologies in companies involve a series of changes, which require different managerial capabilities and the development of new human resource management practices" (Fernandez-Vidal et al, 2022). Furthermore, "digital technologies represent a disruptive way of doing business and require significant changes by organisations to compete in the new environment" (Dash et al, 2021). Vassileva (2017) recommends that organisations must learn to integrate contemporary marketing models to address the new needs of the IT environment. Furthermore, technology is relevant, but as pointed out by Kane et al (2015), "it is strategy, not technology, that drives digital transformation", highlighting the importance of structuring a well and suitable strategy. In this innovative context, B2B firms are in a growth phase using social media, internet-based platforms that enable the creation and exchange of user-generated content (Itani et al, 2017). Social media are defined as a technological component that allow the communications, transaction and relationship building functions of a firm which leverage the network of customers and prospects to promote value co-creation (Andzulis et al, 2012).

A key factor in today's accelerated market transformation lies in the rise and spread of social media platforms, which offer new opportunities for customer interaction and to engage them on deep and meaningful levels (Dessart, 2017). Enabling and sustaining customer engagement through social media marketing is a vital effort to guarantee sales (Agnihotri, 2020). A useful tool to monitor and evaluate the progress into the entire customer journey is the digital marketing funnel, a framework that aims to support firms in several ways, such as to get more targeted leads (by reaching a more qualified audience), nurture customers (by providing a most valuable experience), and increasing revenue by saving costs.

Internationalisation is considered one of the key drivers of a company's growth (Lages et al, 2013). Social network services and digital platforms support the internationalisation process of firms by breaking down geographical barriers, allowing SMEs to access internationally relevant information easily and at low cost (Bai et al, 2021; Lee et al, 2022). Networking is a key practice that facilitates the internationalisation process, especially when networking with foreign partners to mitigate the risk of failure (Jafari-Sadeghi et al, 2020). SMEs' simpler and less bureaucratic structure allows them to adapt more quickly to change (Wang et al, 2017).

To structure a business internationalisation strategy using social media platforms, LinkedIn seems to be a useful networking tool for B2B relationships and could help gain a competitive advantage by sharing content with a professional tone of voice (Hollebeek, 2019).

However, an important gap emerges from the literature about the benefits of digital marketing in B2B SMEs. In order to fill it, the study uses a case study of an Apulian SME operating in a tech-intensive niche market.

3. Research Methodology

This paper adopts grounded theory and action research as exploratory and qualitative research methodology (Glaser, 1978, 1998; Strauss and Corbin, 1990; Suddaby, 2006) aimed at building theories from observation, following a bottom-up approach.

The research question at the basis of this study is: *How can the adoption of a digital marketing strategy using LinkedIn support the internationalisation of a high-tech B2B SME?*

This research question is driven by the desire to thoroughly investigate how a social network can support a company's internationalisation process, especially in the business case of a SME that, on the one hand, operates in a technology-intensive niche sector and, on the other, interfaces with a potential customer from outside its market. Furthermore, the study aims to create a framework that can be adapted by all SMEs operating in the B2B sector, as standard guidelines to be followed when starting the internationalisation process.

The study analyses a case study (Yin, 1994) of Planetek Italia, an Apulian technology-intensive B2B SME operating in the field of aerospace, which provides services to vertical markets such as utilities, transports, engineering firms, and other industries. This case study is relevant because it allows us to understand how LinkedIn supports the internationalisation process of a B2B SME operating in a technology-intensive niche sector and to build the optimal digital marketing strategy in an iterative and inductive way. Specifically, the study was conducted by observing and analysing Rheticus, one of the company's business lines within the SME with internationalisation as its objective, thus representing a pilot project that, if considered effective, can be extended to the company in its totality.

The process of data collection was carried out using two main techniques:

- Participant observation, through the methodology of action research (Susman and Evered, 1978), conducted by one of the authors during a six-month period of collaboration. “Such participation was moderate in nature; in fact, the researcher maintained a balance between the role of ‘insider’ and ‘outsider’, allowing for a good combination of involvement and the detachment necessary to remain objective” (DeWalt and DeWalt, 2002; Schwartz and Schwartz, 1955);
- Structured interviews, using the guidelines offered by Boyce and Neale (2006), with five company stakeholders (business development manager, business development assistant, corporate & marketing communication specialist, co-founder & CMO, and global B2B development business). These interviews turn out to be necessary to understand the performance of the strategy as LinkedIn does not offer analytics related to messages.

Regarding the data analysis process, this study follows the grounded theory (Glaser and Strauss, 1967), "process of iteratively and inductively constructing theory from observations using a process of theoretical sampling in which emergent insights direct selection and inclusion of the next informant or slice of data" (Gephart, 2004), aimed at building theories from observation, following a bottom-up approach. The interviewees' answers were subjected to a content analysis process to identify frequent themes and patterns, thus examining the rationale behind the choice of LinkedIn as a tool to support internationalisation.

4. Findings

The company under analysis aimed to internationalise its services. Operating in a B2B context, the marketing strategy needed a well-defined structure since their "buyer persona" represents a decision-making actor of particular identified target industries. The "buyer persona" identified is the target audience the company wants to reach and represents a suitable contact that is crafted using market research and actual data owned by the company, considering the users' demographic details, business role, and objectives. First, the company proceeded to conduct an analysis of potential countries to interact with, and more importantly, which companies and which people within them they could identify as targets. The company's business development manager then proceeded to connect with these people on LinkedIn and a corresponding introductory

message. From the very first approaches, it was noticed that the performance achieved through the use of the social network was beneficial therefore it was decided to enhance its use and start with strategies geared towards direct interaction, implementing two different types of communication based on two identified goals:

- Lead generation, supported by standardised communication,
- Conversion, being a goal regarding sales, supported by a personalised communication strategy.

Findings highlight that the internationalisation strategy based on the use of LinkedIn saw its most concrete start with the advent of the Covid-19 pandemic, which led to the need to digitally integrate a strategy as it was not possible to conduct physical events. As a platform seen as the place of professionals, LinkedIn was deemed the most suitable social network with respect to the highly innovative industry in which the company operates.

As for the results achieved, the personalised strategy is still in its early stages, but it is the most suitable approach when targeting a precise user or a smaller audience. On the other hand, the standardised strategy was conducted through lead generation campaigns and prospect nurturing activities. Some countries responding positively and resulting in one-to-one meetings. Therefore, the company plans to continue with this strategy for future events, as the first interaction with the users on LinkedIn enabled a 1-to-1 meeting that would have been impossible to plan otherwise. Regarding expected results, a higher conversion rate is anticipated in personalised communication because of the highly targeted audience and the added value offered (e.g., providing reports, data analysis), thus requiring different marketing efforts.

Furthermore, it was possible to translate the findings into a framework which highlights the ideal path to follow in order to reach the target audience and lead them to conversion (Fig. 1).

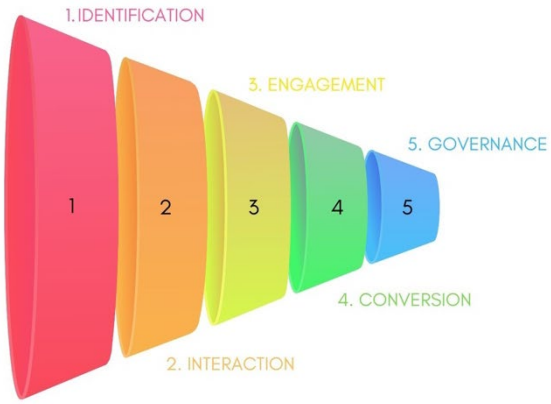


Figure 1: LinkedIn-Based Strategy Funnel

The design of the above framework (Fig.1) was developed to concretely help and support managers in the application of an innovative digital marketing strategy through the use of LinkedIn.

The framework starts with identification of the buyer personas and the relevant countries the company wants to reach. The second step sees the interaction with users in target with the company's objectives, thanks to the 'filtering' operation offered by the platform. Then there is the engagement phase, pursued with lead generation or prospect nurturing activities by offering a value proposition to buyer personas (e.g. reports). The fourth step is represented by conversion, which is completed by the company's alignment of the buyer personas' business needs. The last but crucial step is governance, aimed at maintaining an active value relationship with customers so that they can up-sell or act as ambassadors for other potential customers.

5. Discussion

LinkedIn surely represents a platform that enables a more personal interaction, as opposed to mailing, between salespeople and buyer personas. The latter are more easily reached, targeted, and profiled since it uses professional demographic data and therefore it is possible to reach the right people based on qualification, company, sector, seniority. Further, the "filter" function offered by the platform itself, which also enables them to break down geographic barriers and costs, accelerate lead generation, and perform a more accurate analysis of countries and markets and their resources.

The success of the LinkedIn-based strategy depends on various factors such as the way of communicating, the initial network of connections, and geographic area, but the company has seen positive results and plans to continue with this strategy.

However, there are limitations to consider, such as the fact that some geographic areas and certain types of users are almost unreachable on LinkedIn, as a result the tool is not universally effective but needs to be calibrated to certain circumstances. For now, each country must have its own method, as there is a risk of "losing" a market that is not active on LinkedIn. However, this is compensated by physical events, so there is a need for proper integration. In countries where LinkedIn is not widely used, a softer digital strategy with less effort is employed.

Overall, the *"LinkedIn-based strategy funnel" (Fig.1)* was designed with the aim of reinforcing and contributing to the existing literature on how a social network such as LinkedIn can support and facilitate the path of corporate internationalisation, suggesting concrete guidelines that can be a useful tool for implementing innovative digital marketing strategies.

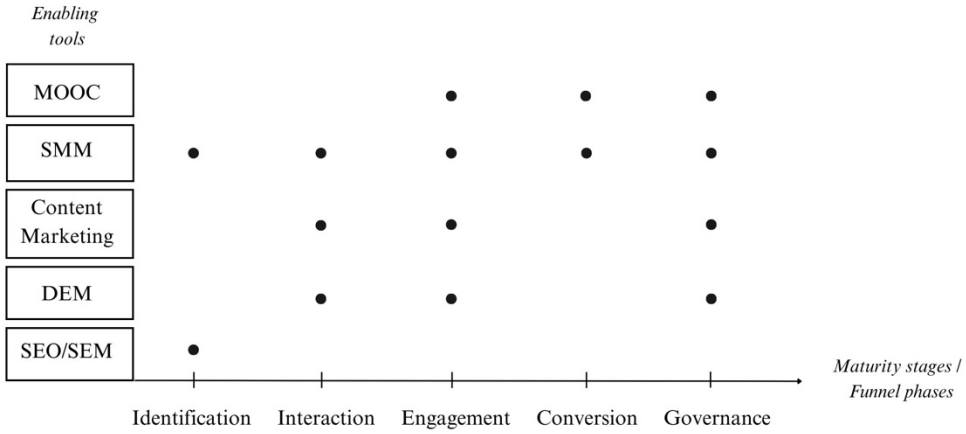


Figure 2: Digital Maturity Model: A Framework for Evaluating Enabling Tools

It was also structured the "*Digital maturity model: A framework for evaluating enabling tools*" (Fig. 2), so that it is clear what role social media plays within the business environment. In fact, as can be seen from the framework, social networks, and in this case study, especially LinkedIn, can support the company throughout the growth and maturity stages or, in reference to Fig. 1, throughout the funnel. In fact, the company under analysis, although it has used, uses or is inclined to use search engine optimization (SEO) and search engine marketing (SEM) tools, direct email marketing (DEM), content marketing, social media marketing (SMM), and massive open online courses (MOOCs), the only tool that appears to support all stages of the funnel (identification, interaction, engagement, conversion, governance) is SMM, and particularly in this case the creation and management of LinkedIn-based digital strategies. This is very important so that one can understand the potential that such a tool, if implemented with the right strategy, can improve digital marketing performance and help the company in the process of growth and internationalisation.

6. Managerial Implications and Conclusion

In order to address the research gap in knowledge about digital marketing's use or benefits in B2B SMEs, this study, driven by the key goal of analysing how the adoption of a digital marketing strategy using LinkedIn can support the internationalisation of a high-tech B2B SME, provides two useful frameworks as guideline for business managers that can support them in implementing an internationalisation digital marketing strategy (Fig.1; Fig. 2). Indeed, when a company decides to internationalise, digital transformation can be considered both a method and a tactic to pursue international business prospects and facilitate rapid communication (Feliciano-Cestero et al, 2023). Furthermore, thanks to digital platforms, companies could use social media channels to attract foreign customers and partnerships. When companies decide to develop digital technologies and explore innovations, they gain opportunities in the areas of knowledge benefits (Bouncken et al, 2021; Eerme and Nummela, 2019), international entrepreneurship (Pergelova et al, 2019), corporate

sustainability and competitiveness creation (Bouncken et al, 2021; Suhendra, 2017), among others. The internationalisation strategy using LinkedIn represents an interesting data-driven marketing approach, as it is based on the analysis of buyer personas' data, especially in terms of geolocation, socio-demographic characteristics, sector and company. This data-driven strategy is fundamental in identifying the target audience to intercept and communicate with, in order to optimise resources and not to disperse them towards users not in line with the characteristics of the buyer persona. LinkedIn turns out to be very useful in finding and identifying such users, in line with the target audience identified by the company. Moreover, it represents a tool in which networking is enhanced, so communication is more effective (Dwivedi et al, 2020; Sundström et al, 2021).

Thus, the main advantage derived from such a digital and innovative marketing strategy is the possibility of reaching new business opportunities in international contexts at reduced cost, thanks to social network platforms that allow physical and geographic barriers to be broken down (Dessart, 2017; Lee et al, 2022). Indeed, social media are identified as important tools to support entrepreneurial marketing in the creation of stable relationships with users by companies and also as important sources to improve business growth (Secundo et al, 2020). To effectively use LinkedIn, companies must conduct careful analysis to adapt their use to specific buyer personas. Due to the heterogeneous nature of the platform's user base, standardisation of processes may not always be possible. However, LinkedIn can support the creation of a streamlined workflow that helps companies achieve their internationalisation goals over time.

Overall, LinkedIn is a valuable tool to support internationalisation, but it must necessarily be integrated with other corporate actions, such as content creation and physical participation in events. However, it also requires experimentation to optimise its effectiveness and a willingness to invest in advertising and network building. In addition, a solid communication strategy is essential for establishing credibility and reliability, and proficiency in the languages of target markets is also important. The main challenge for companies is to be able to seize this opportunity by investing in resources that can bring knowledge into the company and are professionally capable of managing such tools to the best of their ability.

The main managerial implications that emerged from our study are first and foremost the identification of LinkedIn as a tool to support the internationalisation process, due to its ability to identify the right buyer person and reach them by breaking down geographical barriers and with low costs. Secondly, LinkedIn emerges as a tool as part of a broad ecosystem into which other activities need to be integrated. However, such a strategy needs careful analysis and experimentation as not all countries and markets might respond equally. Third, our study contributes to the existing literature by providing a strategic funnel based on LinkedIn as an innovative tool that can guide managers on the path to corporate internationalisation (Fig.1), and a digital maturity model for the assessment of enabling tools (Fig. 2).

7. Limitation and Future Research

The main limitations of the study can be identified into the methodological approach embraced, consisting into a single case study, as well as into the sectorial characteristics of the research context. If those limitation restrict the opportunity of generalizing the results obtained, they allow to identify areas for future investigation. Specifically, future research could consider expanding the number of cases involved in by including a larger number of companies also considering a larger sectorial coverage. By allowing to collect a larger basis of evidences about the internationalization strategies of companies based on the adoption of LinkedIn, those evidences could offer a broader perspective and a better understanding of the dynamics within and across the sectors by allowing to identify specific and common patterns. This provides more robust evidences and insights into the effectiveness and applicability of the strategies proposed.

Additionally, future researchers could utilise the frameworks developed in this study as a guide for conducting in-depth analyses of the strategic funnel path using LinkedIn. This would involve verifying the effectiveness of the strategic funnel path in different contexts and industries, thus further validating and refining the proposed frameworks. Furthermore, the integration of different approaches for data collection based on quantitative methods and social media big data analytics could be used for assuring a major understanding of the observed phenomenon.

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Knowledge Management in the Implementation of the Company's Business Strategy

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Abstract: The aim of the study is to learn and evaluate the impact of knowledge dynamics processes on the effectiveness of the implementation of the company's business strategy project. The implementation of the changes is the result of external circumstances related to the implementation of the company's tax policy. Elements of the tax policy implemented by the enterprise are a source of both threats and opportunities, and the volatility of the tax environment in which the enterprise operates is undoubtedly a challenge for enterprises. Observation and identification of these changes is a premise and tool for effective knowledge exchange, enabling the neutralization of threats and the use of emerging opportunities, especially in the implementation of changes. In the light of the considerations presented in the study, it can be indicated that knowledge management processes allow for the observation and description of changes in the environment, indicating the justification of emerging threats and opportunities in the company's environment and the reaction of the company, in particular in terms of the implementation of the company's tax policy, which fills the gap noted research. The implication of the conducted research is that there is a significant impact of external conditions, shaped, among others, by the company's tax environment, on the implemented project of the implemented business strategy, which can be effectively used in the company management process by increasing the effectiveness of knowledge management in the company. This means that the effectiveness of knowledge management can have a positive impact on the implementation of the company's business strategy. The research methods used to achieve the assumed goal are literature studies, descriptive analysis and survey research. Empirical research was based on 250 entities implementing tax policy in terms of corporate strategy. The research was carried out in 2021. The discussed problem is important and topical due to the possibility of achieving an increase in knowledge in the company and increasing the effectiveness of project implementation in the perspective of changes in the external environment.

Keywords: Management of knowledge, Enterprise business strategy, Company tax policy

1. Introduction

One of the key aspects of business management is to take up the challenges related to the spread of knowledge that allows the company to adapt its operations to the changing environment. Knowledge-based adjustment activities can be implemented through knowledge management processes, the purpose of which is to improve the effectiveness of the implementation and execution of the enterprise's business strategy. Knowledge management is a process during which the company, based on observation and analysis of the environment, conducts purposeful planning and control of tasks included in the implemented business strategy. As a result of the knowledge obtained, the company makes the appropriate allocation of resources allocated to the implementation of the strategy, using appropriate techniques and methods to achieve the imposed requirements within a specified time and at the specified costs. Therefore, knowledge about the implementation and implementation of the company's business strategy, caused by external and internal factors, is inextricably strategy adopted by the company. One of the key determinants of the environment affecting the company's strategy is the fiscal environment, which on the basis of feedback, manifests itself in the company’s tax policy, as part of the company's business strategy.

The goal of this article is to find out and evaluate the impact of knowledge of the dynamics processes of employees and managers of companies on the effectiveness of the business strategy implementation project in terms of the impact of the tax strategy. The variability of the environment accelerates the processes of learning and integrating the available knowledge in the enterprise. What's more, the increase in knowledge determines enterprises to change, especially in the area of the implemented economic strategy. Thus, when examining the current conditions of the turbulent environment in which knowledge is managed in enterprises, one can use phrases that are not synonymous with the word stability, but on the contrary, and include: uncertainty, volatility, turbulence. The presented study refers to the impact of knowledge dynamics processes on the implementation of the management of the business strategy implemented by the company. The research was conducted on 250 entities implementing tax policy in terms of corporate strategy. The research was carried out in 2021. The basic problem addressed in the study was reduced to the search for an answer to the question whether the increase in knowledge about changes in the business environment has become the reason for the implementation of business strategy implementation projects in enterprises, implied by a change in the fiscal environment, especially in the aspect of corporate tax policy?

2. Management of the Company's Business Strategy and the Dynamics of Knowledge in the Changing Environment of the Company

Business strategy management in terms of the dynamics of knowledge occurring in the process of changes in external factors of the environment is an immanent element of managing a modern enterprise (Cowan, Jonard, Özman, 2004). Knowledge dynamics in a network industry (Łęgowik-Świącik, 2021). Of particular importance for the increase in knowledge are changes caused by the management of the company's business strategy, as they can help in the search for market advantages (Brusoni, Prencipe, 2001). This means that knowledge moderates the operational and strategic elements of enterprise management, enabling the implementation of change projects in key areas of business, including the implemented strategy (Brown, Duguid, 2000).

The volatility of the business environment, visible especially in 2021, when companies experienced changes resulting from the COVID-19 pandemic or the war in Ukraine, implies new knowledge about the instability of the environment and the need to implement projects adapting the company's business strategy to the challenges of the economic environment (Kerzner, 2021) . Variability of conditions, which is characteristic of a modern economy characterized by the frequency of changes with a significant scope and effects, which is generally referred to as turbulence (Brown, et al, 2008). According to some economists, the best state is achieving equilibrium, i.e. stability of the system, and this most likely stems from humanity's desire to eliminate fears such as uncertainty or moments of instability (Tiganas, 2011).

The volatility of the economic environment caused by changing conditions, and the related uncertainty observed in economic realities, implying instability at the same time, are features related to the functioning of enterprises, visible especially in the economic strategy implemented by enterprises. These features are related to the functioning of enterprises and economies of all countries. An interesting observation in this matter is presented by C. Tiganas, who states that humanity has never made progress in stable conditions, on the contrary, when instability, crises, uncertainty and tension ruled the world markets, humanity reached the next level of development (Tiganas, 2011) . In general, it can be said that instability becomes a generator of knowledge, and equilibrium, or perfect stability, may mean the lack of factors for creating new knowledge. This means that when everything is stable and all variables are constant, the knowledge algorithm is stationary (North, Kumta, 2018, p. 38-39).

The ability to implement change projects is classified as a dynamic intangible resource (Bontis, Nick, 1999). Dynamic capabilities are the organization's ability to intentionally create, enhance or modify baseline capabilities (Bratianu, 2007). According to Teece, dynamic capabilities are high-level competencies that determine the company's ability to integrate, build and reconfigure internal and external resources and competencies in response to the changing business environment (Teece, 2007). The essence of these abilities is not only the possession and use of resources, but also their development and renewal, which are possible thanks to organizational learning processes (Łęgowik-Świącik, 2021). In turn, Zollo and Winter emphasize that dynamic capabilities are learned and enduring patterns of collective action through which an organization systematically creates and modifies operational routines in order to improve efficiency (Zollo, Winter, 1999). Thus, dynamic capacities reflect the possibilities of changing or reconfiguring the existing substantial capacities, which refer to the resources and capabilities used in operational activities and serve to achieve efficiency within the existing activities (Venczel, et al, 2021). Thus, the basic component of the dynamic capabilities of the organization is the organization's ability to change (Haas, 2018). This means that organizations have a specific configuration of resources, knowledge, structures, processes and procedures that enable efficient design and implementation of not only a single change project, but a whole bundle of changes.

In conclusion, the concept of an organization's ability to implement a change project is based on the existing knowledge of the concept of continuous change and includes the effective management of single change projects with a clearly defined beginning and end, as well as the management of a change project that is related to each other or running independently next to each other (Haas, 2018).). Moreover, this ability applies to the various forms, sizes and types of changes introduced in the organization. The effective implementation of knowledge management in the field of change is therefore a critical factor for all organizations that want to survive and succeed in a competitive and changing business environment (Lawle, Worley, 2006; Wit, 1988). Therefore, the ability of the organization is understood as a "meta-opportunity" that enables the company to remain competitive in a very unstable and unpredictable business environment (Strambach, 2008).

3. Quantification of events Affecting the Variability of the Environment

The organization's ability to implement changes, especially in the area of knowledge management, is a construct that solves a specific conflict between change and stabilization, between exploitation and exploration, because it assumes making changes and effectively maintaining daily activities at the same time (Meyer, Stensaker, 2006). The literature on the subject identifies many events affecting the volatility of the environment, which prevent or partially hinder the normal economic activity of enterprises, and although they may not happen at all, if they do occur, they have huge consequences and, above all, require an immediate reaction of the company's managers (Takagi, Varajao, 2019). Situations that threaten the continuity of long-term business operations that require the implementation of a change project include:

- natural disasters (earthquakes, tsunamis, typhoons and hurricanes, floods, volcanic eruptions or pandemics),
- disasters caused by inappropriate human activity,wypadki spowodowane niewłaściwym użyciem produktów lub usług, niewłaściwym projektowanie produktu,
- accidents caused by improper use of products or services, improper product design,
- terrorism,
- cyber attacks and other IT incidents,
- breaking the law or accounting fraud in connection with the financial crisis (Kagaya, 2013).

The oldest typology of crises allows us to distinguish two groups. The first is crises caused by natural causal relationships. The second group is related to crises caused by human activity (Otola, 2013). In addition, B. Rike distinguished three groups of crises: natural, related to human activity and social (Rike, 2003). The presented classification criterion does not fully reflect the reality in which enterprises currently operate. I.I. Mitroff and M.C. Alpaslan attempted to classify contemporary threats and crises. The classification of threats to enterprises presented by these authors resulted from the analyzes of crises. The discussed authors stated that in the 1980s, crises were mainly caused by the occurrence of typical hazards, while in the 1990s, crises caused by atypical and natural hazards prevailed (Mitroff, Alpaslan, 2003).

The year 2021 is the time of the development of the pandemic related to the COVID-19 virus and the war in Ukraine, which led to a collapse in demand in many industries (e.g. the hotel or catering industry). The above considerations show that both opportunities and threats are the result of an event or a combination of events that occurred at a given moment in time (Meadows, et al, 2022). During the pandemic, enterprises are forced to develop skills and develop systems and processes to quickly use, monitor and predict sudden changes in the environment (Łęgowik-Małolepsza, 2022) and recognize the dangers and opportunities brought by chaos. Therefore, the next step should be a wise, accurate and firm reaction of people managing the enterprise (Kotel, Caslione, 2009), which can be called a change management project.

Survival of an enterprise on the market, especially in terms of changes in the environment, is the result of constant continuous change, including through change management projects in the area of owned (broadly understood) resources (Hartung, 2011). The concept based on the implementation of knowledge management is creative destruction, it consists in the continuous internal revolutionizing of economic structures as well as existing technologies and production methods, the constant destruction of the old ones and the continuous creation of new, more effective ones (Caballero, 2010). As a result of changes in the environment observed in 2021, the technologies, processes and resources used so far become inadequate to the changing environment (World Economic Outlook, 2020). This process means that some enterprises that are not able to effectively manage knowledge in the field of change are unable to survive in a changing environment (Leybourne, Sainter, 2012).

In conclusion, it is worth noting that the process of implementing knowledge management in the field of changes in the environment requires comprehensive knowledge by people managing the company about events affecting the variability of the environment. The aging of production methods, product distribution channels, or knowledge in the field of fiscal regulations for the functioning of enterprises is now faster than even a few dozen or even a few years ago. Therefore, the ability to identify events affecting the variability of the environment will affect the process of implementing knowledge management in the field of changes in the business strategy implemented by enterprises. Moreover, the turbulence of the environment affects the company, requiring decision-makers to manage change knowledge in order to plan, organize, motivate and control change processes, as well as neutralizing emerging threats and taking advantage of emerging opportunities.

4. Research Methodology

Triangulation of research methods was used to achieve the assumed goal. In the theoretical part, the method of analysis and criticism of the literature was used. It allows to present a new approach to the assumed goal of the study and to indicate the relevance and novelty of the adopted solutions. The method of literature analysis and criticism makes it possible to present the complexity and essence of the described problem (Coombs, Holladay, 2009). The method of descriptive analysis was used to describe the research methodology adopted in the research conducted in this study. The method of descriptive analysis allowed for the presentation of activities, standards and rigors, which are the basis for formulating conclusions from the conducted research (Gibbert, 2008). In order to obtain an answer to the research question, the method of qualitative research, i.e. a survey, was used. Conducting survey research is empirical in nature, as it enables the analysis and evaluation of the studied phenomena (Zainal, 2007). Due to the fact that the examined variables were mainly qualitative variables (measured on a nominal and ordinal scale), the chi-square test of independence was used to examine the strength and, possibly, the direction of the relationships between the variables. The chi-square test of independence requires that the expected counts in all cells of the contingency table are greater than or equal to 5. If this assumption was not met, then Fisher's exact test was used. The contingency analysis research methodology (including the conditions of its applicability) is described in detail in the literature (Howell, 2006).

5. Description of the Research

The sampling frame was the databases of medium and large enterprises, taking into account the records contained in the Bisnode commercial database. Enterprises were randomly selected from a database of approximately 1 million records. Then, the CATI Support computer system randomized subsequent telephone numbers for enterprises from the sampling frame. The sampling scheme was probabilistic - simple random selection.

The course of the research included the following stages:

- development of survey questionnaires,
- preparation of a database of enterprises from which enterprises will be selected for research. From each selected company, one manager and one specialist from the accounting and tax department will be surveyed,
- implementation of 250 interviews with management proportionally in medium and large enterprises,
- conducting 250 interviews with specialists from accounting and tax departments in the same enterprises,
- preparation of a merged database of respondents' answers to questions contained in research questionnaires,
- carrying out quantitative analyzes of the obtained data using the PS IMAGO package and the Excel spreadsheet.

This study analyzes three questions from the survey questionnaire presented to the respondents. The respondents' task was to evaluate each statement relating to a given problem in the surveyed enterprise based on a 5-point Likert scale: from 1 - "completely disagree" to 5 - "completely agree".

6. Results of the Conducted Empirical Research

The aim of the study is to learn and evaluate the impact of knowledge dynamics processes on the implementation of the company's business strategy. As a result of the analysis of the data obtained on the basis of the questions contained in the questionnaire, the answer to the research question was obtained, whether the implementation of the tax policy is included in the company's business policy.

Table 1 presents the results of surveys focusing on the tax strategy treated as an element of the business strategy of enterprises. It was assumed that the answers confirming that the tax strategy is an element of the company's business strategy will be graded 4 and 5, with the scale of ratings indicating a large range between belief (score 5) and rather belief (score 4). In the group of all respondents, the summed answers "yes" gave the result of 80.4%, which means that the majority of respondents agree with the statement that the tax strategy is part of the business strategy of enterprises.

However, there is a significant difference in the assessments made by managers and specialists in accounting and tax departments. Based on Table 1, we can conclude that 68.8% of specialists are of the opinion that the tax strategy is an element of the company's business strategy, while over 92% of managers in the surveyed

enterprises share the above opinion. Equally numerous is the group of surveyed specialists from accounting and tax departments compared to managers who do not see the relationship between the tax policy and the implemented business strategy of the company. Then, the relationship between the size of the company and the implementation of the tax strategy as an element of the company's strategy was examined.

Table 1: Tax Strategy as an Element of Business Strategy of Enterprises

The implementation of the tax strategy is part of the company's business strategy		
Rating	**manager**	**specialist**
1	3	4
2	1	7
3	16	67
4	25	78
5	205	94

Source: Own elaboration.

Table 2: Company Size and the relationship Between the Tax Strategy and the Company's Business Strategy %

The implementation of the tax strategy is included in the company's business strategy		
Rating	**medium enterprises**	**large enterprises**
1	1,4	0,0
2	1,6	0,0
3	16,7	14,3
4	20,4	28,6
5	59,9	57,1

Source: Own elaboration.

Analyzing the respondents' answers to the question whether the implementation of the tax strategy is included in the company's business policy, the following conclusions can be drawn: 3% of respondents from medium-sized companies indicated that the relationship between the implemented tax policy and business policy is weak or very weak, compared to 0% of respondents from large enterprises. According to 16.7% of respondents from medium-sized companies, compared to 14.6% of respondents from large companies, they do not perceive tax policy as an element of the company's business policy. For 80.8% of respondents from medium-sized enterprises, compared to 85.7% of respondents from large enterprises, they identify tax policy as an element of the company's business policy.

Due to the indicated structure of assessments of strategic goals for the implementation of the tax strategy from the point of view of all and individual respondents (management and specialists from accounting and tax departments), table 3 presents respectively.

Table 3: Strategic Goals for the Implementation of the Tax Strategy in the Enterprise in %

Strategic goals for the implementation of the tax strategy				
Rating	optimization of tax burdens	increasing the efficiency of the entire enterprise	impact on cooperation with related entities	minimization of the tax risk
1	3,8	4,0	23,0	3,6
2	4,0	2,4	4,8	2,6
3	14,8	12,8	12,0	11,0
4	27,4	30,2	18,4	28,6

Strategic goals for the implementation of the tax strategy				
Rating	optimization of tax burdens	increasing the efficiency of the entire enterprise	impact on cooperation with related entities	minimization of the tax risk
5	50,0	50,6	41,8	54,2

Source: Own elaboration.

- Considering the assessment of the strategic goals of the implementation of the tax strategy, issued by all respondents, it is possible to conclude that (Table 3):
- the impact on the optimization of tax burdens is weak or very weak, according to 7.8% of respondents, 14.8% do not see the impact, compared to 77.4% of respondents who consider the impact important or very important.
- in the opinion of 6.4% of the respondents, the increase in the efficiency of the entire enterprise is small, 12.8% of the respondents do not see the impact, 80.8% of the respondents stated that this impact is significant.
- according to 27.8% of respondents, the tax strategy does not affect cooperation with related entities, 12% of respondents do not have a specific opinion, 60.2% of respondents indicated a significant relationship between the tax strategy and cooperation with related entities.
- according to 6.2% of respondents, the tax strategy has no impact on minimizing tax risk. 11% of the respondents have no opinion on this subject. 82.8% of respondents are of the opinion that the tax strategy significantly affects the minimization of the company's tax risk.

7. Discussion

The main objective of this study was to learn and assess the impact of knowledge dynamics processes on the effectiveness of the implementation of the company's business strategy, taking into account the impact of the fiscal environment. As expected, the increase in managers' knowledge of the business conditions of the surveyed enterprise has an impact on the implementation of the business strategy in the fiscal environment. Therefore, the chi-square test of independence was used to test the strength and, possibly, the direction of the relationships between the variables, because it allows the variables that were qualitative variables to be tested with the theoretical (expected) distribution that would occur if the variables were independent. The contingency coefficient used for variables measured on a nominal scale was used to assess the strength of the relationship between the variables. If the value of this coefficient is 0, it means that the variables are not related (the variables are not related). A value close to 1 means that there is a very strong relationship between the variables (Howell, 2006).

Table 4: Significance Tests of the Relationship Between the Company's Tax Strategy and the Company's Business Strategy by the Company's Management and by Tax Specialists

Grupy pracowników a:	Statistics Chi-square	df	Asymptotic materiality (two-tailed)	Statystyka Fishera	Exact materiality (two-sided)
The implementation of the tax strategy is included in the company's business strategy	104,459[a]	4	0,000	108,207	0,000

a) unfulfilled assumption of the chi-square test of independence, so that the expected numbers in all cells of the contingency table are greater than or equal to 5

Source: Own elaboration.

When juxtaposed with the data contained in Table 4, the relationship between the tax strategy as a support for the company's business strategy in the analyzed areas, and groups of employees (specialists from accounting and tax departments) and management is noticed. Research results that the research results are taken into account between teachers, employees, specialists from accounting and tax departments, and the management's knowledge of the implementation of the tax strategy as a business strategy of the enterprise. Following scientific research, there is a gap in the perception of the role of the company's tax strategy in the company's business

strategy between management and specialists. This gap means that the knowledge management of management and specialists cannot use the convergent business strategy of the company, taking into account the dichotomy of understanding the business strategy of cooperation at the level of management and specialists.

The implication of the study is the software for acquiring knowledge from the implementation of business policy in the company in the field of fiscal environment. It is a source of knowledge about both threats and opportunities, but it controls the changes that are required for people managing the surveyed enterprise.

8. Conclusion

The goal of this article was to find out and evaluate the impact of knowledge dynamics processes on the effectiveness of the implementation of the company's business strategy project. In light of the considerations presented in the article, it can be pointed out that there is a research gap between the understanding of business management processes by management and professionals, in terms of the implementation of the company's business strategy, and the implemented tax policy of the company.

The literature studies shows that there is a need to acquire new knowledge in the field of elimination of the dichotomy of perception of phenomena related to business management, in particular in the implementation of the adopted business strategy in the company in terms of tax strategy.

Their observation and analysis is a source of knowledge in the field of business management, especially with regard to the search for solutions in eliminating the cognitive gap in the identified difference in the perception of the implementation of the business strategy of the enterprise by management and professionals in terms of implementing a tax strategy.

Surveys conducted showed that the knowledge gained from the analysis of the understanding and implementation of business strategy by managers and professionals, influences the management processes of the company.

It can be assumed that the process of knowledge dynamics positively influences the effectiveness of the implementation project of the company's business strategy, of which an important element is the tax policy implemented by the company.

A recommendation for the surveyed companies could be closer cooperation in transferring knowledge of the implemented business strategy of the company between management and specialists. This should contribute to increase the efficiency of the company's management processes, mainly by improving the effectiveness of the implemented business strategy, the understanding of which, especially in a turbulent environment, acquires significant importance from the field of business management.

The considerations presented are important and timely, as the environment turbulence observed especially in recent times, creates risks and opportunities. The ability to manage the flow of knowledge of the implemented company business strategy, can significantly increase the efficiency of business management.

The contribution to the management sciences is the growth of knowledge in knowing the dichotomy of the business strategy implementation between management and specialists, the effective use of which is an expression of the effective use of knowledge for business management, especially in the implementation of business strategy in terms of the company's tax policy, constituting an important element of the company business strategy.

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Scientific Ethos and Knowledge Management

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Abstract: The development of knowledge creation theory (Nonaka and Takeuchi, 1995) took into account the values shared by the members of an organization, later generating an extended concept of "Ba" (Nonaka and Toyama, 2005), understood as shared context. Matsuadira (2010) defined the complex of organisational values (the *ethos*) as knowledge (intangible) assets for knowledge creating companies. I suggest that this leads us back to R.K. Merton's theory of the normative structure of science and the ethos of science. The challenge is to ask whether we can we talk about the applicability of the norms proposed by Merton to the case of knowledge management in knowledge creating companies, or rather there will be some evident deviations and counter-norms. It is well known that the value of universalism is contested by particularism or that of "communism" by the secrecy of research. My hypothesis is that at methodological level the technical norms of knowledge testing and evaluation are universal and globalizable, but in the practical context of the action the guiding values and the mores of knowledge production are local and particular, i.e. depending on various social and cultural factors. The principle of glocalization ("think globally and act locally") should, therefore, be applied.

Keywords: Knowledge creation company, Scientific ethos, Concept of "Ba", Universalism, Glocalization

1. From Tacit Knowledge to Shared Values

Over the past century, the traditional view of knowledge as created by "heroic pure science", i.e. by the scientist isolated in the "ivory tower", has been drastically challenged. While historians of science have shown that the progress of knowledge takes place in relation to the context in the diversity of its social, economic and cultural aspects, philosophers of science have focused on the epistemic relevance of external factors. The decisive turning point was reached by bringing the scientific community to the fore and analyzing the progress of knowledge in relation to the internal interactions that take place within it. The structured scientific communities, understood as groups of professional science practitioners, were "presented as the producers and validators of scientific knowledge." (Kuhn, 1970, p. 178)

However innovative, Kuhn's perspective on the production of organizational knowledge defended in *The Structure of Scientific Revolutions* continued to be based on the Cartesian assumption regarding the distinction between the knowing subject and the known object. It worked with the assumption of a similarity between the case of an individual processing information to solve problems, and that of a scientific community processing information from the external world to solve puzzle problems while doing normal science or, as an effect of some anomalies, understood as adaptive failures to the objective environment, doing extraordinary research. It should be mentioned, nevertheless, that Kuhn recognized the importance of the tacit knowledge incorporated by the paradigm shared by the members of a community working in the same research tradition. At the same time, he insisted on the elements of discontinuity, of a revolutionary type, in the transition from one paradigm to another, without considering the possible deep and innovative transformations within the community.

A new approach to the process of creating organizational knowledge was proposed by Nonaka and Takeuchi (1995) starting from the exemplary case of the company that assumes as an explicit managerial objective to be innovative. The epistemological novelty of this theory consists in emphasizing the decisive role of tacit knowledge in the creation of new knowledge. The upward spiralling process of creating knowledge begins with the mobilization of tacit knowledge and the possibility of converting it into explicit knowledge. This process of mutual transformation of tacit knowledge into explicit knowledge and *vice versa* at various ontological levels - individual, group, organizational and inter-organizational - is the mechanism by which individual knowledge is extended and articulated into and throughout the organization.

Although Nonaka and Takeuchi use the standard definition of knowledge as justified true belief, they do not reduce it, as traditional epistemology does, to propositional or explicit knowledge, i.e. to semantic information only, but rather consider it as a dynamic human process of justifying beliefs to obtain truth. This implies two subjective dimensions, one related to beliefs and commitments related to the epistemic subject, the other to action and intentionality. Therefore, from this perspective, knowledge is not constituted by timeless epistemic entities only. Rather, it is relational and context-dependent. The subjective nature of knowledge is all the stronger at the organizational level as the individuals who communicate and act refer to a system of values that may be the organization's own.

Berger and Luckmann (1966) argued that society is constructed as an objective and subjective reality in the process of interpersonal interaction (both face-to-face and distant). This implies that information is communicated in certain historical situations and cultural contexts that influence personal judgments on reality, individual behaviours and attitudes. Society becomes a subjective reality through internalization, a process which, through socialization, is open to transformation. Society as a subjective reality influences the objective construction of society by institutionalizing and legitimizing certain practices which, in turn, lead to subjective reconstructions. Also, Nonaka and Takeuchi build on Polanyi's arguments (1966) in favour of the importance of tacit knowledge in cognition, especially through the active role it has in the acquisition, creation and organization of knowledge, so that we always know more than what is defined as propositional knowledge. Finally, another precursor is the ACT model from cognitive psychology proposed by Singley and Anderson (1989). It argues that declarative, i.e. explicit, knowledge must be transformed into procedural one, which is the equivalent of tacit knowledge when we consider the acquisition of skills. Nevertheless, despite the significant perspectives they provide, all these theories remain one-sided or partial.

Nonaka and Takeuchi (1995) overcome all these particularities of Western epistemology and offer a general and complete theory accompanied by a dynamic model for the interactions between tacit and explicit knowledge in the form of what they call "knowledge conversion". They claim that knowledge is the product of the interaction between tacit and explicit knowledge in four different modes expressing four possible conversions:

- Socialization: from tacit knowledge to tacit knowledge;
- Externalization: from tacit knowledge to explicit knowledge;
- Combination: from explicit knowledge to explicit knowledge;
- Internalization: from explicit knowledge to tacit knowledge.

Socialization is the process by which individuals share their experience with each other and transmit various mental models and skills without using language, but rather observation, imitation and practice. Since information transfer is not enough to learn a practice, the process of learning from experience is associated with a specific context loaded subjectively and emotionally. This is the only form of interaction able to ensure the transfer of tacit knowledge.

Externalization transforms tacit knowledge into explicit concepts, metaphors, analogies, and models. Since linguistic expressions cannot fully capture the content of tacit knowledge, there remains a gap manifested as inadequacy, inconsistency or insufficiency. However, it is only through externalization that we obtain new concepts, so that we can understand the unknown through the knowledge we already have.

Combination is a process of systematizing concepts and reconfiguring explicit knowledge. Through these orderings of concepts, new knowledge can be produced and new fields of research can be opened. Combination can be understood as a managerial process aiming at adequately ordering and integrating concepts in relation to other theoretical concepts or principles. The decisive role belongs to the so-called middle range theories and concepts that flexibly ensure the relationship between the great concepts or principles and their field of application.

Internalization is the process by which explicit knowledge is incorporated into pre-existing tacit knowledge. Various theoretical advances become practical and are converted into experiences: knowing that becomes knowing how. This process is correctly described by the phrase "learning by doing". Experiences turn into tacit mental models that are shared by the members of an organization, and the organizational culture is reconfigured by assimilating new knowledge.

The model proposed by Nonaka and Takeuchi generated a lively debate between theorists and experts in the field of management. The model was recently confirmed by Bandera et al (2017) in a research applied to small and medium enterprises. Anyway, in response to the various criticisms that particularly targeted the lack of a fine agreement of the model with an empirical basis, Nonaka and his collaborators initiated a review and an expansion of the model by including two more levels of analysis: the context shared by the members of a knowledge-creating organization, and the knowledge assets.

The concept of "Ba", roughly translatable by "place", was proposed by the Japanese philosopher Nishida (1970), developed by his compatriot Shimizu (1995), then applied by Nonaka and Konno (1998) to answer questions regarding the fundamental conditions of knowledge creation, the location of this creative process and the possibility of treating knowledge as a resource. Nonaka and Konno adapted this concept of the common space of the interpersonal relationships dynamics to the knowledge production process and integrated it into the SECI Model. This space is not only the physical one, i.e. workplace or meeting place, but also the virtual one, of remote

communication, or the mental, ineffable one, of sharing ideas, experiences and ideals, as well as anything that combines these elements. We distinguish between two dimensions of tacit knowledge in this common space: the first is the technical dimension, which is usually called “know how”, the second is the cognitive dimension, which “consists of beliefs, ideals, values, schemata, and mental models which are deeply ingrained in us and which we often take for granted.” (Nonaka and Konno, 1998, p. 42)

The four ways of knowledge conversion are redefined from the perspective of the concept of “Ba”. Socialization involves the sharing of tacit knowledge between individuals who interact in the same space and who, without using language, are emotionally prepared to receive it from each other. Relationships between people must be not only of external sympathy, but also of empathy, which presupposes a certain inner state of the self. Through externalization, tacit knowledge acquires a comprehensible form, which means that each individual transcends the limits of the self and integrates into the group, namely, his intentions and ideas merge with those of the group. Therefore, the conversion of tacit into explicit knowledge is not only an epistemological process, but involves self-transcendence and group integration. In this sense, dialogue is both a cognitive process that involves understanding the propositional meaning and an empathic one, in which individuals feel each other as present face-to-face in the group. Combination involves the complex development of propositional knowledge through communication, diffusion and systematization, a process that leads to new knowledge. Nonaka and Konno distinguish between three processes of combination, each associated with certain practices. The first one consists in the capture and integration of newly created knowledge, which involves the collection and ordering of explicit knowledge from inside and outside the organization. The second process consists in the dissemination of explicit knowledge through the direct transfer of knowledge, and the third consists in the processing and editing of explicit knowledge so that it can be used by anyone outside the organization, like a public good. Internalization implies the conversion into tacit knowledge of those knowledge elements that are relevant at the organizational level, so that the individual is again in a relationship with an entity that integrates him. Completing this process involves two practical aspects: "First, explicit knowledge has to be embodied in action and practice. Thus the process of internalizing explicit knowledge actualizes concepts or methods about strategy, tactics, innovation, or improvement. (…) Second, there is a process of embodying the explicit knowledge by using simulations or experiments to trigger learning by doing processes." (Nonaka and Konno, 1998, p. 45)

Accordingly, to each stage of knowledge conversion corresponds a specific Ba. Socialization is related with Originating Ba, an existential level where the individuals interact face-to-face, sympathize, empathize, share their feelings, emotions, experiences and mental models in order to obtain some emerging qualities such as care, love, trust, and commitment that lead to the removal of the barrier between oneself and others. Externalization is related with Interacting Ba, a reflective level where individuals consciously interact peer-to-peer through dialogue to convert individual mental models and personal skills into concepts and utterances with intersubjective use value. Combination is based on Cyber Ba, a systemic level where the interaction is from group to group in a virtual world where new explicit knowledge is combined with existing information so that, in a collaborative environment, it should ensure the logical systematization of cognitive contents with the help of various information processing technologies. Internalization is supported by the Exercising Ba, a synthetic level where, on the site and through practices, explicit knowledge is internalized by the participants who apply it to concrete situations.

The third element of the development of the SECI model, namely, the notion of knowledge assets, after specifying the phases of knowledge conversion and defining the concept of Ba, was introduced by Nonaka, Toyama and Konno (2000). Assets are generally defined as those resources of any organization that are indispensable to creating value. Knowledge itself is a fundamental asset for any organization, and the knowledge-creating process is in turn based on knowledge assets which have to be created, acquired and exploited. All the inputs, outputs and moderating factors of the knowledge-creating process, from informational contents (such as a structured theory) to emotional components of the context (such as trust among members of the organization), constitute knowledge assets. Nonaka, Toyama and Konno (2000) propose to distinguish between four categories of assets: experiential, conceptual, systemic, and routine. Experiential knowledge assets consist in tacit knowledge shared through common experiences (individual skills and know-how, emotional knowledge such as care, love and trust, physical knowledge such as gestures, energetic knowledge such as passion and tension, or rhythmic knowledge such as the ability to improvise and entrainment). Conceptual knowledge assets consist of explicit knowledge articulated through images, symbols and language, but also of their design and the so-called brand equity. Systemic knowledge assets consist of systematized and packaged explicit knowledge, such as documents, specifications, manuals and other explicitly stated technologies or product specifications, databases, patents and licences related to intellectual property rights.

Routine knowledge assets consist of the tacit knowledge embedded in organizational actions and practices such as know-how in daily operations, organizational routines and organizational culture.

This integrative perspective in which the SECI model, the concept of Ba and the concept of knowledge assets merge to explain the dynamism and complexity of knowledge management as an intangible public good or commodity was articulated in details by its authors and underwent a revision by extension. Whereas Nonaka, Toyama, and Konno (2001) offer only a new systematization highlighting the emerging role of Ba and definitively breaking with an individualistic theory of knowledge management, subsequent research by Nonaka and Toyama (2003, 2005) proposes taking into account another level of analysis, namely, that of the values shared by the organization and the general managerial vision. Nonaka and Toyama present a dynamic model of knowledge creating company and describe knowledge creation as a synthetizing process based on certain enablers such as: knowledge vision, driving objectives, dialogue, practice, Ba (shared context), knowledge assets and environment. This revised version explains the differences among the organisations regarding knowledge creation not just as a result of a competitive market but mainly as a result of their strategic vision. The guiding theoretical principle of this approach is that knowledge creation is a dynamic process of interaction between subjectivity and objectivity, a synthesis of thinking and actions of individuals who interact with each other in an emergent organization and also beyond it.

However, a question is necessary: how can the organization as a whole give identity to individuals, motivate them and obtain results at the organizational level transcending the individuals that make it up? The web of relationships in knowledge creation process becomes a very complex one: there are relationships between individuals within the organization and outside it, then there are mutual relationships between individuals and the organization, but also between the organization and the outside environment. What exactly facilitates this whole relationship process and how? What exactly ensures the cohesion of the enablers mentioned above and integrates them into a bundle?

Although Nonaka and his collaborators progressively expanded the subjective dimension of knowledge management, the importance of values structured in an ethos was not distinctly emphasized. Yoshito Matsudaira (2010), starting from a case study on Nissan Company, draws attention to the role of ethos in the production of knowledge. Matsudaira adopts a triple viewpoint – according to the first, the second and the third person – on the knowledge creation process and claims that the ethos as a continued practice guided by an ethical basis founded on reason, becomes one of the intangible assets for all the three managerial categories, namely individual, team and organisation. The ethos enables knowledge creation in the knowledge-based society. It provides the coherence and cohesion of practices and vision, and is, therefore, indispensable.

2. Back to the Scientific Ethos

By adding this normative level of the scientific ethos, the knowledge management theory seems to have become complete. The path taken by the knowledge management theory somewhat repeats the short history of the philosophy of science in the twentieth century when it moved from the linguistic vision of the theory to models that take into account the so-called subjective side of science. We thus return to the ethos of science, a topic proposed by Robert K. Merton (1942). He distinguished between technical (or cognitive) norms and moral (or social) norms. In the case of cognitive ones, Merton mentions two methodological principles, one regarding the adecquacy and reliability of empirical evidence, the other regarding the logical consistency and validity, while in the case of moral ones he enumerates universalism, “communism”, disinterestedness and disinterestedness.

Both types of norms assure the extension of certified knowledge, understood as the institutional goal of science, but they do it in a different way, primarily in terms of their rational charge: “The mores of science possess a methodological rationale but they are binding, not because they are procedurally efficient, but because they are believed right and good. They are moral, not technical, prescriptions” (Merton, 1942, p.118). The principle of universalism guarantees the objectivity of research and requires us to evaluate any scientific result on the basis of preestablished impersonal criteria, first of all, according to empirical observation and previously accepted knowledge, not to any personal or social attributes of the scientist. “Communism” presupposes the possession and free sharing of knowledge as a common heritage. Disinterestedness requires the scientist to remain uncorrupted by subjective motivations and to do science for the sake of knowledge as a member of his community. Finnaly, organized skepticism is defined as the “detached scrutiny of beliefs in terms of empirical and logical criteria” (Merton, 1942, p.126). This means that the producers of knowledge need to be transparent in all their activities, while the users of knowledge have to suspend their judgment until the result are scrutinized according to the institutional accepted criteria. All these norms make up the ethos of science, “that affectively toned complex of values and norms which is held to be binding on the man of science. The norms are expressed

in the form of prescriptions, proscription and permissions. These are legitimatized in terms of institutional values. These imperatives, transmitted by precept and example and reenforced [sic] by sanctions, are in varying degrees internalized by the scientist…. Although the ethos of science has not been codified, it can be inferred from the moral consensus of scientists as expressed in use and wont, in countless writings on the 'scientific spirit' and in moral indignation directed toward contraventions of the ethos" (Merton, 1942, pp.116–117).

The main criticism of these norms was to show that science works according to contrary norms or counternorms. Merton anticipated the counternorms in his paper focusing on how moral norms work as principles against which we may meet deviations. Merton's examples are secrecy as a counternorm for communism and the competition for priority as threatening disinterestedness. Later (1976), he developed the idea of sociological ambivalence, a social phenomenon which results when a person is subjected to more conflicting normative systems and he or she chooses alternatively one of the two systems.

It was argued that the norms proposed by Merton are derived from the standard model of "pure science" and are associated with an inherent rationality, while the *New philosophy of science*, starting with Kuhn, showed that the various commitments of a scientific community are variable and relative. Barnes and Dolby (1970) highlighted the temporality and ambivalence of the norms and values constituting the ethos of science and proposed a deviant viewpoint. Ian Mitroff (1974), who studied the Apollo missions, showed that the so-called counternorms (solitariness, particularism, interestedness and organized dogmatism) are equally strong and claimed that the dominance of one set of norms is situationally dependent. Mulkay suggests that the norms are just a mixture of social, ideological and verbal stereotypes and conventions used by scientists in their relations with outsiders. It is better to conceive of these norms "as vocabularies of justification, which are used to evaluate, justify and describe the professional actions of scientists, but which are not institutionalised within the scientific community in such a way that general conformity is maintained" (Mulkay, 1976, pp.653–654).

However, although these norms are not universal, any community aiming to produce knowledge shares certain values. In other words, it is necessary to share certain values, to base the research on an ethos, but the shared values are context-relative and community-relative. So, if in knowledge management the result reached was that a complete theory must take into account the ethos as a knowledge asset, the immediate amendment, based on the debate in the philosophy of science, is that the correct perspective is a relativist one. How do we then resolve the tension, at least apparent, between the universality of knowledge management as a theory and the relativist consequences of knowledge production practices? How should we understand this simultaneity of two tendencies, one toward theoretical universalization, the other toward practical particularism?

I think that an answer was already given by Von Krogh, Ichijo, and Nonaka (2000) by their definition of knowledge enablers as a set organisational activities which ensure knowledge creation. They offered a list of five key enablers: instilling a knowledge vision, managing conversations, mobilising knowledge activists, creating the right context and globalising local knowledge. All of these enablers facilitate relationship and conversation within organisation as well as sharing local knowledge beyond cultural and geographic organisational borders. The two simultaneous tendencies of universalizing and particularizing (Robertson, 1995) understood as globalization and localization merge emergently in the glocalization process.

3. An Exploratory Conclusion: Glocalization and Knowledge Management

The simultaneous occurrence of both universalizing and particularizing is specific in the case of knowledge management through the interference of two different levels, one theoretically universalizing and another practically particularistic, which are harmonized by vision and ethos, and correlated by the principle "think globally, act locally". This means that the theory of knowledge management, considered through its validity within the scope of universality, is adapted and adjusted to the local context in which managerial practices take into account the local vision and ethos structured at community level. As a result, the theory is relative to the context through its application and is successful only if it is projectable to local parameters determined by locally shared values. The ethos facilitates preferences and choices and reinforces them. Suffice it to think of the so-called McDonaldization: a global fast-food chain offers specific menus depending on the geographical area to meet tastes deeply shaped by local traditions. The menu list is tailored to local customs and preferences. Cultural reflexes, beliefs of any kind and their implicit values become obstacles for any strategy that does not adapt to them. Therefore, the theory of knowledge management manages its own glocalization in order to be efficiently applied to the contextual needs structured around an ethos which precludes non-conformities.

The differences between the global and the local are not essentialist polarities, so that globalization would only produce homogenization and lead to the loss of local identities. On the contrary, it is about simultaneous

divergent trends that do not annihilate each other, but develop each separately in their interconnectedness. The concept of glocalization pays more attention to this relationship of connectivity and in this way proposes a new perspective.

Thus, if we analyze the way in which the flow is assured by different innovation systems, we realize that the possibility to use knowledge according to subjective aims and the capacity to use them depends on different cultural, institutional and organizational factors. Vaniscotte (2001) proposed a typology of innovation and educational systems. In Europe we have the Anglo-Saxon model, the Nordic model, Rhine-Danube model and Club Med model. The first innovation system is liberal, innovative, with a strong mobility. At the educational level it is decentralized, selective and unequal. The second model is intermediary, with high performance, and a very high mobility. At the educational level it has many pathways after 16 years of age. The third model is regulated, with predicted performances and weak mobility. The educational system has a dual character. The fourth model is under liberalization, with increasing performance and mobility. At the educational level it is based on a general structure. Undoubtedly, all these differences belong to cultural traditions that are supported by different values.

Hong also adopted a practice-based view of knowledge and engaging critically with Nonaka's SECI model, and argued that a successful implementation of it requires a 'glocalized' approach, "which involves trade-offs between core underlying values and objectives during the process of local translation" (Hong, 2011). I think that the problems are not just global or local but interdependent and interconnected. Methodological universality of a necessitarian type has to be replaced by a holistic integrative perspective that reintegrates cultural differences and discontinuities. Ethical values become one of the bonds that strengthen the organization and give it efficiency. Therefore, we will be able to talk about different managerial practices depending on various cultural frameworks which prioritizes and ranks differently in relation to the same managerial target

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A Bibliometric Analysis Deconstructing Research on how Cognitive Technologies Affect Man-Machine Collaboration

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Abstract: This paper addresses knowledge work challenges relating to emerging cognitive technologies. The field of research addressing artificial intelligence (AI), and related topics, is rapidly increasing. However, despite this emerging interest, the currently body of published research remains complex and unstructured. In particular, it remains to be understood how these technologies is implemented and cause changes in man-machine collaboration. To inform this issue, we conducted a bibliometric analysis of extant literature on AI and man-machine collaboration to take stock of extant published research in order to provide a foundation upon which both future theory and practice can be built. We based our analysis of an exhaustive structured literature search of published academic research in Web of Science (WoS) until 2020. Using the keywords digi* AND transform* OR artificial intelligence, 8 728 articles were identified. The bibliometric analysis enabled us first to identify 202 relevant articles published within the fields of business and management, and subsequently to further narrowing our scope to 25 core contributions using bibliometric coupling. A content analysis of these 25 articles revealed that whereas there is a lot of attention to the technological complexities related to the emerging cognitive technologies, there is to date limited empirical descriptions of the consequences for individuals, organizations or value creation of adopting these technologies. Our study identifies four important dimensions of man-machine collaboration; Knowledge worker, Organization, Market, and Society. Moreover, our findings reveal extant research is inconclusive with respect to the forces affecting these dimensions as different authors record both proactive forces and constraining forces associated with each of the four dimensions. Our contribution, as well as, the identification of a core canon of relevant research articles provides a foundation upon which future research and practice can be built by identifying core dimension and the forces acting upon them.

Keywords: Artificial intelligence, Bibliometric analysis, Digital transformation, Cognitive technology, Man-machine collaboration

1. Introduction

Artificial intelligence (AI) is about imbuing machines with a kind of intelligence that is mainly attributed to humans (Kakatkar et al. 2020), such as visual perception, speech recognition, decision-making, and translation between languages. Artificial intelligence has gained an enormous amount of attention during "the second wave of AI". A recent search on google scholar indicate an astonishing 439 000 results on papers written only since 2016. Current and near future organizational strategies are placing great emphasis on machines, robots and AI (Holford 2019). Automation to reduce menial or repetitive jobs, digitization of work to render remaining workers more efficient and AI to provide more reliable and productive top-end professional work are all interrelated initiatives enacted by current dominant imaginaries of efficiency and maximization. Hammershøj (2019) found that creativity and innovation are among the most uniquely human capacities and therefore most resistant to automation, but there is no consensus as to if or when computers and robotics will be capable of creativity or innovation.

In light of recent cognitive technology developments, even knowledge intensive firms (e.g. Løwendahl 2005; von Nordenflycht 2010) might not be as insulated towards automation of core task as anticipated in extant theory. Sawney (2016) states that technology offers professional service firms a way to raise productivity and efficiency. By leveraging the power of algorithm-driven automation and data analytics, nonlinear scale becomes feasible as productized services take over the high-volume tasks and aid judgement-driven processes. This frees up well-paid professionals to focus on jobs that require more sophistication and generate greater value for the company, as well as employees with more-meaningful jobs and companies with more-profitable business models and innovative opportunities (Kakatkar 2020; Sawney 2016; Hammershøj 2019; Kudyba et al. 2019).. However, these predictions necessitate organizational changes based on a sensible division of labor between man-machine. To date, we lack knowledge about this division of labor and the opportunities and best practices of AI implementation across different organizational and industry contexts. Moreover, it remains to be understood how these cognitive technologies are implemented and how they cause changes in collaboration, structures, management and value creation in organizations. To enlighten these issues, our study addresses the following research question: "*How does cognitive technologies affect man-machine collaboration in knowledge-intensive firms?*"

To explore the research question, we employed a structural literature search to extract a final search database that could be used for bibliometric analysis and to identify key articles for a content analysis. The search resulted in an initial sample of 8 728 articles which were reduced to 202 for our bibliometric analysis, resulting in a final sample of 25 articles upon which we conducted a content analysis. Our findings suggest that man-machine collaboration is dependent on individual factors, such as attitudes to technology and change, as well as societal attitudes towards the AI-evolution. The study contributes by identifying four core dimensions related to man-machine collaboration, starting at the individual level and progressing to the societal level. The identified dimensions are: Knowledge worker, Organization, Market, and Society. Moreover, existing research suggest different forces acting upon each of these dimensions. However, extant research is inconclusive with respect to the directionality, whether forces acting on a dimension is proactive or constrain. Our contribution is the synthetization of the insights provided by prior research and the subsequent conceptualization that explicate the counteracting forces for each of the four dimensions. The study thus has implications for theorization and practice alike, as it offers a vantage point for subsequent empirical and conceptual research to extend insight on related AI-implementation themes, especially related to innovation and strategy discussions, as well as to managerial decisions related to digital transformation and AI implementation.

2. Theory

According to Kudyba et al. (2019) cognitive technologies is a sector of emerging technologies in the digital era, which incorporates advanced analytic methods to provide robust decision support (Kudyba et al. 2019). Artificial intelligence (AI) has received considerable attention during the last two decades and has been widely applied in many business areas (Metaxiotis 2003, pp. 216-221).The term artificial intelligence was originally coined by John McCarthy in 1956 (McCarthy 1959). However, Artificial intelligence (AI) is today considered an umbrella term. The term covers everything from dedicated tasks conducted by a computer (weak AI) e.g. identifying content in pictures or playing chess, to general AI (so-called general AI) which are systems which can be trained to do almost everything. AI is helping companies improve customer service, improve customer loyalty and brand reputation, and enable employees to focus on higher value tasks that provide greater returns. (Walch 2019). According to Davenport (2017) AI can be considered a cognitive technology that emulates activities traditionally associated with the human brain. Cognitive technologies leverage significant enhancements in data availability and processing that have augmented information and knowledge creation capabilities to enhance operational strategizing. Advancements in visualization, natural language processing, predictive modeling and search etc., have augmented the creation of and access to knowledge enhancing informational resources (Kudyba 2014; Kudyba et al. 2019). Other elements of the cognitive spectrum involve the utilization of artificial intelligence (AI) to perform an ever-increasing number of organizational processes (Westerman and Bonnet 2015; Kudyba et al. 2019).

Cognitive technologies leverage significant enhancements in data availability and processing that have augmented information and knowledge creation capabilities to enhance operational strategizing. Other elements of the cognitive spectrum involve the utilization of artificial intelligence (AI) to perform an ever-increasing number of organizational processes (Westerman and Bonnet 2015; Kudyba et al. 2019). It is clear that AI has a socio-economic impact in terms of labor division and how businesses will implement AI in knowledge-intensive firms in the near future. Fleming (2018) point out that all jobs probably will not be taken over by AI and contributed with some heuristics that help map out how computerization has reinforced paid employment: The Highly skilled and remunerated elite workers, semi-automated workers and lastly, the jobs that are not worth automating. Further Witz et al. (2018) discuss the cost benefits of chatbots, but states that economies of scale and scope are likely to become important sources of competitive advantage with the risk of "winners take it all" markets. A future where man and machine work side by side seems to be inevitable, but the challenge of trust will have implications for organizational implementation of AI. However, it remains to have a concise and unified understanding of how the current technological changes creates changes in the work practices and content of activities – what humans are best at, what can be let to technology – how to organize, create value considering these changes – and how to implement these new solutions and organizational structures in firms.-particularly knowledge intensive firms – where automation of activities traditionally have been perceived as very difficult.

3. Methodology

We employ science mapping from the discipline of bibliometrics with the aim to provide a systematic and thorough review of artificial intelligence research related to man-machine collaboration. Bibliometrics refer to "*the collection, the handling, and the analysis of quantitative bibliographic data, derived from scientific*

publications" (Verbeek et al. 2002, p. 181). A systematic review adopts a replicable, scientific, and transparent process based on the theoretical synthesis of existing studies, thus differing from general reviews (Cook et al. 1997). We based our analysis of an exhaustive structured literature search of extant published academic research in Web of Science (WoS) (Van Eck & Waltman 2014), 7th of March, 2020. Using the keywords digi* AND transform* OR artificial intelligence, 8 728 articles were identified. Subsequently we reduced the sample to 1092 papers by only selecting the Web of Science Categories: *Computer science artificial intelligence, law, management, business, communication, economics, international relations, ethics and psychology multidisciplinary.* For categories with 50 or more papers we performed a bibliographic co-occurrence analysis using a threshold of 5 to identify relevant keywords. We also read the abstract of all papers to assess their relevance for categories with less than 50 results. To ensure that high-impact articles within categories that were discarded by the bibliometric analysis were not overlooked, we read the abstracts of the 25 most cited papers for each category, except for *management* and *business*, where we read all of the abstracts. Experimentation with different search function (e.g topic-, key word- or title-search) , and subsequent reading of abstracts, suggested that the title search would make us best equipped to answer our research question, we chose to build our paper on the title sample resulting in a final search database condensed down to 202 relevant papers.

The analysis commenced in three stages. First, we did a descriptive analysis consisting of our final search database to identify the evolution on the field and the development within highly ranked academic journals (2018 Academic Journal Guide (AJG guide). The purpose was to ensure the validity of the database and to assess the distribution and impact of the various journals. Subsequently, we sorted all the articles and cross referenced them including only articles from journals at level 3, 4 and world-leading 4* articles at the AJG-list. Resulting in 75 potential articles for a content analysis. Second, we deployed the VOSviewer software to map and analyze our dataset, enabling us to visualize the dataset through a bibliometric analysis cluster visualizationa (Markoulli et al. 2017). VOSviewer contains several key metrics to help identify the most influential articles or authors e.g. links, total link strength and citations). The bibliometric analysis was utilized to identify the most influential articles by analyzing the clusters, and performed a content analysis of these papers identifying how issues pertaining to man-machine collaboration was treated. First, we read the abstract of all 75 articles and excluded the papers that did not contain concepts of man-machine collaboration, resulting in a final sample of 25 out of 202 papers. We thoroughly read all papers and coded them in Excel. Further, the data from the initial coding was further compiled in separate tables to identify the content and common features of each concept.

4. Findings

4.1 Descriptive Analysis

The quantity of the publications is an important indicator that reveals the development trends of a scientific research. Figure 1 depicts a chronological view on volume of articles published, and the current exponential growth in published research addressing the selected topic.

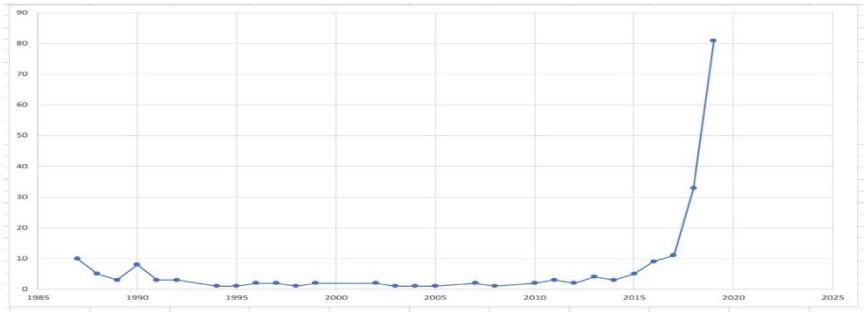


Figure 1: Development of Publications per Year, Within the Database Consisting Of 202 Papers

Based on the large number of journals represented, we found it beneficial to use the AJG-list as a guideline to make further selection. Figure 2 presents an overview of the distribution of AJG-list levels for the database.

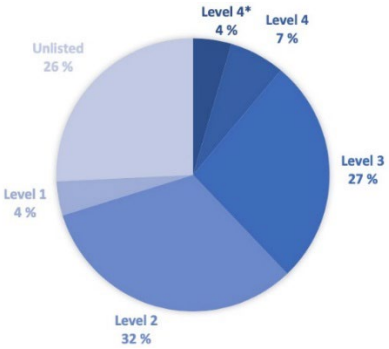


Figure 2: Percentage of Journals Within Each AJG-List Level

Given the overwhelming number of identified articles published in top ranking journals for business and management related fields, we found it necessary to limit the number of articles to consists of articles from level 4*, level 4 and level 3. As we can observe from figure 3, 11 percent of the articles are published at level 4 and 4*. The sample we chose for our content analysis consists of level 4*, level 4 and level 3, which gives the total of 38 percent. Thus, ensuring the validity of the database and to assess the distribution and impact of the various journals. Table 1 gives an overview of level 3, 4 and 4* ranked journals by AJG, and number of publications we included before conducting our content analysis.

Table 1: Level 3, 4 and 4* Journals and Number of Publications

Level 4*, 4 and 3 rated journals by AJG	**#**	**Level 4*, 4 and 3 rated journals by AJG cont.**	**#**
Information systems research (4*)	1	Harvard Business Review (3)	3
Journal of Consumer Research (4*)	1	Industrial Marketing Management (3)	2
Journal of Management (4*)	1	Information and Organization (3)	1
Management Science (4*)	1	International Journal of Forecasting (3)	1
Marketing Science (4*)	1	Journal of Business Ethics (3)	1
Mis Quarterly (4*)	1	Journal of Business Research (3)	2
Research Policy (4*)	1	Journal of Information Technology (3)	1
Strategic Management Journal (4*)	2	Journal of Strategic Information Systems (3)	2
European Journal of Operational Research (4)	10	Journal of the Operational Research Society	9
International Journal of Research in Markt. (4)	1	Long Range Planning (3)	1
Journal of Management Information Systems (4)	1	MIT Sloan Management Review (3)	4
Journal of Service Research (4)	1	Organization (3)	1
California Management Review (3)	8	Public Management Review (3)	1
Decision Sciences (3)	3	Technological Forecasting And Social Change (3)	10
European Journal of Marketing (3)	1	Technovation (3)	1
European Journal of Work and Organizational Psych. (3)	1		

4.2 Bibliometric Analysis

4.2.1 Co-Keywords analysis

Keywords are nouns or phrases that reflect the core content of a publication. The bibliometric data show 986 keywords involved in this research. Co-keyword network visualization was based on occurrences. The co-occurrence threshold was set as 5 and 35 items where brought into visualization (Figure 3).

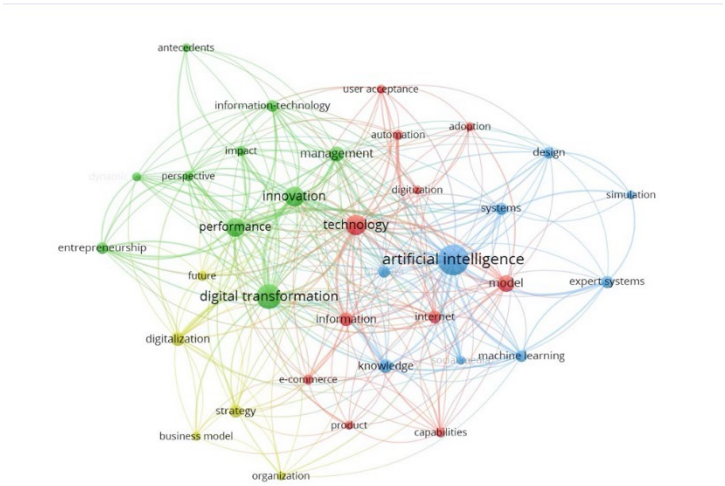


Figure 3: Keywords Co-Occurrence Analysis

In figure 3, the size of the circles represents the occurrences of keywords. The larger the circle the more a keyword has been co-selected in the digi* transform* and/or artificial intelligence publications. The keyword "artificial intelligence" and "digital transformation" and "technology" had the strongest strength. The distance between the keywords are demonstrated relative strength and topic similarity. Circles in the same color cluster suggested a similar topic among these publications. The co-keyword network in Figure 6 clearly illustrated four distinct clusters. Each represented a subfield or a field of technological development. Appropriate labels of the four main clusters could be allocated to each of them by analysing the main node circles. The cluster number derive from the VOSviewer software. Especially, as was shown in the red cluster (Figure 2, cluster 1, center, 11 items) overlap with both the blue and green cluster. Containing keywords such as digitization, automation, user acceptance, adoption, internet, e-commerce etc., apparently related to the topic of "techonology". The green cluster (Figure 6a, cluster 2, upper left corner, 10 items) gives us the keywords such as performance, innovation, management, informational technology, dynamic capabilities, entrepreneurship etc. focused on the main domain "digital transformation". In The blue cluster (Figure 2, cluster 3, upper right, 9 items), keywords such as knowledge, machine learning, expert systems, big data, simulations etc., apparently related to the topic of "artificial intelligence". From the green cluster branches out the yellow cluster (figure 2, cluster 4, bottom left corner, 5 items) containing keywords such as digitalization, future, strategy, business model and organization.

4.2.2 Bibliographic coupling analysis

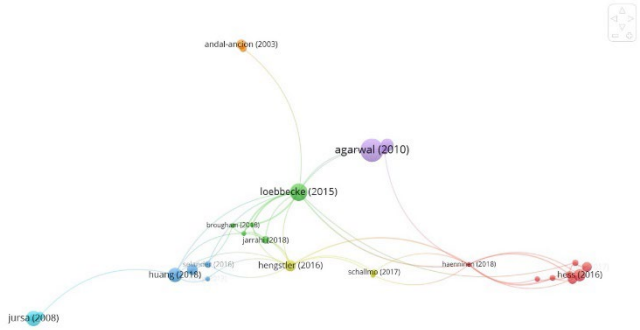


Figure 4: Bibliographic Coupling Document Analysis

Figure 4 shows VOSviewers clusters based on the bibliographic coupling method. Here we conducted a full counting and the unit of analysis were documents. The minimum number of citations of a document was 10. Of the 202 documents, 55 meet the threshold. The size of the circles represents the number of citations for each document. In Figure 4 lines among the documents represent their co-citation links, while 7 different colours seen in Figure 4 represent the co-citation cluster of the documents.

After conducting three bibliometric methods we did not find any direct contribution to man-machine collaboration. However, in the keyword analysis we did find a lot of keywords which gives an indication of the

content within this database. The different themes in the literature can be associated with and might inform our research question. It was good a clear visualization of the content within the chosen database. The co-author analysis gave an indication of minor collaboration structures and the bibliographic coupling of documents gave an indication of how documents were connected to each other and which papers that were most influential. Nevertheless, we found the need to conduct a thorough content analysis, based on insights from both the descriptive analysis of journals and the bibliometric analysis.

4.3 Content Analysis

Previously in this paper we have described the process of our selection of the 25 articles to conduct our content analysis. After a thorough reading of the documents we identified four dimensions which are used to give a comprehensive presentation of the findings in this chapter. The dimensions are: Knowledge worker, Organization, Market and Society.

Table 2: Content Analysis of 25 Core Articles Revealing Four Dimensions of Man-Machine Collaboration

Referance	Knowledge worker	Organization	Market	Society
Bader & Kaiser (2019)			x	
Brock & von Wangenheimz (2019)	x	x		
Chablo (1994)			x	
Davenport & Ronanki (2018).	x	x		
Doukidis & Paul (1990)		x		
Garbuio & Lin (2019)	x	x		
Haenlein & Kaplan (2019)				x
Hall (1999)		x		
Hengstler et al. (2016)			x	
Huang & Rust (2018)	x			
Huang et al. (2019)	x	x	x	
Kumar et al. (2019)				x
Loebbecke & Picot (2015)	x	x		
Longoni et al. (2019)			x	
Luo et al. (2019)			x	
Martinez-Lopez & Casillas (2013)		x		
Metcalf et al. (2019)	x			
Montes & Goertzel (2019)				x
Quinn et al. (2016)		x		
Robinson et al. (2005)	x			
Shrestha et al. (2019)		x		
Syam & Sharma (2018)			x	
Tambe et al. (2019)	x			
Warner & Wager (2019)				x
Wilson et al. (2017)	x			

5. Discussion

In this paper our aim was to get a deeper understanding of how cognitive technologies affect man-machine collaboration in the context of knowledge intensive firms. Our content analysis revealed four dimensions of this

man-machine collaboration addressed in extant published research; Knowledge worker, Organization, Market and Society. The study further identified important dilemmas associated with each of the dimensions.

5.1 Knowledge Worker

In knowledge-intensive firms' employees are often viewed as the most important asset, and competitive advantage is built through careful recruitment and training of employees. In service organizations, high-performing human assets are harder to duplicate than any other corporate resource. According to Loebbecke and Picot (2015) the nature of knowledge work and cognitive processes, digitization and big data analytics expect to hit knowledge-based business models and cognitive workers as hard as – and perhaps even faster – than non-knowledge business models and manual workers. Digitization and big data analytics are associated with the autonomous information processing tasks typically performed by firms and knowledge workers – whose high profits and wages provide economic incentives to even speed up substitution (Loebbecke & Picot 2015). An illustrative example is Chatbots. They will behave identically across a service delivery system, providing highly predictable and homogenous service interactions and solutions (Wirtz et al., 2018) Human error and fatigue are not a factor. As chatbots are connected to the CRM- system connection, and can identify customers, they provide customized service on scale and they are also designed to have no biases, such as ethnic groups, gender, age and social status, unless programmed (Witz et al. 2018). Fleming (2018) point out that all jobs probably will not be taken over by AI and described three types of work: The Highly skilled and remunerated elite workers, semi-automated workers and the jobs that are not worth automating. Additionally, Davenport and Ronanki (2018) believe that most workers have little to fear at this point. Cognitive systems perform tasks, not entire jobs. Most cognitive tasks currently being performed augment human activity, perform a narrow task within a much broader job, or do work that wasn't done by humans in the first place, such as big-data analytics (Davenport & Ronanki, 2018).

Huang and Rust (2018) further states that AI job replacement occurs fundamentally at the task level, rather than the job level, and for "lower" (easier for AI) intelligence tasks first. The progression of AI task replacement from lower to higher intelligences results in predictable shifts over time in the relative importance of the intelligences for service employees. The authors states that analytical skills will become less important, as AI takes over more analytical tasks, giving the "softer" intuitive and empathetic skills even more importance for service employees. Witz et al. (2018) states that the extent to which service robots can display the emotions, like empathy and compassion, and behavior that give the impression that they truly have the customers best interests at heart, may prove to be a challenge. It remains to see if the robot can provide the same emotional connection resulting in trust. Brock and von Wangeheimz (2019) identified lack of skilled staff and knowledge in digital technologies as the top AI implementation challenge and engaged skilled staff as one of the key AI implementation success factors. Therefore, managers need to develop digital intelligence in the form of suitable human skills within their organization. In fact, AI requires organizations to develop *human* intelligence (Brock & von Wangeheimz 2019).

Man-machine collaboration in the employee dimension seems applicable. Our recommendations for management urge the development of human intelligence, and to think of AI and humans as a team. As we have identified here the skills and knowledge in digital technologies are of grave importance in order to implement a successful AI system. Employees should focus on the empathic skills, as the cognitive technologies have an advantage in analytical skills. By usage of man-machine collaboration employees will gain the newfound capabilities will ultimately leave employees with more-meaningful jobs and companies with more-profitable business models and innovative opportunities.

5.2 Organization

There seems to be an overall consensus about the strengths of cognitive technologies and how they excel in efficiency and outperform in analytical tasks. Cognitive technologies leverage significant enhancements in data availability and processing that have augmented information and knowledge creation capabilities to enhance operational strategizing and to provide robust decision support (Davenport 2017; Kudyba et al. 2019). AI is helping companies improve customer service, customer loyalty, brand reputation, and enable employees to focus on higher value tasks that provide greater returns (Walch 2019). We found that already in 1990, Doukidis and Paul reported the enthusiasm of practitioners and clients trying AI. Brock and von Wangeheimz (2019) also reported two global surveys among senior managers across industries that AI is typically implemented and used with other advanced digital technologies in the firm's digital transformation projects. However, the digital information projects in which AI is deployed are mostly in support of firm´s existing businesses. Kolbjørnsrud et al. (2017) found that AI ability to facilitate cloud-based applications as advisors in contexts such as medical diagnosis, security analytics, drug discovery, financial advice, etc. may make some managers uncomfortable. 46

percent of the top managers taking part in the survey stated that they would trust advice of intelligent systems. Only 24 percent of middle managers and 14 percent of front-line managers demonstrated the same level of agreement.

Shrestha et al. 2019 addresses that human decision makers, practitioners and scholars need to advance understanding of the implications of AI's limitations for organizational decision making. First, there is a risk that AI is "fooled" into altering decision outcomes—either through the manipulation of the data it uses as input or through its design (e.g., by changing weights of predictors). Thus, inviting algorithmic decision making into organizations will require new regulation and procedures for auditing AI algorithms. Secondly, AI-based decisions amplify human biases in available data. Bias and unfairness embedded in AI decisions are particularly detrimental to vulnerable groups in our society. Countering these grave concerns requires a stronger emphasis on the development of algorithms that can expose biases in data and human decision making, as well as collaboration between the AI community, legal practitioners, policy makers, corporates, and scientists to develop new measures for fair, accountable, and transparent applications of AI in organizations. Furthermore, introducing AI-based decisions into organizations becomes relatively effective when some level of transparency or interpretability of decisions can be achieved. Managers need to keep abreast of the developments in interpretable and explainable AI. Finally, algorithmic decision-making skills remain highly specialized such that decision outcomes are often difficult to interpret. In introducing AI to organizational decision making, managers must build internal capabilities to decide on the inputs to the algorithm, the algorithms themselves, and the interpretation of predictions. Because AI technologies advance rapidly, organizations must remain vigilant to the strengths and limitations of AI in fully delegated and hybrid human–AI decision-making structures (Shrestha et al. 2019). In the discussion implementing AI and man-machine collaboration at the organizational dimension, there are many factors which need taken into consideration. Man-machine collaboration seems to be inevitable in the future. Man-machine collaboration increase value and give way to new business models as well. But as Shrenstha et al. (2019) pointed out there are several risks to be aware of. Although the research only covers a brief number of papers in the literature there are clear differences in each field on how to implement cognitive technologies and how man-machine collaboration are to be achieved within each organization.

5.3 Markets

Robots can become almost indistinguishable from humans, especially on phone and text interactions. A recent study found that 38 percent of chat users were uncertain whether they interacted with a human or chatbot. 18 percent guessed wrong (Wünderlich and Paluch 2017; Witz et al. 2018). However, Luo et al. (2019) reported negative effect if usage of chatbots where incorporated. Luo et al. (2019) reported that as long as the chatbot identity is disclosed, regardless of before or after the conversation, customer purchase rates are negatively affected. However, disclosing the bot identity after the conversation helps mitigate such negative impact. The findings are also suggesting that prior AI experience is helpful in reducing the negative disclosure effect (Luo et al. 2019). Longoni et al. (2019) report that consumers are reluctant to utilize healthcare provided by AI in real and hypothetical choices, separate and joint evaluations. Consumers are less likely to utilize healthcare (study 1), exhibit lower reservation prices for healthcare (study 2), are less sensitive to differences in provider performance (studies 3A-3C), and derive negative utility if a provider is automated rather than human (study 4). Uniqueness neglect, a concern that AI providers are less able than human providers to account for consumers' unique characteristics and circumstances, drives consumer resistance to medical AI. Indeed, resistance to medical AI is stronger for consumers who perceive themselves to be more unique (study 5). Uniqueness neglect mediates resistance to medical AI (study 6) and is eliminated when AI provides care (a) that is framed as personalized (study 7), (b) to consumers other than the self (study 8), or (c) that only supports, rather than replaces, a decision made by a human healthcare provider (study 9) (Longoni et al. 2019). In the words of Witz et al. (2018): "*People have a general aversion toward algorithms. Especially if the algorithm has made a mistake,".* The aversion is prevalent even if the situations where evidence-based algorithms consistently outperform humans. Educational approaches to consumers will be beneficial in the long run, as consumers with prior AI experience prevents aversion and distrust. Man-machine collaboration should be communicated to gain trust.

5.4 Society

Economists and sociologists leading the discussion about societal implications of the "second machine age" take either an optimistic view of the workforce future or they have a pessimistic view envisaging levels of unemployment never before seen. In our findings we first found the optimism of AI in Kumar et al. (2019) statement about that the focus have shifted to information management. The shift has risen due to the role of

technology. The ability to collect, store, process and reuse information through technology has given us further thrust in exploring the new frontier of AI. On the other hand, Haenlein and Kaplan (2019) point out that governmental regulation might again be a way to prevent such an evolution. They point at some examples of firms required to spend a certain percentage of the money saved through automation into training employees for new jobs, that cannot be automated. States may also decide to limit the use of automation. Or they might restrict the number of hours worked per day to distribute the remaining work more evenly across the workforce. These restrictions could prevent or at least delay the evolution of cognitive technologies, and the reluctance of the state will potentially stagnate the prosperity of man-machine collaboration in the future. Yet the findings also reveal the development of new technology to prevent "the winner takes all" markets. Montes and Goertzel (2019) describes how decentralization of AI affords functions that could transform the AI landscape with positive ethical effects, by unsiloing AI making it coordinate and cooperate with other AIs. The AI evolution in our society and the effect of it will remain to be inconclusive at this point. There are indeed optimistic and pessimistic views on cognitive technologies and the possibility of man-machine collaboration. Even so, the man-machine collaboration is yet an important part of the societal debate. As the machines are made in the reflections of humans, when constructing new cognitive technologies there will no doubt be necessary for a close man-machine collaboration in the development-, implementation- and monitoring phase. The fear is that we as a society will not be able to base the AI-data on unbiased foundations and that it will be difficult to address accountability of the decision or fault of man and machine. The society must also see the opportunities rather than the treats of the technological advancements; thus, the man-machine collaboration will be possible at a societal level.

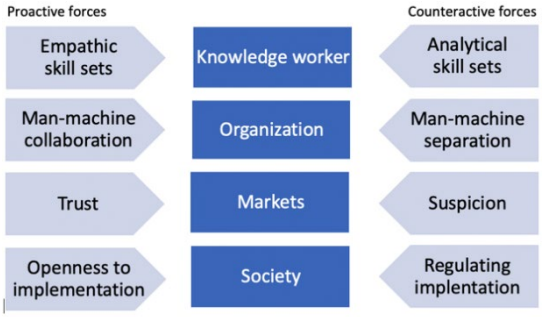


Figure 5: Four Dimensions of Man-Machine Collaboration with Identified Dilemmas

Our findings depicts both proactive and counteractive forces for each of the dimensions. Figure 5 is an attempt to illustrate the dilemmas for each of the four dimensions based on the above discussion of the dilemmas, or counteracting forces, associated with each of the four dimensions. To date there exist limited empirical research that can establish the directionality of these counteracting forces.

6. Conclusion

The study confirms that the field remains immature and fragmented, and despite revealing that all identified articles in our content analysis sample address artificial intelligence and cognitive technologies as an important aspect of changes in organizations and related strategy development, few journals deal with the man-machine collaboration in particular. Indeed, there exist no comprehensive description on how strategy should be adapted to technological developments. Our study condensed an overwhelmingly amount of digitalization research into a digestible 25 papers spanning across different disciplines. Our study reveals how extant research have recorded how cognitive technologies affect man-machine collaboration in different ways, and have identified four dimensions that experience different effects on man-machine collaboration. The influence on man-machine collaboration is largely dependent on individual factors, such as attitudes to technology and change, as well as societal attitudes towards the AI-evolution. Moreover, extant research is inconclusive with respect to the forces affecting these dimensions, depicting the forces almost as dilemmas. Future research can build on this insight to further knowledge of the vast potential of AI application and digital transformation by empirically seeking answers to the directionality of forces at each dimension level. Moreover, the study can be utilized to inform the innovation and strategy discussions when implementing cognitive technologies. Our study also has clear limitations. Whereas we based the study on an exhaustive search, and experimented with different search phrase combinations, we still were neither able to identify several articles addressing the effects cognitive technologies have in the workplace, nor empirical data describing contingencies within one industry. The reason for this may be that this type of technology is still in the growth phase and thus has little basis for researching

the implications. Further research should therefore continue the investigation of what defines the man-machine collaboration of knowledge workers, both conceptually and empirically.

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The Effect of Intellectual Capital and Strategic Partnerships in Construction Companies

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Abstract: The construction industry is facing significant challenges due to globalization, increasing competition, and rapid technological advancements. In this context, intellectual capital and strategic partnerships have emerged as essential factors for the success and competitiveness of construction companies. Intellectual capital encompasses a company's intangible assets, such as knowledge, skills, experience, expertise, and relationships. At the same time, strategic partnerships involve a mutually beneficial relationship between two or more organizations that work together to achieve common goals. This paper aims to explore the effect of intellectual capital and strategic partnerships on the performance and competitiveness of construction companies. The study employs a qualitative research design and uses a literature review approach to analyse existing research and identify key concepts and themes. The findings suggest that intellectual capital and strategic partnerships can significantly improve construction companies' innovation, efficiency, and competitiveness. However, effective management and utilization of these assets require a clear understanding of the company's goals, resources, and capabilities, as well as the development of a collaborative and knowledge-sharing culture. The paper concludes by proposing future research directions and practical implications for construction companies to enhance their intellectual capital and strategic partnerships.

Keywords: Intellectual capital, Strategic partnerships, Construction industry, Knowledge management, Competitiveness

1. Introduction

The construction industry has undergone a significant transformation over the years, driven by technological advancements and increasing global competition. To remain competitive, construction companies need to focus on developing and leveraging their intellectual capital and forming strategic partnerships (Asiaei & Jusoh, 2017). Intellectual capital, which includes knowledge, skills, and expertise, has been identified as a key driver of organizational performance and competitiveness. Strategic partnerships, on the other hand, allow firms to access resources, capabilities, and knowledge that they do not possess in-house, thereby enhancing their competitive advantage (Ali *et al*., 2021).

This paper aims to investigate the effect of intellectual capital and strategic partnerships on the performance and competitiveness of construction companies. By examining these two constructs, the study seeks to provide insights into how construction companies can enhance their performance and competitiveness in a rapidly changing environment. To achieve this objective, a review of the relevant literature on intellectual capital and strategic partnerships in the construction industry will be conducted, followed by an empirical study of construction companies. This research is part of a set of papers belonging to ongoing research. Since data collection is still ongoing, the nature of this paper is purely exploratory.

The paper is structured as follows. The next section provides a review of the literature on intellectual capital, strategic partnerships, and their relationship with organizational performance and competitiveness. This is followed by a section on the research methodology, which outlines the research design, data collection, and analysis procedures. The results of the study are then presented and discussed in the subsequent section. The final section concludes the paper by summarizing the findings, highlighting their implications for construction companies, and suggesting directions for future research.

2. Literature Review

The construction industry has been facing significant challenges in terms of its performance and competitiveness in recent years. As a result, many construction companies have started to focus on strategies that can enhance their performance and competitiveness. Two such strategies that have gained significant attention in recent years are the development of intellectual capital and the formation of strategic partnerships (Afroz *et al*., 2019).

Intellectual capital is a crucial factor for companies to achieve and maintain a competitive advantage in the current business environment. The concept of intellectual capital encompasses three main components: structural, relational, and human capital (Matos *et al*., 2020).

Structural capital refers to the organizational infrastructure, systems, and processes that support knowledge creation, sharing, and utilization. It includes intellectual property, patents, trademarks, copyrights, databases, and proprietary software. Structural capital is essential for companies to capture and retain the knowledge and expertise that is embedded in their processes and systems (Edvinson & Malone 1997). Relational capital, on the other hand, refers to the network of relationships that a company has with its stakeholders, such as customers, suppliers, and partners. These relationships provide access to external knowledge, information, and resources, which can be leveraged to enhance a company's intellectual capital. Relational capital is particularly important in the construction industry, where collaboration and coordination with other stakeholders are critical for project success (Matos, 2013). Human capital refers to the knowledge, skills, and expertise of a company's employees. It includes both explicit knowledge, such as technical and professional skills, and tacit knowledge, such as experience and intuition. Human capital is the most critical component of intellectual capital, as it is the source of innovation and creativity (Edvinson & Malone 1997).

Several studies have highlighted the importance of intellectual capital for construction companies. For example, Liu et al. (2022) found that intellectual capital positively affects the performance of construction firms. Similarly, Li et al. (2019) found that intellectual capital has a significant positive effect on the competitiveness of construction companies. In addition to intellectual capital, strategic partnerships are also critical for the success of construction companies. Strategic partnerships can provide access to resources and capabilities that a company may not have on its own, such as specialized knowledge, technology, and expertise. Several studies have emphasized the importance of strategic partnerships in the construction industry. For example, Bilgin et al. (2015) found that strategic partnerships positively affect the innovation performance of construction companies.

Overall, the literature suggests that intellectual capital and strategic partnerships are crucial factors for the performance and competitiveness of construction companies. The effective management of intellectual capital and strategic partnerships can help construction companies to achieve their objectives and sustain their competitive advantage in the long term (Zhytchenko et al., 2017). However, it is important for construction companies to carefully select their partners and establish clear goals and communication channels to ensure that the partnership is effective and beneficial for all parties involved.

3. Theory and Hypothesis

Intellectual capital is a critical resource for firms in the construction industry because it can enable firms to develop new and innovative solutions to complex problems, improve their operational efficiency, and increase their overall competitiveness. According to the resource-based view of the firm, the availability and effective use of intellectual capital can provide construction firms with a sustainable competitive advantage over their rivals (Li et al., 2019). In this context, the following hypothesis is proposed:

> *Hypothesis 1: There is a positive relationship between intellectual capital and construction firm performance.*

Strategic partnerships can also have a significant impact on the performance and competitiveness of construction companies. By forming alliances with other companies in the industry, construction firms can leverage their complementary strengths and resources to achieve common goals, such as reducing costs, improving quality, and increasing innovation. In addition, strategic partnerships can help companies access new markets and customers and build stronger relationships with suppliers and other stakeholders (Hao & Song, 2016). Based on these findings, the following hypothesis is formulated:

> *Hypothesis 2: There is a positive relationship between strategic partnerships and construction firm performance.*

Finally, it is expected that intellectual capital and strategic partnerships may have a complementary effect on the performance and competitiveness of construction companies. By combining their intellectual resources and forming strategic alliances, construction firms can increase their innovation capability, improve their operational efficiency, and increase their market share (Ferreira & Franco, 2017). Therefore, the following hypothesis is proposed:

Hypothesis 3: The combined effect of intellectual capital and strategic partnerships is positively related to the performance of construction companies.

4. Method

The empirical analysis used in this study is based on the use of primary statistical data collected from several SMEs operating in the construction sector. To build the database, data were collected concerning the characteristics of individuals working in companies in the construction sector and data corresponding to the intellectual capital and strategic partnerships of organizations that develop their economic activity in the same area.

This research is based on a quantitative research where descriptive and correlational approaches correlational approaches allow testing and validating the model. The starting point are the opinions and perceptions of individuals working in the construction sector in management positions. The variables under study allow us to analyze the dynamics of the dynamics of the model. All statistical analysis was performed using IBM SPSS28®.

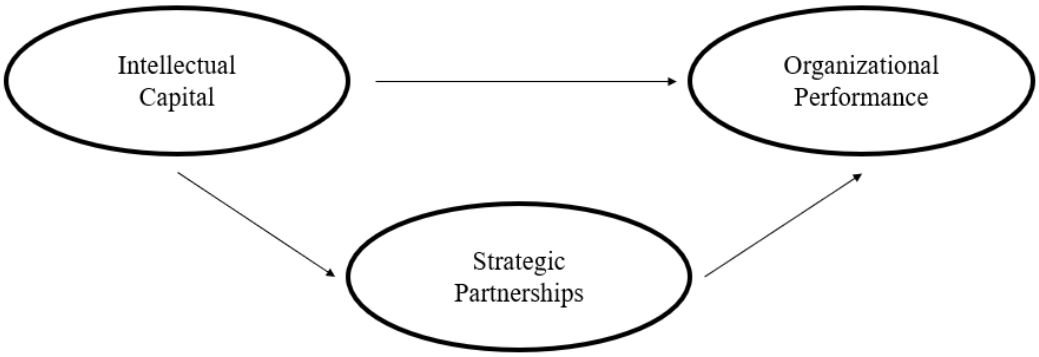


Figure 1: Theoretical Model

5. Sample Characterization

The sample consists of the opinions of eighty-eight (n=88) people with management roles in SMEs in the construction industry. It is characterized by being mostly made up of graduates up to master level, with only (25%) doctorates. Two thirds of the participants work in the human resources areas, in the department or administration of the organization under analysis. As for the period of work, (8%) have worked in the organization for less than a year, (46,6%) have worked in the organization for between one and five years, (23.9%) have worked in the company for between six and ten years, and (21.6%) have worked in the company for more than ten years. Most of the respondents work in organizations with less than 250 employees and with a turnover of less than 10 million euros.

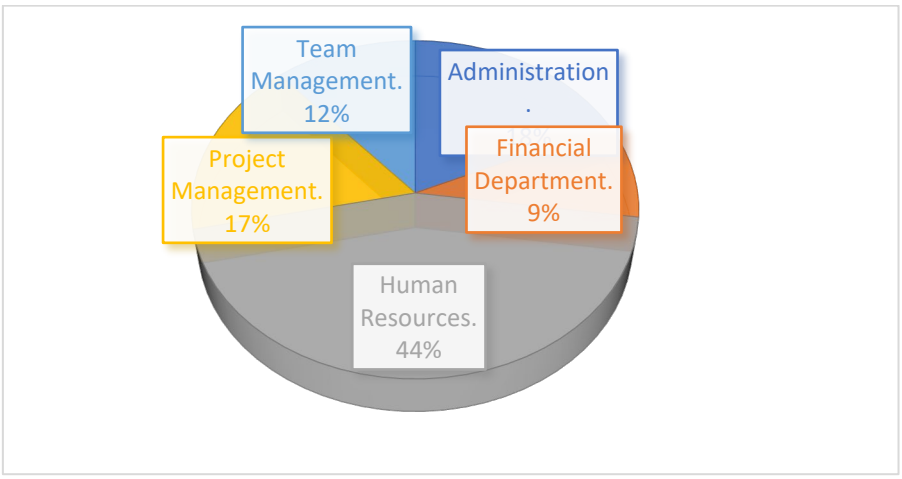


Figure 2: Company Department

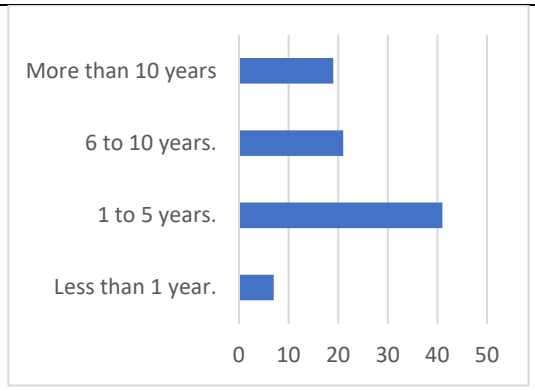


Figure 3: Number of Employees

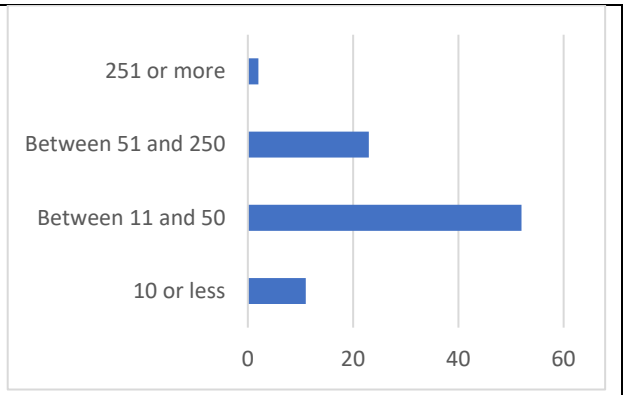


Figure 4: Number of Years at the Company

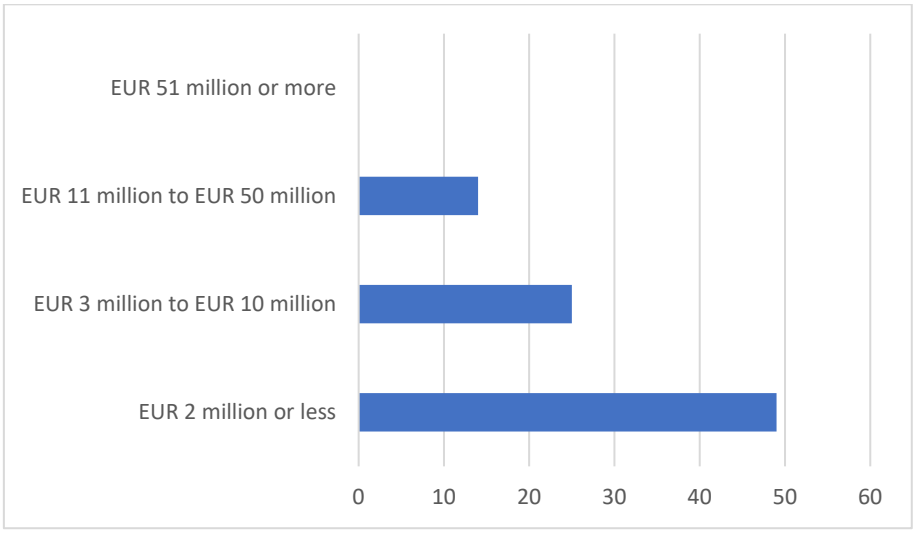


Figure 5: Turnover

6. Measurement Scales

To measure the intellectual capital it was used the scale of Matos et al. (2020), where the relational, structural and human components are evaluated. In the same sense, to measure the construct strategic partnerships the scale of Hoffmann and Schlosser (2001) was used, which is composed of 6 items. Finally, the scale used to measure performance through the ability of organizations to innovate (Elsaman et al., 2022) is composed of 8 items. Responses were given on a five-point Likert scale ranging from (1) strongly disagree to (5) strongly agree.

Using SPSS (version 28) correlation analyses were performed in order to test hypotheses 1, 2 and 3.

7. Data Analysis

In today's complex and competitive business landscape, organizations are constantly looking for ways to improve their performance and gain a competitive advantage. Two key factors that have emerged as crucial drivers of success are intellectual capital in its components relational capital, structural capital and human capital, and strategic partnerships. After collecting data and testing Cronbach's Alpha, we conclude that the questionnaire has a good reliability (0.839). The analysis reveals a positive and highly significant correlation between intellectual capital and strategic partnerships. In this sense, the human capital and relational capital constructs stand out for their positive and highly significant relationship with strategic partnerships. This suggests that construction firms with higher levels of human capital and relational capital are more likely to engage in strategic partnerships, achieving more success with them. Structural capital also appears with a positive and quite significant correlation with strategic partnerships, however, with less weight than the other constructs.

Furthermore, the analysis shows a positive and significant correlation between strategic partnerships and organizational performance, as well as a positive and significant correlation between intellectual capital and

performance. In this scenario, the construct with the highest weight is human capital. This implies that construction firms that establish strategic partnerships and apply intellectual capital management policies tend to achieve better results in terms of organizational performance. Strategic partnerships allow firms to access complementary capabilities, share risks and resources, and leverage synergies, ultimately leading to better performance. The results highlight the importance of intellectual capital and strategic partnerships to the performance of construction firms. By effectively developing and managing intellectual capital, firms can improve their knowledge base, innovation capabilities, and operational efficiencies. Engaging in strategic partnerships allows them to leverage external expertise, expand their market reach, and access new opportunities.

In view of the results obtained, and as referenced above, it is possible to verify that all the hypotheses are true. By validating them it becomes clear the importance of the variables intellectual capital, where the three constructs stand out, and strategic partnerships in the organizational performance in companies in the construction sector. Thus, hypothesis 1, where the focus was the positive relationship between intellectual capital and the performance of organizations in the sector (Liu et al., 2022), hypothesis 2, where the focus is the positive relationship between strategic partnerships and organizational performance (Bilgin et al., 2015) and, finally, hypothesis 3, where the focus is the positive impact caused by the relationship between intellectual capital and strategic partners on the performance of companies in the construction sector (Zhytchenko et al., 2017) are validated.

Table 1: Correlations of Variables

	IC	SC	HC	RC	SP	PERF
IC					,681**	,501**
SC			,508**	,516**	,478**	,300**
HC				,662**	,672**	,509**
RC					,556**	,458**
SP						,630**

**Correlation is significant at the 0,01 level (2-tailed)

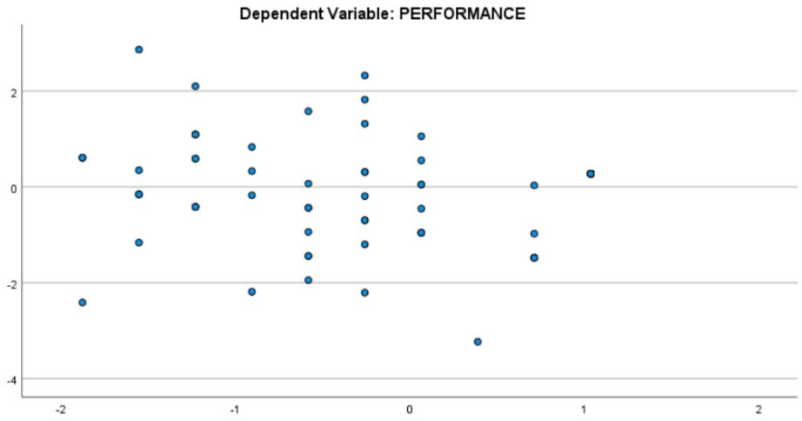


Figure 6: Scatterplot - Dependent Variable - Performance; Independent Variables - Intellectual Capital and Strategic Partnerships

8. Discussion and Conclusion

The validation of all the mentioned hypotheses allows us to broaden the discussion around the interaction between intellectual capital, strategic partnerships, organizational performance and the significant impact that these factors can have on the success and competitiveness of construction companies. The results of various studies and the proposed model highlight the importance of effectively managing intellectual capital and establishing strategic partnerships to improve organizational performance.

First, intellectual capital, which includes human, structural and relational components, is a valuable resource for organizations. Construction companies that invest in developing the knowledge and skills of their employees (human capital), optimizing their internal processes and systems (structural capital), and fostering external

relationships and networks (relational capital) tend to gain a competitive advantage (Matos et al., 2020). The availability and effective use of intellectual capital provide a solid foundation for organizations to establish strategic partnerships (Li et al., 2019).

Thus, and as data collection provides evidence that strategic partnerships positively influence organizational performance, facilitate knowledge exchange, enable cost sharing and risk reduction, and create opportunities for joint value creation (Bilgin et al., 2015). These collaborative efforts have the potential to improve productivity, efficiency, and overall performance outcomes.

Finally, and after corroborating hypotheses posed, it is possible to highlight the crucial role of intellectual capital and strategic partnerships in improving organizational performance in the construction sector. By effectively managing intellectual capital and leveraging strategic partnerships, construction firms can gain a competitive advantage, achieve operational excellence, and drive sustainable growth (Zhytchenko et al., 2017). This knowledge tends to facilitate construction firms in making decisions and developing strategies that maximize the benefits derived from intellectual capital and strategic partnerships.

9. Limitation and Future Lines of Research

The present article, despite its contribution to the literature, contains limitations. A limitation of existing research on intellectual capital, strategic partnerships, and organizational performance is the lack of generalizability to different contexts. Many studies were conducted in specific industries or geographic regions, which may limit the applicability of the findings to other contexts. Future research should aim to explore diverse industries and geographic locations to improve the generalizability of the findings.

Another limitation lies in the measurement and operationalization of intellectual capital and strategic partnerships. These constructs can be complex and multifaceted, which makes it difficult to develop standardized and comprehensive measurement tools. Different studies may use different measurement approaches, making it difficult to compare results across studies. Future research should focus on developing reliable and valid measurement instruments to ensure consistency and comparability. The number of answers to the questionary, despite of providing good data, is insufficient to take further conclusions.

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Strengthening Collective Action and Sustainability of Traditional Farming Organizations From an Indian Philosophical Perspective

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Abstract: Developing countries like India are formulating various models to improve farmers' lives and agribusiness organizations' sustainability. However, most models focus on technological interventions in improving agriculture production, pest control and creating hybrid seeds that resist climate change to achieve agriculture sustainability. They ignore the role of the collective action approach to ensure the holistic development of farmers and the agriculture sector. There is significantly less attention given to indigenous ways of building collective action and organizational sustainability of the traditional Farmer's groups. Therefore, the researcher aims to explore the existing activities followed by traditional farmers to ensure collective action and the organizational sustainability of their groups. Additionally, the researcher maps its similarity to the Indian philosophical principles of *Pancha Maha Yajna* propagated by the Vedas. *Pancha Maha Yajna* describes five daily obligations or sacrifices an individual must make to respect and give back to society, nature, and the divine. Firstly, Brahma Yajna, which involves knowledge creation and updating. Secondly, Dev Yajna which is seeing divinity within and around. Third, Pitru Yajna, where we acknowledge and celebrate the contributions made by our ancestors. Fourth is Bhuta Yajna, which describes an individual's responsibility to respect and care for all living things, including people, animals, and plants. Lastly, Manushya Yajna is a service to society. A qualitative case study method was adopted to explore the evidence of applying these ancient principles in the daily activities of traditional farmers groups in India. A theoretical model to enhance collective action and organizational sustainability grounded on Vedic concepts was developed based on the evidence from the study. Thus, agribusiness organizations worldwide can implement the tenets of *Pancha Maha yajnas* to encourage ethical behaviour, social responsibility, collective action, and sustainability in their organizations to promote the social welfare of farmers and society.

Keywords*: Pancha Maha Yajna*, Hinduism, Indian philosophy, Vedas and yajnas, Collective action, Organizational sustainability, Agribusiness organizations

1. Background

Farmers form collectives to support each other in all farming areas (Annual-Report, 2019). These formal and informal organizations can help small farmers improve their income and asset holdings (Mutonyi, 2019). Farmers can adopt new technologies and techniques, access markets, and increase their yields by pooling resources and sharing knowledge and expertise through collectives (Khan *et al.*, 2022). Farmers gain access to local, regional, and international markets (Ochieng *et al.*, 2018). They can produce and market their products more effectively, negotiate better prices, and reduce transaction costs (Chimombo Masautso et al., 2022). Agriculturalists manage risks associated with agricultural production, such as weather events, pest infestations, and market fluctuations, with the support of farming organizations (Gava *et al.*, 2021). But sometimes, these organizations face sustainability issues to achieve the abovementioned goals and benefits.

Several models proposed by Government and private institutions can be used to build sustainability of agribusiness organizations. However, most models neglect the importance of collective action in ensuring organizational sustainability and focus on technological interventions to boost agriculture sustainability. There is a scarcity of models that acknowledge the uniqueness of sociodemographic characteristics and the cultural context of the farmers' community. Sometimes traditional farmers already apply the principles of collective action and sustainability in their groups, but their theoretical foundations are unexplored and unknown to the academic world. Therefore, the current research study aims to explore the existing activities & principles followed by traditional farmers to ensure their groups' collective action and organizational sustainability. Additionally, the researcher maps the Indian philosophical principles of *Pancha Maha Yajna* propagated by the Vedic concepts in Indian philosophy to the activities of traditional farmers' organizations in India.

Pancha Maha Yajnas is a Sanskrit term referring to the five sacrifices or offerings traditionally performed in Hinduism (Woodroffe and Avalon, 1913). While *Pancha Maha Yajna* is primarily a spiritual concept, its principles can be applied to many life aspects, including agribusiness organizations. These sacrifices are considered a duty for every individual and are intended to show gratitude to various beings and entities contributing to human life. Performing these sacrifices is believed to help individuals develop a sense of appreciation and detachment towards their possessions and desires. Also, it allows them to cultivate collective action and a spirit of service

towards all living beings. However, research studies are needed to reinforce its capability to act as a model of collective action and sustainability.

2. Sustainability Models for Business Organizations and Agriculture

John Elkington introduced the Triple Bottom Line (TBL) approach to sustainability in his 1994 book, *Cannibals with Forks: The Triple Bottom Line of 21st Century Business,* which is still relevant to business organizations. The TBL framework suggests businesses should focus on economic performance and consider their operations' environmental and social impacts. The model considers economic, social, and environmental factors when making decisions (Sala, 2019; Loviscek, 2021). However, the organizations say it is difficult for them to ensure a proper balance of economic, social, and environmental factors in the long-term functioning of organizations. Because when they focus on environmental and social considerations, the organizations cannot run profitably and sometimes decide to shut down.

Another sustainability model of Circular Economy features ways to improve the profits of organizations by minimizing waste and maximizing the use of resources using closed-loop systems. It involves reusing, recycling, and repurposing resources to create a more sustainable approach. The focus is on resource utilization and effective resource management (Pieroni, McAloone and Pigosso, 2019).

The Value Chain Analysis model elaborates on the sustainability of a business organization's demand and supply of products. The model examines a development or service's value chain to identify improvement opportunities. It analyses each step in the product value chain process to identify inefficiencies and areas where sustainability can be improved (Cristino Mandinga Bonfim *et al.*, 2019).

The most popular approach of Corporate Social Responsibility can also be considered a sustainability model to take responsibility for a company's operations' social and environmental impact. It consists of developing policies and programs that promote sustainability, such as reducing carbon emissions, supporting local communities, using sustainable materials, etc. (Popova *et al.*, 2019). This model works well in corporate business organizations to empower a community or group of people as a part of their organization's vision and mission.

There is another set of sustainability frameworks specifically designed for agriculture. The Food and Agriculture Organization (FAO) sustainability assessment framework evaluates the sustainability of agricultural systems by considering six criteria: productivity, environmental sustainability, economic viability, social acceptability, food quality, and food safety (Leknoi, Rosset and Likitlersuang, 2023). The Global Reporting Initiative (GRI) sustainability reporting framework provides guidelines for reporting on sustainability performance in agriculture(Tarquinio, Raucci and Benedetti, 2018).

The Regenerative Agriculture framework emphasizes reducing inputs such as synthetic fertilizers and pesticides, promoting crop rotations, and integrating livestock into cropping systems (Giller *et al.*, 2021). The social sustainability framework was developed using a social science-based approach to understand the complexity of social interaction in agriculture(Janker, Mann and Rist, 2019).

It's fascinating that these frameworks focus on economic, social & environmental dimensions of agriculture sustainability. However, academia lacks a model from ancient scripts that addresses collective action and sociocultural and traditional aspects of sustainability. Therefore, this study explores the potential of the ancient Indian philosophical concept of *Pancha Maha Yajnas* in the sociocultural context of traditional farmers' organizations. The researcher believes that recovering the relevance and application of ancient knowledge & principles in the contemporary world enhances acceptance and inclusivity of the culture and traditions followed by the farmers. In a way, it helps to preserve and protect indigenous knowledge for future generations.

3. Methodology

A qualitative case study method was done to understand the daily activities of traditional farmers' organizations. Since this method helps to collect in-depth and real-time contextual information about the functioning in the group setting, the researcher can observe the complex natural environment of a group to derive findings related to the scope of the study.

4. Sample

A Farmers Producers Organization (FPO) located in the Tamil Nadu state in the southern part of India was taken as a unit of the study. Because this FPO is familiar to the researcher since the researcher has done several community intervention programs with them, and the FPO has covered a minimum of five years of successful

functioning as an active Farmer's organization in the community. Purposive sampling was adopted to select the farmers for the data collection process. FPOs were formed in 2016. There were 20 members in each Farmer's interest group under the organization. The researcher interviewed sixteen members from two farmers' interest groups, including males and females. The age groups of respondents ranged from 25 to 65. Most of the members are above 35 years of age. Two members have graduated from college, and few completed higher secondary education; the rest are below the upper primary level of education. All the respondents were from Antyodaya Anna Yojana Beneficiaries, which denotes the poorest of the poor according to the household's economic status prescribed by the Government of India. Table 1 shows the sociodemographic details of the farmers.

Table 1: Sociodemographic Details of Participants

Sociodemographic details of participants	**Group 1**		**Group 2**	
Categories	N	%	N	%
Male	0	0	3	37.5
Female	8	100	5	62.5
Age of participants				
25 to 34	2	25	0	0
35 to 44	0	0	1	12.5
45 to 54	2	25	2	25.0
55 to 64	0	0	5	62.5
Above or equal to 65	4	50	0	0
Education Status				
No formal education	0	0	0	0
Completed Primary education 4th Grade pass	2	25	2	25.0
Completed Upper Primary education 7th-grade pass	1	12.5	4	50.0
Completed Secondary education 10th pass	0	0	2	25.0
Completed higher secondary education +2 pass	3	37.5	0	0
Degree holder	2	25	0	0
Above graduate level	0	0	0	0
Economic Status				
Antyodaya Anna Yojana Beneficiaries	8	100	8	100
Below poverty line	0	0	0	0
Above Poverty Line	0	0	0	0
Non – Priority	0	0	0	0

5. Data Collection Process

The researchers prepared an in-depth interview schedule to understand the functions of farmers' groups and the sociocultural underpinnings that influence the sustainability of the groups. Therefore, there were questions about the evolution of the Farmer's group, significant transitions, benefits attained by members and the existing challenges, if any. The interactions with the farmers are perceived from the theoretical lens of *Pancha Maha Yajnas* for deriving the same's scope to build the study's theoretical framework. Interpretivism, the idea that each observer's reality is distinct from another, served as the foundation for the research philosophy in this study. The *Pancha Maha Yajnas* are considered as duty and responsibility of an individual in daily life in their family, organization, and community. So on, the researcher focussed on the respondent's overall experience as a part of an FPO, daily duties and responsibilities concerning the FPOs, the governance process, and how the group performs and contributes to society. The steps in the data collection process are illustrated in Figure 1.

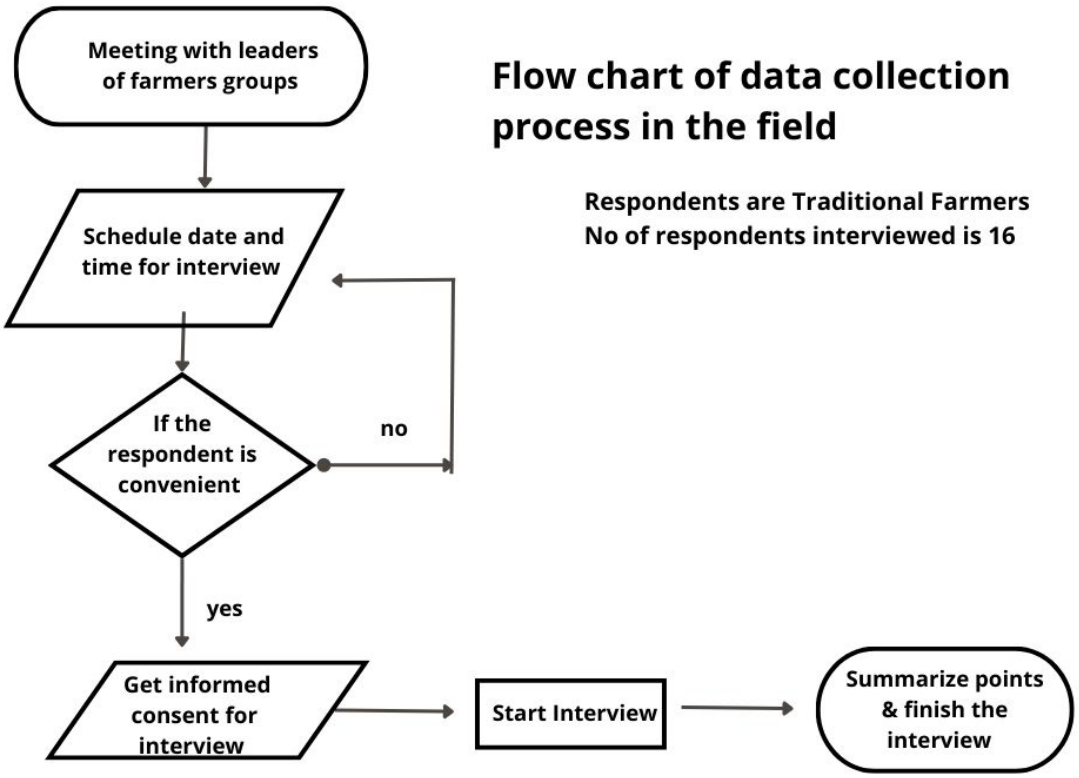


Figure 1: Flow Chart of the Data Collection Process in the Field

6. Data Analysis

Thematic data analysis was performed by the researcher using NVivo data analysis software. The interview transcripts were uploaded into the NVivo platform, and started coding the data. First-order coding identified essential functions, activities, roles, responsibilities, and governance processes in farmers' groups. Later these codes are grouped under themes of fivefold sacrifices mentioned in the ancient concept of *Pancha Maha Yajna* to project the resemblances of Indian philosophical concepts and principles followed by farmers' groups to build collective action and sustainability.

7. Ethical Considerations in Qualitative Research

Ethical considerations of privacy and confidentiality are maintained by taking informed consent from the respondents, especially before the interview. The respondent's convenient day and time were enquired before scheduling the date for the interview. A known person within the community accompanied the researcher to make the respondents comfortable openly sharing their experience with the farmers' group.

8. Results

The respondents described the critical functions of the Farmer's group. The essential functions include collecting agricultural products, identifying the market, facilitating collective bargaining and mobilizing credits from banks during production. The group's collective effort helps farmers negotiate better prices for their produce by aggregating it and bargaining collectively with buyers. Market access was direct without intermediaries enabling farmers to receive better prices for their produce. The group allows women to access credit facilities from financial institutions like banks every year. The agriculture office in the locality provided capacity building and training for farmers in areas such as production, marketing, and value chain.

The theoretical lens of *Pancha Maha Yajna* applied by the researcher mapped each function into the five yajnas, illustrated in Table 2. And the theoretical framework evolved from the findings is shown in Figure 2. While *Pancha Maha Yajna* is primarily a spiritual concept, its principles can be applied to many settings, including

agribusiness organizations. These principles are considered a duty for every individual and are intended to show gratitude to various beings and entities contributing to the organization's development.

Table I Description of Pancha Maha Yajna

Sanskrit name	English meaning	Description	General Example of Practice	Example of this practice in Farmers' producers' organizations
Brahma Yajna	Sacrifice to the divine knowledge & develop inspiration the self-knowledge	Involves knowledge creation and updating.	Study and teaching of the Vedas and other spiritual scriptures (Veda, 2022).	Capacity building and training to farmers, transfer of indigenous knowledge
Dev yajna	Sacrifice to the celestial beings and develop divine qualities	Involves the worship of the gods and goddesses through the performance of various rituals and the progression from animal instincts to divine qualities	Develop divine qualities of compassion, forgiveness and love for all (Jaisawal, 2022).	Ensure effective use of natural resources and produce quality products without harming nature.
Pitru Yajna	Sacrifice to the ancestors	Acknowledge and celebrate the contributions made by ancestors and fellow beings.	Offering food and water to ancestors and departed souls. Thanksgiving Day for ancestors (Adinarayanan and Rekha, 2017).	Honouring elderly farmers during festivals by acknowledging their contributions to agriculture development.
Bhuta Yajna	Sacrifice to the animals and nature	Describes an individual's responsibility to respect and care for all living things, including people, animals, and plants.	Offering food and water to animals, birds, and insects (SIVANANDA, 1999).	Preservation of indigenous seeds. Exhibiting respect to animals (especially Cows) for their support during farming.
Manushya Yajna	Sacrifice to fellow human beings	Service to society	Offering hospitality and service to humanity (Sanskriti, 2020).	Provide quality products to the community and fair treatment of all stakeholders in agriculture. A portion of the harvest was given to the temple to feed needy people during a crisis.

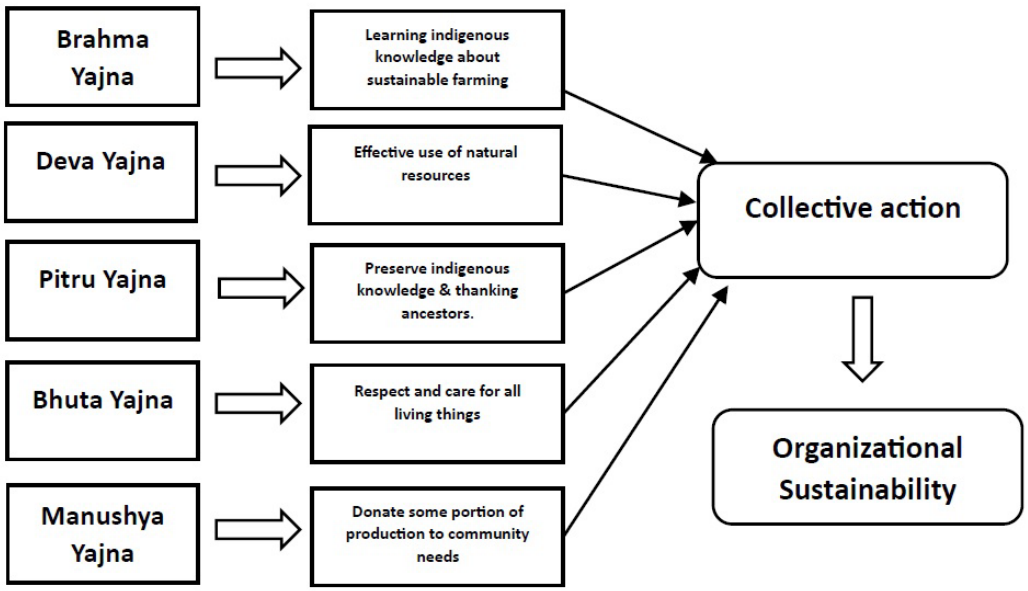


Figure 2: Theoretical Framework of the Study

Apart from the essential functions of FPOs, the sociocultural context in which the sample FPO exists has a tradition of celebrating the harvest festival called Pongal by the farmers and local community. Pongal is a four-day harvest festival celebrated by Tamil people, usually in January every year. The celebration symbolizes the passing of the winter solstice and the start of the sun's six-month journey northward, also known as Uttarayanam. On the first day, Bhogi, people clean their homes and discard old and unnecessary items by burning them in a bonfire. The second day is the primary day of the festival, also called Pongal, where people cook a sweet dish using freshly harvested rice, jaggery, milk, and other ingredients. They offer this dish to the Sun God, thanking him for a bountiful harvest regarded as Dev Yajna in the Vedic period. The third day, Mattu Pongal, dedicated to cows, is considered sacred and an essential part of agriculture. Cows are decorated with colourful beads and flowers, and farmers thank them for their hard work in the fields, which denotes Bhuta Yajna. The fourth day, Kaanum Pongal, is for family reunions and outings. People visit their relatives and friends, enjoy traditional food, and exchange gifts. Wealthy people will donate food and clothes to vulnerable sections of society and can be considered Manushya Yajna.

The significance of Pongal for farmers is enormous. It is when they celebrate the harvest and offer gratitude to the Sun God, who they perceive as responsible persons for a good crop. The festival also marks the beginning of the farming cycle as the farmers start preparing their land for the next season's crops. Pongal is a significant festival for Tamil people and holds great cultural and agricultural importance. FPO members in this study viewed their work as a form of worship and service to the divine by producing food that sustains life and supports human well-being. Overall, *Pancha Maha Yajn*a's principles aligned with agribusiness organizations' activities to promote ethical and sustainable practices and foster a sense of connection and responsibility towards the natural world and the communities they serve.

9. Discussion

Indian philosophical rituals, traditions and customs always have significance in the well-being of humans (Jayalakshmi, 2020). Indigenous traditional spirituality practices from Indian philosophical concepts have been practised and developed as a curriculum for healing practices in some Urban Indian health centres in America (Gone, Tuomi and Fox, 2020). Proper knowledge of Indian spiritual concepts improves life satisfaction among youngsters (Lourembam and Ete, 2021). The tribal population in India who still possess the rich tradition of practising ancient spiritual principles in their daily life are living happily (Rowkith and Bhagwan, 2020), and their actions help in the conservation of nature (BAMIN, Yakang; GAJUREL, 2015). These ancient spiritual values and principles can create such an impact in various dimensions of life. In that case, it is evident to remark on its impact and relevance in the context of agribusiness organizations.

The Farmer's groups in the study are pleased to take agriculture practice in the spirit of Yajna. The practice of Yajna has two dimensions, one is external, which is the practice of five yajnas as a ritual, and the second is internal, which is the attitude of Yajna, the philosophy of offering or giving away possessions out of compassion (Misra and Kapur, 2014). Both external and internal dimensions of *Pancha Maha Yajna* were visible in the life of farmers in the study. They are practising yajnas by preserving nature. They respect the animals, especially cows which helps in farming. They transfer their indigenous knowledge to their younger generation. They also possess the attitude of offering. They used to offer help to their fellow group members during the economic crisis, and they bonded together as a group and shared the loss created by natural disasters. This attitude of collective action was learned from the spiritual principles they adopt in their daily life. Thus, the farmers were able to sustain their activities even amid vulnerabilities. The application of *Pancha Maha Yajnas* greatly benefited the Farmer's group in building collectivism and sustainability. However, the generalization of the application of *Pancha Maha Yajnas* for promoting sustainable agriculture practices in farmers' groups has both strengths and weaknesses.

Strengths are it is a holistic approach that integrates spiritual, economic, social, and environmental aspects of well-being. This approach recognizes the interdependence of human beings with the environment and promotes a sustainable way of life. The *Pancha Maha Yajnas* can help preserve nature and traditional knowledge essential for sustainable agriculture by incorporating traditional rituals and practices into agricultural activities. The *Pancha Maha Yajnas* emphasize community involvement and social responsibility. This can form strong social networks and develop collective action towards sustainable agriculture practices. These Yajnas prioritize the long-term sustainability of agriculture rather than short-term profits. This can lead to developing sustainable agriculture practices that harmonize with nature and prioritize future generations' well-being.

The weaknesses are the use of *Pancha Maha Yajn*as for promoting sustainable agriculture practices may not be acceptable to all farmers, particularly those who do not share the same religious beliefs. Secondly, the effectiveness of *Pancha Maha Yajnas* in promoting sustainable agriculture practices has not been scientifically validated. This may limit the credibility of these practices in the outside world.

10. Social Implication of the Model

The Indian philosophical approach of *Pancha Maha Yajna*, which translates to "Five Great Sacrifices," has implications for agriculture organizations in the future. Here are some implications of the *Pancha Maha Yajna* for agriculture organizations:

- Brahma Yajna – Emerging technological interventions like GeoFarmer, a monitoring system for agricultural practice, are introduced to transfer factual time information about farming to the farmers. Farmers and agricultural professionals find it beneficial to manage their farms and crops better, lower risk, boost productivity, and enhance their quality of life (Eitzinger *et al.*, 2019). Conversely, the transfer of indigenous knowledge regarding farming practices remains stagnant without much attention. Therefore, traditional agriculture organizations can be reinforced to practice Brahma Yajna, which can focus on acquiring and sharing indigenous knowledge about sustainable and eco-friendly farming practices, soil health conservation, and natural resource management. Through this Yajna, traditional farmers are encouraged to educate young farmers about the benefits of integrating both emerging and indigenous farm practices to achieve sustainability.
- Deva Yajna - Due to organic foods' benefits for nutrition and health, an increasing number of individuals are making this choice. Furthermore, organic farming protects the environment and has a more significant economic impact on a nation. (Das, Chatterjee and Pal, 2021). Various initiatives were taken to promote organic farming in the country. When agriculture organizations apply Deva yajna, that is, seeing and developing divine qualities within and outside the world, it helps them to see divinity in everything they do. They treat natural resources respectfully. They adopt organic farming methods, reduce the use of pesticides and chemical fertilizers, and promote sustainable practices that protect the soil, water, and air. They take action to supply good quality products because they can separate themselves from the customer. This attitude of deva yajna can improve collection action, cooperation and social cohesion among the Farmer's group.
- Pitru Yajna – Indian Government has honoured Cheruvayal Raman, a tribal rice farmer from Wayanad in Kerala, with the Padma Shri Award (highest civilian award of the nation) for his exceptional achievement in preserving more than 50 regional types of rice. This recognition encouraged traditional farmers to maintain traditional farming practices and techniques. Such recognitions are possible via farmers' groups at the community level by implementing Pitru yajna. Farmers' groups can

encourage locally available seeds, crops, and livestock breeds and support farmers in maintaining their connection to their ancestral land and farming practices.

- Bhuta Yajna – Studies show that farmers' practical knowledge of participatory biodiversity management and maintenance is crucial to India's agriculture and economy. The top-down decision-making regimes are the least effective at achieving sustainable development in traditional Indian farming landscapes (Bisht *et al.*, 2020). Therefore, community-based agriculture organizations can promote the welfare of animals and wildlife in their areas using the concept of Bhuta yajna. They can support biodiversity conservation and encourage sustainable farming practices that do not harm the environment or animals.
- Manushya Yajna – India is the most populated country in the world, and apart from government initiatives, the people require support from humanity to satisfy their basic needs. Agriculture organizations can contribute to the socioeconomic development of their communities. They can help economically backward people cope with food insecurity and poverty. Through Farmer's organizations, unemployed people can be mobilized and provided training, credit, and market access. They can also promote fair trade practices and work towards creating a sustainable and equitable food system.

11. Conclusion

The study investigated the practices currently used by traditional agricultural producers to guarantee collective action and organizational sustainability. A theoretical framework was developed to understand the analogies between the practice and the *Pancha Maha Yajna* principles promoted by Vedic thoughts in Indian philosophy. However, the researcher claims that using *Pancha Maha Yajn*as in agribusiness organizations has both strengths and weaknesses. These practices offer a holistic and long-term approach to agriculture that emphasizes collective action, community involvement and preservation of traditional knowledge. There is a limitation in the applicability of this framework because people may think it is only meant for a specific religious-affiliated population. Lack of scientific validation and cost and time implications are the other limitations of this framework. Nevertheless, such limitations can be fixed by conducting future research studies that can validate such indigenous models. Another potential research directions are the quantitative studies that assess and rate the generalizability of these indigenous models globally. Because real sustainability can be achieved only by addressing the sociocultural dimension of a community that strongly influences how people behave, evolve and flourish in the future. Agriculture organizations that adopt this approach can help create a more sustainable and equitable future for farmers, consumers, and the environment.

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Strategic Knowledge Bases in the Context of Discovering and Creating Business Opportunities

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Abstract: Due to the level of interdisciplinarity and complexity, knowledge management processes in organizations need to be considered from different points of view. The key area of interest of the article is systemic processes of creating knowledge bases that take into account strategic events in organizations in the form of market opportunities. Thus, the article's main purpose is to create two models of knowledge bases, the structure and types of which are directly related to the processes of opportunity management: their discovery and creation. For the main objective thus formulated, the researchers defined the following research questions: 1) What are the information needs for creating a strategic knowledge base model in the opportunity discovery process? 2) what is the information needed for creating a strategic knowledge base model in the opportunity creation process? 3) What are the benefits and utilitarian goals for the organization from the creation of strategic knowledge bases in the context of discovering and creating business opportunities?. The detailed objectives derive from analyzing the organization's interior models and environment. The methodology used in the article is a critical review of the literature, the method of deduction in the area of generating assumptions for discovery processes and creating opportunities in the context of creating knowledge models. The results will enable extracting the cognitive knowledge of strategic knowledge bases in the context of the organization's opportunities. Furthermore, this will result in research models detailing the organization's strategic activities in opportunities and knowledge management processes, along with the specification of the potential benefits of the processes carried out (utilitarian purpose). The research results will expand the understanding of the utilitarian nature of knowledge management processes and strategic theory.

Keywords: Knowledge management, Knowledge base, Opportunity, Opportunity discovery, Opportunity creation, Opportunity management

1. Introduction

Opportunity is a situation arising from the acquisition and processing of incomplete information (uncertainty), with its emergence generated by both external factors and those located inside the company. Opportunities can and are exploited by entrepreneurs, managers, and decision-makers, resulting from these individuals' perception and ability to perceive and discover, but also intentional actions triggering these market situations. An Opportunity can be understood "as the relationship that occurs between events and situations taking place in the business environment and the objectives or intended effects as well as available resources, which consists in the fact that events and situations favor the achievement of goals and effects using available resources" (Trzcielinski, 2019). The process of exploiting opportunities takes the form of active strategic action (Hunter, 2013), The process of exploiting opportunities takes the form of active strategic action (Hunter, 2013), and its objectives are clear and simple: to increase the company's value (Eisenhardt, Martin, 2000). The effects of correctly identifying and exploiting opportunities are usually an increase in the profitability and applicability of the novelty—in the form of a product, service, or technology. An important effect of these is also the increasing attractiveness of the products—in the form of both moral and formal recognition of the new product, service, or technology by society (Baron, 2004).

S. Cyfert and K. Krzakiewicz (2013) evaluated the process of identifying and exploiting opportunities in terms of unfavorable trends in the formulation of strategic objectives that disrupt planning processes. A contrasting perspective stands out in the research of R. Krupski (2007), whose aim was to determine to what extent opportunity determines the development directions of Polish companies. It turns out that 54% of the companies surveyed have developed based on some coincidence (opportunities), and what is interesting is their surprising variety. These range from entering new, previously unknown markets, to the unplanned purchase of new resources, including means of production, such as premises, plots of land, or buildings, as well as diversification of existing activities and increasing the flexibility of the enterprise. Thus, given the positive effects of both taking advantage of emerging opportunities and creating them—the question is whether it is possible to build a knowledge base that would allow opportunities to be treated as a natural and immanent part of the static planning process. This requires a change not only in how decision-makers think but also in how they act. How do you put into a plan something that is not there today?

The article consists of three main parts. The first presents the elements of the strategic model of the knowledge base—providing information on where to both search for and create opportunities. The second – is the models of needs arising from the inside and outside of the organization, answering the question: what are the benefits of monitoring these two elements for the organization if opportunities are discovered or created in them? The third one presents the process of searching for strategic knowledge bases for discovering and creating opportunities.

2. Strategic Knowledge Base Model

Opportunities are future states that may be desirable and feasible for the organization, and their exploitation depends on many individual factors—they, therefore, have a relativistic context (Stevenson, Jarillo, 1990). Consequently, the process of identifying an opportunity is a function of the individual capabilities inherent in enterprise employees: knowledge of the market, technology, or customer needs (Krupski, 2013). The main aspect of the perception of certain phenomena through the lens of opportunity is the priority in identifying them and taking action faster than other market players. Opportunities are, therefore, closely related to the moment of time and period (Krupski, 2007). The inability to capture opportunities in a company's plan indicates its unpredictable nature. Equally difficult to grasp are the periods and lengths of their occurrence. Those opportunities originating from the porter (closer) environment have a much shorter time of market presence, appear abruptly, and last a short time due to their competitive nature.

In contrast, opportunities originating from the Porter environment last longer but have larger and more widespread (Krupski, 2013). The interior of the organization is also an important source of opportunity. The following sections of the study present both opportunities originating from the environment and interior of the organization.

2.1 Knowledge of the Environment as a Source of Opportunity

The environment of modern businesses is dynamic and uncertain. Uncertainty, in turn, translates into the quality of information available to enterprises, which simultaneously reduces their ability to estimate the present and future states of the environment. In addition, the inability to predict future states of the environment generates indeterminacy (ambiguity) in the decision-making process (there is a lack of adequate knowledge about identifying and exploiting opportunities). However, the available research conducted in the subject area under review indicates a positive relationship between the dynamics of the environment and the creation of new ventures based on opportunities (Aldrich, 2000). J. Child defined the complexity of the environment by the heterogeneity and range of activities of companies (1972, in Dess, Beard, 1984), which means that as the heterogeneity of the environment increases, the level of perceived uncertainty will be greater, consequently increasing the need for information and other types of resources. In a dynamic environment, companies will use relationships to gain access to required resources through cooperative arrangements of interaction, such as alliances or co-opetition.

Opportunities arising from external sources should be identified with the elements of the environment and the relationships between them. Although, as the analysis of such sources shows, the greatest opportunities for opportunities exist in the case of competitive behavior. Table 1 shows strategies for exploiting opportunities in the context of individual market forces in the arrangement of active and passive approaches to opportunities.

Table 1: Examples of Active and Passive Strategies for Seizing Opportunities From the Company's Point of View

Part of environment	Examples of active strategies for seizing opportunities	Examples of passive strategies for seizing opportunities
Competition in the industry	differentiating the product using marketing that is unusual for the industry, such as lateral marketing, creation of new channels and ways of distribution (e.g., through a network of partners that is established for the needs of the market entity), introduction of sales of complementary products and/or services (so-called cross-selling)—investment in the development	mistakes of competitors, including "black" P.R. of competitors, use of new, unusual distribution channels, withdrawal from the market of a competitor, reduction of fixed costs by competitors (consequently, reduction of the intensity of competition),

Part of environment	Examples of active strategies for seizing opportunities	Examples of passive strategies for seizing opportunities
	of convergent products, the intentional creation of new co-opetition arrangements;	entry into an existing co-opetition arrangement;
Threat of substitute products	use of alternative and complementary products and/or services as a source of knowledge (the study of substitutes is recommended as one of the paths for the development of a blue ocean strategy), use of new technologies to eliminate from the market a product and/or service that meets the same customer needs;	withdrawal of a substitute product and/or service from the market, taking advantage of deficiencies in the functionality of the substitute product, customer habituation to the substitute product (product obsolescence) and customers' search for other goods and services;
Power of suppliers	cooperative arrangements with suppliers of other services and/or products, but which, in conjunction with a specific service and/or product, form an integral whole, the establishment of a network of technological and commercial partnerships between suppliers, involving backward and forward integration;	low degree of concentration of suppliers in relation to customers, low cost of switching suppliers, low opportunities for horizontal integration, i.e., the supplier's inability to undertake production and/or service provision is an opportunity for the company to enter existing supplier networks;
Power of customers	cooperative arrangements with other customers for products/services, including the initiation of such arrangements by the company, detailed identification of customer needs and provision of tailor-made products/services to customers, opportunities related to increasing the relevance of products and/or services to customer profits;	a high degree of concentration of customers relative to suppliers, a high degree of concentration of companies providing substitute products and/or services, but few suppliers of the desired product and/or service;
Potential of new entrants into the industry	minimizing the likelihood of new business entry through deliberate changes in the law (lobbying), deliberate differentiation of product offerings, as an action to create high barriers to entry, granting patents, utility models, licenses for use of products/services, again: the creation of new channels and means of distribution (e.g., through a network of partners that is created for the needs of a market entity);	"top-down" change in existing laws over which the entrepreneur has no influence, unification and minimization of product offerings of competitors as a result of economic changes (e.g. crisis, fashion, and spread of the idea of simple life among consumers, etc.), invalidation and/or expiration of patents of competing entities, including design decisions and applicable licenses, low capital requirements for launching a new business, lack of market dominance of strong brands;

According to Table 1, opportunities found in the competitive environment of businesses relate to both existing barriers to entry into the sector and forces that act on market players. Detailed identification of these elements allows the entrepreneur to specify potential opportunities. A precondition is to be aware of environmental phenomena and exploit them ahead of the competition, which can significantly affect the enterprise. This impact can be both positive and negative—representing significant sources of opportunities and threats for the company. The methods of analyzing the near and far environment and the event scenarios created on this basis are insufficient to get a complete picture of the spectrum of opportunities. This is primarily because none of the anticipated changes will occur with 100% probability—especially in view of the

multiplicity and diversity of sources of opportunities, including those coming from companies. Nevertheless, this does not exempt entrepreneurs from analyzing signals from the environment, especially the weak ones.

2.2 Knowledge of the Company's Potential

Opportunities emerging inside companies are identified with the category of innovation in Shumpeterian terms—as discoveries of new materials (Schumpeter, 1934 [in:] Shane, Venkataraman, 2000) or market changes in products (Venkataraman, [in:] Katz, 1997) – otherwise as Drucker's changes (Drucker, 1985). The last approach presents opportunities as a) the creation of new information due to the emergence of new technologies, b) the exploitation of market inefficiencies resulting from information asymmetry, and c) responses to changes in the relative costs and benefits of using alternative uses for resources. Opportunities represent a source of internal changes in companies (Allaire, Firsirotu, 2000) and assume the form of innovation activity. M. Hunter suggested a matrix that illustrates four different types of opportunities depending on (a) the charge of innovation and (b) the degree of ambiguity. The author distinguished four basic types of opportunities: allocative, constructive, imitative, and exploratory.

The most basic type of enterprise activity, triggered by the need to adapt to environmental changes, is imitation. It is associated with a low level of innovation and creativity, taking the form of imitating existing solutions. Imitation does not lead to a significant increase in efficiency but is nevertheless associated with a lower risk of implementation. An example of imitation opportunities is expanding existing solutions and duplicating them in other markets.

Allocative opportunities, on the other hand, arise due to a mismatch between demand and supply, the existence of scarce resources in certain areas, or demographic changes that require specific products or services to fill an unexpectedly created gap in customer needs. Viewing opportunities through the lens of supply and demand represents classical economic theory. It is also, to some extent, identical to the resource dependence theory, which emphasizes that there are scarce and valuable resources in the environment that determine the survival of an enterprise. The struggle for resources essentially adopts two objectives. One is to gain control of resources in order to become independent of other market players. The other is to control those resources that increase the dependence of other players on their own resources (Stańczyk-Hugiet, 2013). Allocative opportunities result from a company's response to the needs of its customers, which is why intensive monitoring of the environment is so important. The level of innovation in resource-related opportunities is higher than that of imitative opportunities. However, it is still a passive-reactive form of them (Hunter, 2013) (reflected in the system: stimulus-response, without active participation in their formation).

Discovery opportunities are related to opportunities to gain a competitive advantage by identifying gaps in the market. The sources of these opportunities are new technologies, social conditions, changes in political and legal conditions, and the economic situation. Thus, they are derivative attributes of the environment, regardless of the actions taken by the enterprise. An entrepreneur who knows the specifics of the industry in which his company is embedded combines old and new knowledge in the process of identifying opportunities. This is why in-depth knowledge of the industry in which the company operates is essential. Without this knowledge, the entrepreneur's anticipation of opportunities becomes impossible (Casson, 1982; Shane, 2001). M. Hunter emphasizes the significant role of inductive thinking in the process of opportunity capture, although rational, analytical, and intuitive thinking is also vital in this case (2013).

The sources of constructive opportunities should be sought in the emergent process of certain events emerging from the environment (Chell, 2000; Kruger, 2000; Ardichvili, Cardozo, Ray, 2003), which, through the experience of managers, will be referred to as "opportunities," arising through a process of "trial and error." However, this is a relatively expensive method, which is due to the need to support it with various additional heuristic methods, based on which cognitive maps are created, covering a wide variety of options for action (March, Simon, 1958; Cyert, March, 1963; Mintzberg, Waters, 1985). Knowledge of upcoming opportunities is generated in the process of building on existing information rather than acquiring information and knowledge by new means (Choi, 1993), especially since solutions to complex problems are unique combinations or syntheses of existing knowledge (Nickerson, Zenger, 2004; Henderson. Clark, 1990). The full knowledge resulting from the consequences of seizing an opportunity will therefore be known only after the entire process and may differ significantly from the planned results. The dichotomous effects of the opportunity creation process can thus be both positive and negative, with the opportunity proving to be an opportunity or a threat.

A comparison of the identified forms of opportunity by selected criteria is presented in Table 2.

Table 2: The Comparison of the Forms of Opportunity Exploitation by Selected Criteria

Criteria for comparison	Imitative	Allocative	Discovery	Constructive
Opportunity definition	The ability to undertake a previously known activity in an area defined geographically or by customers.	Opportunities to gain market space through demand-supply mismatches and demographic changes, as a result of using resources to cover these mismatches.	Opportunities to gain an advantage by identifying gaps in the market through new technologies, social conditions, political and legal conditions, and the economic situation.	Opportunities for the emergence (creation) of new phenomena through new means that did not exist before.
Focus of interest	Operational goals and objectives.	Existing market spaces and development of existing strategies (e.g., product sales growth).	Potential market spaces and development of exploitative strategies (e.g., new product development).	The emergence of strategies through environmental monitoring and feedback.
Identification method	Opportunities arise from the ability to replicate the behavior of other market players.	As a result of the deduction.	Through inductive actions.	Constructed through intuition and abduction, based on trial and error, and experiments.
Entrepreneur's assumptions	The selected business models will operate in specific market spaces.	Belief in information and data.	The belief that the market exists due to industry inadequacy and/or structural change.	A wide continuum of entrepreneurial assumptions, but usually with a strong set of values.
Uncertainty	Managed by imitation—what works in other companies will also work in our company.	Managed by product diversification.	Managed as a result of network control, adequate resources, and rare experiments.	Managed as a result of making changes using different, cognitive styles and experiments.
Targeted outcomes	Business operations with sustainable returns.	Success within targeted markets.	Creating new market spaces, differentiating from competitors, and preventing failures.	Profitable new products, services, and business models that are different from competitors and cover new market spaces.

Imitation operations should not be categorized as opportunities since they arise from activities previously known to entrepreneurs. It seems that M. Hunter has misused the term, taking value away from opportunities and claiming that even minor imitative activities can be treated in terms of opportunities. Additionally, given the considerations of H.H. Stevenson and J.C. Jarillo in the context of pioneering the perception and exploitation of opportunities, M. Hunter's concept should be brought into question.

Allocative and exploratory opportunities are typical entrepreneurial opportunities, especially in view of the classic theories of R. Cantillon, A. Smith, or J.B. Say, linking entrepreneurial activities to the functioning of industrial markets. Today, they are concerned with reproductive or imitative innovation rather than pioneering innovation (Fischer, 2011). This classification may be considered to be too radical—however, the idea here is not to draw specific boundaries between the concepts under consideration but rather to outline them in general and to set the direction for further consideration. Such an approach is justified, especially in the context of integrating strategic and entrepreneurial perceptions of organizational reality (McGrath, MacMillan, 2000; Meyer, Heppard, 2000). S. Vantakamaran and S. Shane clearly emphasized that the disconnected study of entrepreneurship and the elements influencing the company (according to

Schumpeter's view), which are the "igniters" of change, results in an incomplete perception of the business landscape (Shane, Venkataraman 2000).

3. Searching Strategic Knowledge Bases for Discovering and Creating Opportunities

Opportunities are a conjunction of chances, company potential, and business goals. Opportunities appear in the environment and are active over a certain period regardless of whether and which companies take advantage of them. Resources with the right potential (qualitative and quantitative structure) are needed to take advantage of an opportunity. Evaluation of opportunities and potential is done from the point of view of the company's business goals.

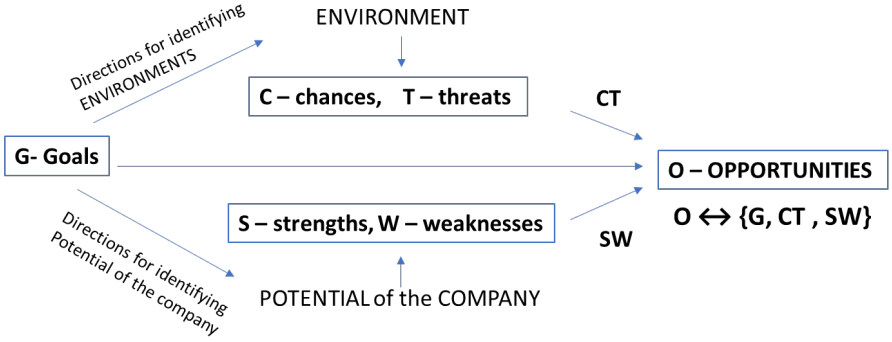


Figure 1: Opportunity Model Interpretation

Chances and threats in the environment can be overt or covert. Overt opportunities and threats are identifiable directly from publicly available or confidential legal, financial, social, marketing, technical, and technological documents, etc.

Examples of such chances could be government agricultural subsidy programs, tax exemptions, customs exemptions, new patents and licenses, news of the bankruptcy of a leading manufacturer in the industry, etc.

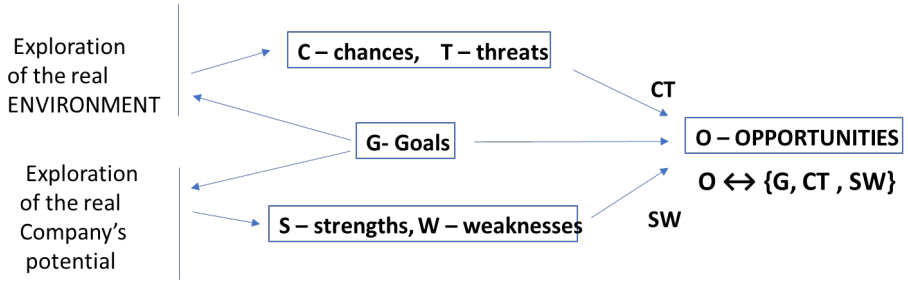


Figure 2: Opportunity Discovery Model

Chances and threats that are covert require specific methods of environmental analysis. This is an area of application of computer simulations and artificial intelligence. These could be predictive analytics methods using Big Data analytics, for example, or Machine Learning. Examples of such opportunities include: potentially new market segments, new product features previously unknown, new substitutes, collapses, or increases in demand.

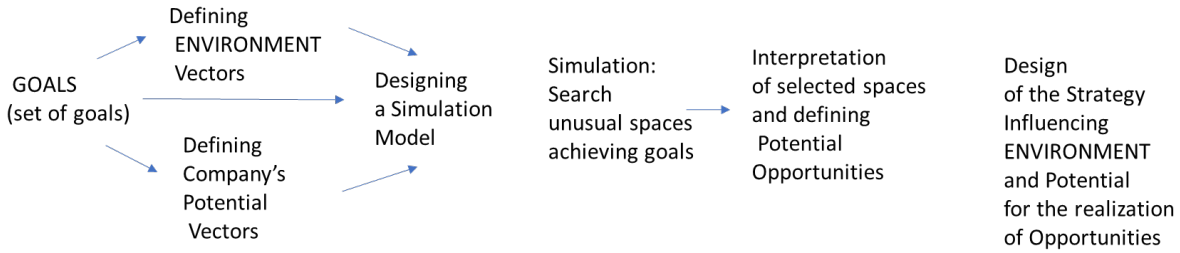


Figure 3: Opportunity Creation Model

There are two possible paths to identifying opportunities:

- Relationship: Objectives—Opportunities; looking for opportunities in the environment from the point of view of defined business objectives
- Relationship: Opportunities—Business Objectives; identifying existing opportunities in the environment and defining business objectives to take advantage of them

Opportunities can be discovered but also created. Discovering an opportunity is finding a way to achieve a goal by aligning a company's potential to take advantage of a chance existing in the environment. For example, the company's potential may be sufficient to take advantage of the chance, or it may need adjustments, such as increased staffing, marketing changes, and capital investment. On the other hand, opportunity creation is finding possibilities to achieve a goal by forcing changes in the environment for business exploitation of the company's potential, e.g., lobbying strategies, mergers and acquisitions, and pricing strategies.

Databases and knowledge bases are needed to identify chances and threats, as well as the strengths and weaknesses of the company. Databases, adequately structured and interpreted, form knowledge bases.

Strategic knowledge bases should include basic information about the environment and information about the company's potential. The information structure of the databases has to allow them to be updated, unambiguously interpreted, and purposefully searched. The knowledge bases of the environment (Table 3, Table 4) are structured according to typical models of macro-environment and micro-environment strategic analyses. Data selection from the point of view of its usefulness for business goals, trend analysis, and evaluation of the data leads to the identification of chances and threats in the environment. Such a model of the environmental knowledge base has been positively verified in searching for opportunities and constructing a business strategy for IAE—Intelligent Autonomous Environment (Kruszynski, Pawlowski, 2020).

Table 3: The Structure of Microenvironment Knowledge Base

Factor of Microenvironment	**Relevance for the Company (1 – valid, 0–invalid)**	**Trend** ↘ ↗ →	**Trend's Appraisal (Positive, Negative**	**Chances** v	**Threats** v
1 Competitive rivalry in IAE sector					
1.1. Number and variety of competitors	1	↘	positive	v	
1.2. Industry growth rate	1	↘	negative		v
1.3. Share of fixed costs in total costs	1	↗	negative		v
1.4. Degree of product differentiation	1	↗	positive	v	
1.5. Cost of changing supplier	1	↗	negative		v
1.6. Exit barriers	1	↘	positive	v	
2 The bargaining power of customers in IAE sector					
3 The bargaining power of suppliers in IAE sector					
4 The treats of new entrants into the IAE sector					
5 The threat of substitute products or services					

Table 4: The Structure of the Macroenvironment Knowledge Base

Factor of Macroenvironment	**Relevance for the Company (1 – valid, 0–invalid)**	**Trend** ↘ ↗ →	**Trend's Appraisal (Positive, Negative**	**Chanses** v	**Threats** v
1. Economic					
1.1. GNP trends	1	↗	positive	v	

1.2. Interest rates	1	↘	positive	v	
1.3. Inflation	1	↗	negative		v
1.4. Unemployment	1	↘	positive	v	
1.5. Disposable income	1	↗	positive	v	
2. Political and Legal					
3. Social and Demographic					
4. Technological					

Knowledge bases of a company's strategic potential have a different strategic perspective and, thus, a different internal structure (Table 5). Two hard (assets and liabilities) and two soft factors (human resources and internal knowledge) are at play here. The level of the company's economic potential is informed by—Assets (level of intangible, tangible, and financial assets), and Liabilities (structure of own and external liabilities). The introduction of soft factors into the knowledge base was the result of empirical research determining their importance ascribed by company boards in the process of building strategic advantage and flexibility of the company's management system (Pawlowski K., and Pawlowski E., 2017; Pawlowski E., 2021). Strategic knowledge is built by the relationship of levels: own resources to the level of resources achievable in the sector. Assessing these levels is the premise for identifying the company's strengths and weaknesses.

Table 5: The Structure of the Company's Potential Knowledge Base

The factor of the Company's Potential	**Scale – set to the business Golas and market level**	**Company level** ↘ ↗ →	**Level assesment (Positive, Negative**	**Strengths** v	**Weaknesses** v
1 Assets					
1.1. Investment Capital	1.5 mln EUR	↗	positive	v	
1.2. Liquidity (Quick ratio)	1,0	↗	positive	v	
1.3. Total asset turnover	1,0	↗	negative	v	
1.4. Return on asset	10	↗	positive	v	
2 Liabilities					
3 Human resources					
4 Knowledge, methods, and techniques of management					

4. In Conclusion

Business opportunity theory is evolving in many aspects and covers the definition of the term, its determinants (independent variables), and the context of these determinants' impact on the business (dependent variables). Opportunities are a unique conjunction of chances, company potential, and the company's strategic business goals. Such a strategic view of opportunities requires analyses of the company's environment and potential, and knowledge of existing and potential sources of opportunity is needed. We routinely look to these sources in the traditional structure of macro-environment and micro-environment factors.

With reference to the micro-environment, examples of strategies for exploiting opportunities in the context of particular market forces are presented. These strategies can take an active or passive approach to exploit opportunities and, as a result, create more or less effective strategies for exploiting opportunities. Adapting a company's potential to emerging opportunities and exploiting opportunities manifests itself in various forms of company innovation. The simplest way is to imitate and improve existing solutions in existing or new markets.

Allocative opportunities arise due to demand-supply imbalances and require activities leading to a resource advantage over competitors. Sources of discovery opportunities are emerging gaps in the market. Product and technological innovations, but also environmental, social, political, and legal innovations, may be important for their use. Constructive opportunities are the area of opportunity creation. Based on the analysis of existing databases and knowledge, computer simulations and artificial intelligence algorithms can be implemented to search for previously unknown trends, combinations of events, and their new interpretation as opportunities. For discovering and creating opportunities, data and knowledge about both existing and postulated reality are needed. The knowledge bases of environments are based on traditional

strategic models of macro-environment and micro-environment analysis. To evaluate the data, criteria were put in place to assess trends and their importance to the company's business goals and identify opportunities and threats. The strategic knowledge base model of the company's potential introduces an analysis of hard factors (tangible and financial resources) and soft factors (people and knowledge resources) and an assessment of these resources from a competitive perspective. The structures of the strategic knowledge bases proposed here were partially verified earlier in research on the development of the Intelligent Autonomous Environment. This research continues, mainly in the use of artificial intelligence algorithms in the process of discovering and creating opportunities.

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Training Initiatives in a Cooperative Network: A Polish Case Study

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Abstract: Paper applies an in-depth example to knowledge-development decisions made at the top levels of firms and their consistency with specific training initiatives arranged with third party educational providers. The unique access provided by the network in Poland at the core of this study yields insights at both levels, an opportunity not often available to academic researchers. Case study is employed. The cooperative training network includes multiple firms (five included here), thirty-eight vocational schools, and a technical university overseeing the program. Data collection including preparatory communication, periodic surveys, and additional in-depth interviews with companies as well as data provided by participating schools though only the quantitative survey results are included in this paper. Both firms and schools, as a proxy for participants, are pleased with training initiatives. Moreover, specific results on training initiatives varying by degree of company control and location (in-house, on-campus) provide insights on how firms can gain more control over the nature of the training (firm-specific knowledge) while still maintaining participant interest (often based on obtaining more industry-specific or occupational knowledge). The research is a case study and so not statistically extendable. The case study also takes place in Poland and describes a unique cooperative network including for-profit firms, vocational secondary schools, and a university. Results should be interpreted with some care, but at the same time provide unique depth and insight. Results provide useful guidance for firms participating in training partnerships as well as for schools joining in such partnerships. Specific feedback on the perception and acceptance of specific initiatives (e.g. internships) has been obtained. Brings together several streams of literature often not discussed in one place. Uses this perspective to analyze a unique cooperative network and provide unique depth to the discussion.

Keywords: Knowledge management, Competency management, On-The-Job training, Human capital, Human resources

1. Introduction

Knowledge management (KM) has always operated as a bridge between planning at the top levels of the firm and the individual knowledge development decisions made by employees and their counterparts in Human Resources. That is not always the case in other disciplines related to KM. Indeed, a number of established scholars have now published work focusing attention on the lack of synchronicity between strategic human capital (SHC) and strategic human resource management (SHRM). The former focuses on organizational strategies to establish a unique company-wide pool of talented human capital, with related organizational level metrics and analytics. The latter is more about individual-oriented knowledge improvement initiatives, with analytics more focused on distinct employees. The two approaches do not necessarily match up well.

But knowledge management provides a foundation to combine the levels and approaches, particularly through the opportunity provided in this application. The Educational-and-Economic Network (EEN) of the Wielkopolska Region in Poland is a unique opportunity to study this question with direct input from potential employers focused on their strategic human capital direction. The network also depends on the individual decisions of vocational schools and the students/prospective employees themselves to participate in the training initiatives. This paper presents initial analysis of seven years of network experience, providing data on training initiative participation and satisfaction from both companies seeking knowledge expansion and schools/potential employees seeking training opportunities and future jobs.

2. Literature Review

Individuals and their knowledge are increasingly seen as the source of competitive advantage (Grant, 1996). Interest in identifying the intangible assets of the firm (intellectual capital/IC) and then managing these assets better (knowledge management/KM) burgeoned as the fields of IC and KM grew over the past couple of decades. Separately but obviously related were the strategic human capital (SHC) and strategic human resource management (SHRM) disciplines. All have to do with the unique combinations of knowledge within employees' heads, what unique capabilities the organization gains from its employees, and how the knowledge, individually and collectively might be better managed.

Knowledge management has typically focused on the differences in the nature of knowledge, especially tacit vs. explicit (Nonaka and Takeuchi, 1995), and how to best manage each type. Highly individual tacit knowledge, for example, is difficult to codify and share, typically leading to person-to-person prescriptions such as communities

of practice or mentoring (Brown & Duguid, 1991). Explicit knowledge, on the other hand, can be more easily captured by the firm in formalized procedures and process documents as well as through information technology solutions (Matson, et al., 2003).

These general themes are echoed in the SHC and SHRM literature though from different perspectives and with different emphases. Strategic human capital is based on idea that the human capital of the firm, the employees and what they know, are a rare, valuable, and inimitable source of competitive advantage (Barney, 1991). Note that human capital in this context is related to how the term is used in intellectual capital circles (Bontis, 1999) but is used somewhat differently.

A commonly used description of human capital in the SHC context includes the knowledge, skills, abilities, and other characteristics (KSAO's) built over time by the firm's employees (Ployhart, et al., 2014). To the extent that these KSAO's add economic value, they can be identified and managed strategically to gain sustainable competitive advantage (Ray, et al., 2022). This uniqueness is generally thought to come from firm specificity, complexity, and causal ambiguity, all familiar concepts within the KM community. To the extent the knowledge assets are specific to the firm, they may not be applicable in other companies (Mayer, et al., 2012; Coff, 1997). The complexity of the knowledge and/or the company environment in which it is applied can also be hard for a competitor to fully understand or duplicate (Ennen & Richter, 2010). Finally, identifying the particular knowledge assets actually adding the value may be difficult, the problem of causal ambiguity, again providing a barrier to other companies trying to acquire or copy them (Reed & DeFillippi, 1990).

One emphasis in strategic human capital (SHC) is the connection between individual KSAO's, including especially tacit knowledge assets such as those possessed by "star" employees (Groysberg & Lee, 2009), and the unique bundle of individual KSAO's held by the organization. If the human capital can be effectively managed, it becomes an organizational resource amplifying the individual knowledge assets into something greater (Ployhart, et al., 2014; Ployhart & Moliterno, 2012). The onus is on the organization as a whole to strategically construct and maintain its unique bundle of human capital assets.

SHRM, strategic human resource management, has some similarities in its concepts but differs in the overall aims and main focus of attention. Individual KSAO's are recognized as is the overall human capital pool as an important resource of the firm. Effective management of these human resources is, then, a potential competitive advantage whether done through effective techniques applied to all employees or through focus on individual employees (Apascaritei & Elvira, 2022) . As HR looks for ways to grow the human capital of the firm, increasing the KSAO's of employees, it can contribute to differentiated competitive advantage that should show up in financial performance (Lepak & Snell, 2002; 1999). But here the emphasis is more on the employee level, what specific initiatives can improve individual human capital (even if the objective is to enhance that of the entire enterprise).

In one thrust of the literature, for example, the AMO (ability, motivation, opportunity) model has been applied (Appelbaum, et al., 2000). By enhancing employee abilities, motivating them to apply them, and providing the opportunity to do so, firms can improve performance through their HR systems. In the context of this paper, a strategic HR capability would construct a valuable set of human capital assets, then encourage employees to effectively apply these assets for the good of the firm (Jiang, et al., 2012).

This approach brings a number of new perspectives to the discussion. Recognizing individual human capital in employees and incentivizing not just participation in KM programs but application of knowledge are important actions that can be leveraged to benefit the full organization (Kucharska & Erickson, 2023). Further, HR plays a critical role by developing and applying a whole range of tools to acquire human capital and enhance it (Wright & McMahan, 2011). Performance-related applications focused on motivation and opportunity can be initiated (Jiang, et, al. 2012). Moreover, a SHRM approach is generally thought to be best if flexible. Different solutions for different groups or even for different individual employees can be key to fully exploiting a firm's human capital (Huselid & Becker, 2011).

While all clearly related and talking about similar concepts and practices, there are also distinct differences between the fields. The differences are wide enough that rationalizing the disciplines (SHC and SHRM, at least) is not seen as particularly straightforward and has generated serious discussions in the literature about how to accomplish the task (Boon, et al., 2018). Connections need to be made with some care. In particular, studies can suffer from a mismatch of level of conceptual development and level of measurement as well as an inability to explain how the macro outcome emerges from the micro inputs (Ployhart & Moliterno, 2011). One could add

that it also begs the question of how the macro level decision makers can encourage the formation of more unique micro inputs (workers with valuable, unique knowledge).

3. Conceptualization

This paper looks specifically at the connection between macro level knowledge management programs designed to enhance firm competitiveness and their more grounded, micro level executions. More precisely, how training programs can be designed and implemented in order to achieve the broader knowledge sharing objectives of organizations.

As noted in the literature review, the actual knowledge obtained by employees has been characterized as explicit or tacit, as KSAO (knowledge, skills, abilities, other), and in other ways in the literature. Another variation, pertinent to this study, is the difference between firm-specific human capital, industry-specific human capital, and occupational human capital (Mayer, Somaya & Williamson, 2012). Firm-specific human capital refers to that which is most useful within the firm itself. Akin to sticky knowledge, firm specific human capital is also seen as the main source of competitive advantage as it is unique and defensible (Raffiee & Coff, 2016). Industry-specific is broader and can be applied across a particular industry while also being a potentially valuable precursor to firm-specific knowledge. It is obviously transferable to another firm in the industry if the employee moves. Occupational or general knowledge is applicable in any firm or industry, easily transferable across different employers.

While firm-specific knowledge is particularly valuable to the firm, it may not be as valued by employees (Coff & Raffiee, 2015). Workers often have personal incentives to instead pursue industry-specific or occupational knowledge, making their human capital more valuable and attractive to other employers.

Whether knowledge is firm-specific, industry-specific, or occupational can be somewhat ambiguous. The classification of the knowledge can be dependent on employee perceptions that may or may not be accurate (Coff & Raffiee, 2015). The firm's human capital is most likely to be enhanced with firm-specific knowledge while employees will likely be more motivated to participate if the knowledge is more widely applicable industry-specific or occupational.

Training is often accomplished through formal programs. An assumption exists in the literature that internal, on-the-job (OJT) training is particularly associated with firm-specific human capital (Hatch & Dyer, 2004) although also recognized as containing more general and transferable knowledge. Internal OJT is certainly seen as a pathway to sustainable competitive advantage both because it can be controlled so as to feature firm-specific topics and because it signals an intention to invest in developing differentiated human capital (Riley, et al., 2017).

OJT has been specifically defined to include programs (1) aimed at improving job skills, (2) provided by the employer, and (3) taking place on-site, not off-site (Raffiee & Coff, 2016). As a consequence, employees may be less engaged with the training. The key question for this paper is whether other options exist, providing a perception of less firm control (and related firm-specific knowledge) and more employee or third-party input into the nature of the training and.

In short, the research question is whether the micro level design of training programs can contribute to the strategic objectives of the firm, building its proprietary human capital resources at the macro level?

Specific training alternatives have been developed in the literature (Nikandrou, et al., 2009) and linked to employee retention (Beynon, et al., 2015). These options include:

- Learning at a local college
- Learning through a government program
- Learning through a local college but within the workplace
- Somebody in the workplace providing on the job training
- Learning by doing/inhouse training by staff
- Learning with a private training provider in the workplace
- Learning with a private training provider outside of the workplace
- Distance learning
- E-learning.

This foundation provides an opportunity to explore how training alternatives are chosen in order to enhance employees' knowledge/human capital while also creating sustainable competitive advantage for firms. This

paper focuses on the category of training programs which might be conducted by the company for a group of potential employees, particularly students of technical schools.

4. Methodology

This study takes advantage of a unique opportunity provided by the Educational-and-Economic Network (EEN) of the Wielkopolska Region in Poland. The "Time of Professionals" program was developed through financing provided by the European Social Fund. As part of this program, the EEN was initiated in 2010, a partnership including the provincial government, Poznan University of Technology, 80 technical secondary schools, 88 large employers, and over 2000 small and medium enterprises (SME's). Among the objectives of the program is developing a database of desired employee competencies (related to the KSAO's and knowledge discussed earlier) and finding ways to better diffuse these competencies once identified. Previous publications detail the development of the EEN model's structure, issues connected with relationships within the EEN (Szafrański et al., 2017), and specific details connected with the functioning of the EEN (Graczyk-Kucharska et al., 2018; Szafrański et al., 2017). Formal reporting has been completed on a periodic basis throughout the life of the project, including annual participation counts, initial phone interviews and face-to-face interviews. These results include quantitative responses to self-report questions from the more in-depth interviews.

Five companies and 38 participating technical schools were included in this study. Companies included an international glass packaging producer (700 Polish employees); a family company, automation solutions and components (100); an international transportation component mechanical/electrical engineering (500); an international aviation component producer (1400); an international automation goods producer(3000)

As noted, the overall project includes regular data collection, both quantitative and qualitative. Both provide interesting insights, but given space constraints, this paper focuses only on the quantitative side. The qualitative insights can be delivered in a longer version of the paper or a new paper altogether. Even though focused on the quantitative results, the study should be treated as a case study, given the small numbers and ability to add some in-depth details for contexts. Results are included in Table 1 and focus on the direct relationship training alternatives identified in the EEN and explored in the case study. These include (from Szafrański, 2017):

- Intern: Student internships.
- Practical: Organizing practical student training sessions.
- Dual: Dual learning, involving students sharing their time between the school and the cooperating companies.
- Patronage: Extending patronage to the school.
- Co-patronage: Co-organization of patronage to the school (letters of intent on cooperation, class-specific student recruitment media support, company-created education materials).
- Meetings: Student-company meetings.
- Visits: Student field trips, workshops at the company.
- Curriculum: Providing curricular materials/aids to schools.
- Exam prep: Cooperating on preparing students for vocational exams.
- Labs: Equipping laboratories, workspaces, etc.
- Programs: Launching new school programs.

In the following table, school rating and firm rating are based on a 1-5 scale, with 5 indicating the highest level of satisfaction. As noted, the school ratings come from 38 actively participating technical secondary schools. The firm ratings come from more detailed reports from the representatives of the five companies noted earlier, organized by whether they participated in that specific training alternative.

5. Results

The results are presented according to the same direct relationship training alternatives described earlier. The initiatives with substantially higher school ratings than total firm ratings are highlighted, those essentially equal or with substantially higher total firm ratings are not (a higher score reflects higher satisfaction on the 1-5 scale).

Table 1: Program Satisfaction

	School Rating	Firm Rating		
		Non-participating	Participating	Total
Intern	4.47	5	4.5	4.8
Practical/apprentice	4.63	--	4.6	4.6
Dual	3.66	3.3	5	4
Patronage	3.82	2.6	--	2.6
Co-patronage	3.71	3	4.3	3.8
Meetings	4.32	3	4.5	4.2
Visits	4.50	3	4.25	4
Curriculum	4.66	1	4.25	3.6
Exam Prep	3.92	3.6	--	3.6
Labs	4.68	1	3.5	3
Programs	4.16	4	5	4.4

The "School Rating" column presents the average ratings reported by the 38 participating technical schools in the Wielkopolska Region on the program platform. “Firm Ratings” report assessments from the five surveyed enterprises. The "Total" column presents the average ratings of all five firms, regardless of actual participation in the eleven training options. As not all employers participated in all forms of training, responses were further divided between “Non-participating” and “Participating” firms. Participating refers to firms utilizing and reporting on the specific training initiative. Non-participating refers to those not. If no firms fit the description of a particular cell, no score is reported. All five firms, for example, participated in practical/apprentice, so the non-participation category has no data.

Reviewing the school ratings, most are relatively high (above 4), sometimes considerably so. These should be treated as evidence of satisfaction from the schools’ administrators built on their perceptions of student satisfaction and success. The training initiatives with very high ratings mainly have to do with the firms handing over concrete assets or experiences that add to the student experience. These are all highly visible and apparently perceived by students and administrators as vocationally oriented. All showcase, teach, or offer experiences with the potential to instill concrete knowledge, skills, and abilities of interest to local/regional employers. The training alternatives with lower but still positive ratings (low-4’s, 3’s) are more related to less visible cooperation or less obvious direct vocational application, including patronage and co-patronage, exam prep, new programs, and dual initiatives.

The firm rankings are less simple. Initially, with only five respondents, the feedback is not statistically reliable but only the viewpoints of the select companies. That being said, it is based on direct perception and experience, and so valid for a case study such as this paper. Looking first at the overall perceptions, regardless of direct experience with them, the highest rated training alternatives include internships, apprenticeships, and new programs. The first two provide the most company control over the learning experience (on-site, supervised by staff) while new programs generated by industry partners are usually heavily dependent upon them for direction and content. The lowest-rated training alternatives are forms of patronage, labs, curriculum materials, and professional exam preparation. As opposed to the higher-rated options, these all have to do with handing resources over to the schools. While the donors undoubtedly remain involved with their use, they don’t have as much control over actual application.

Of particular interest is the difference between participating and non-participating firms. The participating rating is uniformly more than the non-participating in every case in which both are available, with the important but also minimally different exception of internships (both ratings are quite high).

While some of the differences are larger than others, just about all of the direct experiences are viewed much more positively once executed. Setting up labs and providing curriculum materials show substantially more satisfaction, suggesting that firms were pleasantly surprised by the results after handing over tangible and/or intangible assets for classrooms at the schools. One could speculate that the materials generated better demonstrated results than anticipated. Referring back to the literature, that more firm-specific learning took

place even in the less-controlled external environment. Even though expectations of firms not participating in the training initiative might be low, actual experience with labs or program development almost invariably generated significantly higher assessments.

6. Discussion

Returning to the key points from the literature review, organizations need to balance the knowledge types more likely to gain competitive advantage with those more likely to create employee interest and cooperation. This study established that the conflicting perspectives are present but that firms can still better mediate firm and employee (or potential employee) interests. Employees can be motivated to participate in the training while also gaining more firm-specific knowledge, adding to the pool of human capital contributing to competitive advantage. A summary conclusion of the options described in the study is presented in Table 2.

Table 2: Training Alternatives

	Internal	**External**
Controlled by firm	Firm-specific KSAO's Trainees may balk	Some firm-specific KSAO's Third party influence Trainees more receptive
Not Controlled	Some firm-specific KSAO's Third party influence Trainees more receptive	Firm-specific KSAO's limited Third party control Trainees more receptive

Firms have choices for how to conduct training initiatives that may still have at least some of their firm-specific knowledge but also provide different degrees of third-party involvement. Those held onsite (internal) provide an opportunity to determine context (including equipment, mentor, etc.) while not fully controlling all learning aspects. Internships, for example, would have learning outcomes determined by the partner educational institution even though the host firm controls the learning environment. To different degrees, the same considerations apply to other on-site training initiatives such as mentoring, firm visits, and so forth. As noted, trainees, in this case potential employees, perceive these options as less firm-specific even though the firms may be able to actually control quite a bit of the content and context of the training. As illustrated in these case studies, company satisfaction with these options is fairly high as is that of the educational institutions (presumably based largely on student feedback).

Similarly, training held offsite (external) but with some firm control also provide an option. These would include training alternatives such as labs, curriculum assistance, and program development. While taking place at the educational institutions, firms have some degree of influence over the hardware and software found in the labs, the content of teaching materials, and so forth. That can give the firms some ability to instill firm-specific KSAO's in the training initiative in partnership with the educational institutions interested in delivering more industry-specific or general ones. Again, trainees should be more receptive to learning these competencies with broader application and, given the perception issues, may see the training as less firm-specific than might actually be the case. Company and institutional satisfaction with these options is also fairly high in the case studies.

The final option offers less obvious ways for firms to insert customized competencies into a training initiative. Without control and off-site, the firm has minimal influence. Unofficial advisory input is possible but, otherwise, these conditions describe a standard vocational course at one of the educational institutions. As such, industry-specific and general knowledge are present but very little is firm-specific. At the same time, these types of training alternatives are often feeders into the more firm-specific options. Firms noted in separate comments that they draw trainees from particular vocational programs such as mechatronics and logistics. With that industry-specific or general knowledge background, the students are more ready for the firm-specific options.

A tension exists between companies with training needs and the schools in a position to support them with training programs. The literature suggests that companies benefit most when employees or prospective employees acquire knowledge, skills, and abilities (KSAO'S) specific to the firm. Such training supports the competitive strategy of the firm, the strategic human capital (SHC) at the macro level. But specific initiatives for employees or potential employees, strategic human resource management (SHRM), at the micro level gain more motivated participation when offering broader KSAO's, more industry-specific or general. Employee perception of the specificity of programs, however, can vary. This study provides evidence that partnerships with

educational institutions can affect those perceptions. Firm control of the context or content of the training initiatives can provide a greater degree of firm-specific learning while involving third-party educational institutions signaling more industry-specific approaches. As a result, both firms and employees may walk away more satisfied, finding a middle ground supporting both of their training objectives.

7. Conclusion and Future Research Directions

This paper sheds light on multiple disciplines and, in so doing, brings a variety of related research closer together. The core problem is that companies (and researchers) can experience problems with evaluating whether micro level design of training programs can contribute to the strategic objectives of the firm, building its proprietary human capital resources and competitive advantage at the macro level.

The issues revolve around the reluctance of firms to develop industry-oriented or general knowledge that is not unique, may not contribute to competitive advantage, and can be portable if employees leave for other competitors. Consequently, a firm has a strategic incentive to develop KSAO's uniquely related to it. Alternatively, employees or potential employees will be more likely to actively participate in knowledge programs providing the portable, more widely applicable training that might be of less value to the company. The firm's strategic (macro) perspective is often studied at a different level and with different tools than the specific training programs delivered by HR (micro). This paper establishes that a number of alternatives bridging the gap are available and have acceptance from both firms and from their external partners.

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Knowledge Management in HRM: How the Content of Job Offers can Attract More Candidates

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Abstract: The fundamental aim of the research was to deepen knowledge of the influence of developing the wording of job offers on the number of candidates responding to them. It stems from the overarching aim consisting in improving human resource management (HRM) by knowledge management (KM) related to the job market and job seekers' reactions to information concerning competence requirements published in job offers. The specific objective was to answer two questions: are there words in job offers that increase the number of job seekers, and whether this number is dependent on the length of the wording of the selected module of an offer. Particular attention was paid to positive words. It was checked whether their number in relation to the number of all words in an offer matters. In order to answer the research questions, text processing methods such as tokenization and lemmatization were first used, followed by the analysis by means of such statistical methods as the chi-square test (χ^2) and the Mann-Whitney U test. The obtained research results allowed to illustrate job seekers' preferences. It was noted that the length of an offer is also important. However, it was not possible to confirm the assumption that positive words increase the attractiveness of an offer. Despite the limitations of a little diversified database (candidates were dominated by young people with little work experience), the research brought new value to competence and human resource management. The research resulted in extending the scope of knowledge on the use of the analysis of job offers in the area of effective communication with candidates for work in organizations.

Keywords: Knowledge management, Competence management, Human resource management, Text analysis,Jjob offers

1. Introduction

Knowledge management (KM) plays an important role in strengthening the competitiveness of companies (Marimuthu, Arokiasamy & Ismail, 2009). Its use is necessary in many areas of enterprise operation, also in human resource management (HRM) (Zaim et al., 2018). When relationships between KM and HRM are presented in the source literature (Turulja & Bajgoric, 2018), both the context of the impact of HRM on KM (Gope, Elia & Passiante, 2018) and the impact of KM on HRM (Zaim et al., 2018) can be encountered. Analyzing the latter type often concerns the flow of knowledge/sharing knowledge in organizations (Marouf, 2016) and the effect of generally defined main KM functions on generally defined HRM practices (Zaim, 2016).

When preparing this article, a scarcity of research work on specific operational effects of KM on HRM was noted, which ultimately influences companies' strategic results. The research presented here focuses on knowledge management related to the job market and the behavioural mechanisms of its participants, including their reactions to the content of job offers. It was observed that knowledge management in the indicated scope is favourable to the improvement of HRM functioning. It increases the chances of attracting the best candidates, which is a condition for the successful achievement of goals in enterprises.

The development of knowledge management in HRM is positively influenced by the dynamic development of methods and tools in the areas of IT and statistics. In the context of knowledge related to applicants' reactions to the content of job offers, they help to analyze job offers more and more accurately, and are more effective in performing the recruitment function, treated as a component of human resource management (Dubois & Rothwell, 2010, pp. 95-124; Goliński, 2020).

In a strategic dimension, the use of the aforementioned methods and tools improves the provision of the required competences in organizations. Currently, there are many directions of analyzing job offers, for example, for the purpose of determining recruitment effectiveness by improving the attractiveness of job offers (Garver et al., 2019; Kessler et al., 2009). It is important when it comes to reducing difficulties in quickly recruiting employees who meet competence-related requirements at workplaces. An offer may be perceived as attractive due to its many features such as: remuneration (Garver et al., 2019; Schlechter et al., 2014), employer image (Thornbury & Brooks, 2010), a large number of attractive benefits (Alniacik, 2016; Tato-Jimenez et al., 2019; Li et al., 2020), simple and understandable language (Nowak & Ohia-Nowak, 2022), information to meet the expectations of a target group it is specifically meant for (Born & Taris, 2010).

Although it may seem that the issue of preparing attractive job offers has been mastered for a long time, both the scientific literature and practical studies contain few results of research intended to deepen knowledge of factors that affect this attractiveness. This cognitive gap, which translates into real problems in human resource management, especially in the recruitment process, became the basis for conducting research, the results of which are presented in this article. It focuses on the impact of words used on the number of applications submitted in response to an electronic offer. The analyses concentrated on a selected part of offers which describes the benefits of taking up a job at a given position.

- With regard to the identified cognitive gap, the following research questions were formulated:
- Are there differences in the occurrence of words between offers for which no one applied and offers for which at least one person applied?
- Does the number of applications depend on:
    - saturating the "We offer" part with positive words?
    - the length of the "We offer" part?
    - the length of the "Responsibilities" part?
    - the total length of a job offer?

The division of the analyzed job offers into individual parts is explained in Chapter 3.1.

Obtaining answers to the above-mentioned questions allowed to achieve the goal of deepening knowledge of the impact of developing the content of job offers on the number of responding candidates.

2. Theoretical Basis

Employee recruitment research has been one of the fundamental trends in management science for decades (Seear & Thurley, 1963). Sometimes authors focus on designing and improving the recruitment process (Armstrong, Taylor, 2014, pp. 225-245; Dubois & Rothwell, 2010, pp. 95-124), at other times they quite often study economic and demographic factors that may affect recruitment strategies in enterprises (Seear & Thurley, 1963; DeVaro, 2008). The variability of these factors means that it is necessary to constantly improve the processes of knowledge management related to recruitment and its elements.

One of the goals of recruitment is to source the best candidates, i.e. those who, among other things, as seen in the selection process, meet competence requirements to the highest possible extent (Whiddett & Hollyforde, 1999). Requirements should result from competence models implemented in companies and adapted to changing goals (Szafrański, 2022b). In smart economy, it is particularly difficult to attract candidates referred to as "talents" (Spychała, 2022) and this applies both to people with extensive professional experience as well as those who are just completing their studies or school. Therefore, in the recruitment process in companies, various actions are taken to stay ahead of competitors in reaching candidates. For example, some companies begin cooperating with schools in an attempt to source future employees (Szafrański, 2022a). One of the stages of the recruitment process is reaching candidates, which often involves the development and publication of job offers (Armstrong & Taylor, 2014, pp. 228-233). At this stage, particularly when using online recruitment, a problem arises as to how to prepare content so that, on the one hand, there would not be an excessive number of random answers, and on the other hand, the right candidates sought after in a company could respond quickly to an offer.

Košťálová et al. (2022) confirmed that the number of responses to an offer depends on its content and some of its features. The article contains an analysis of more than 170 features of offers, which were divided into 13 categories. The “content” category was described with variables such as the length of a job title, number of words in the description of the scope of responsibilities and the number of characters. Linear models and the random forest model were built to investigate which variables are the most significant. In addition to content, benefits offered by an employer as well as the classification of positions (examples of position classes are: accountants, pharmacists etc.) were important factors. Among them, there was the “content” category. However, the impact of individual words was not analyzed, which was intended to be checked in the following article. In addition, another method was used to analyze the length of the text to see whether longer or shorter content is more beneficial.

In another study (Wille & Derous, 2018), the authors showed that the way information is communicated can have a significant impact on a candidate's reception of an offer. This study was an inspiration to consider whether the presence of positive words increases the chances of becoming interested in an offer.

The above-mentioned not very numerous studies on the attractiveness of an offer are related to the research whose results are presented in this article.

3. Research Methodology

3.1 Data Used

The study made use of 480 electronic job offers in Polish available in a selected online database dedicated to pupils, students, and graduates who are entering the job market. It contained both offers for which no candidate applied (240 offers) and those for which at least one candidate applied (240 offers). The detailed distribution of the number of offers with regard to the number of applications is presented in Figure 1.

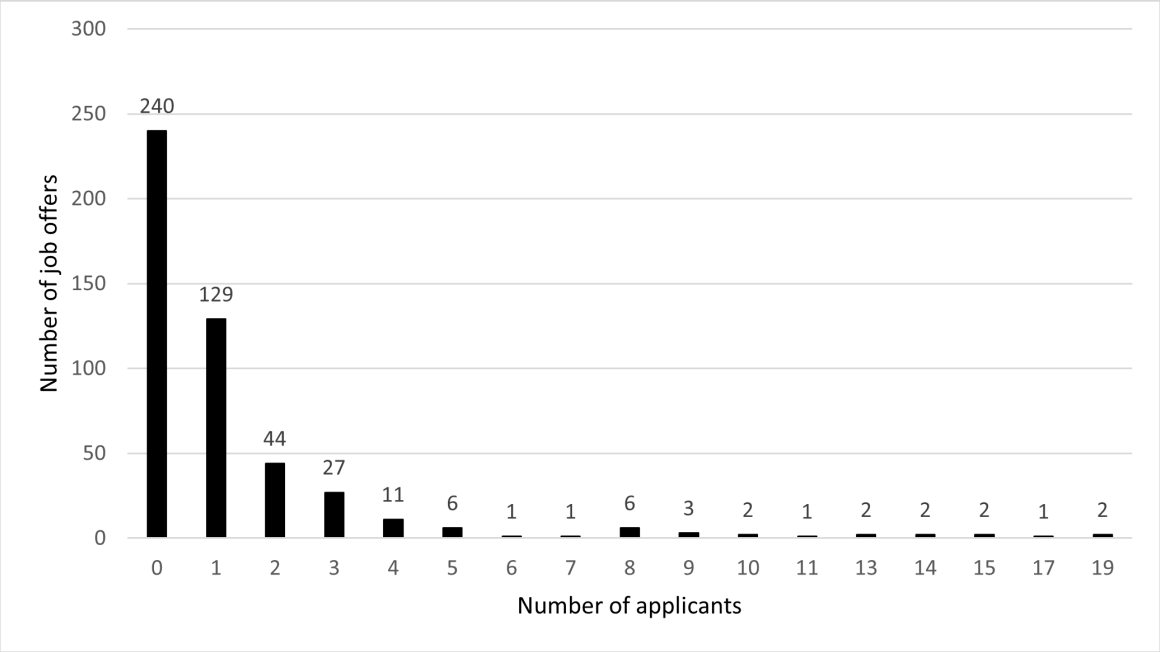


Figure1: Number of Offers with Regard to the Number of Applicants

Each downloaded offer had a structure divided into three parts:

- "We offer" – in this part an employer presents the benefits of taking up work and often mentions the form of cooperation (e.g: employment contract, internship);
- "Responsibilities" – this part lists a future employee's scope of responsibilities;
- "Content" – in this part an employer presents the remaining details and provides contact details.

Due to the fact that the offers concerned different workplaces and their responsibilities were very diverse, only the analysis of words from the "We offer" part was the aim of focus.

3.2 Preparation of Research Data

In order to answer research questions 1 and 2, which were presented in the introduction, it was first necessary to submit text to the normalization process, i.e. to reduce it to a form easier to analyze. The work by Vijayarani & Janani (2016) presents the process of text cleaning consisting of tokenization, stemming and removal of stop words. This article adapts it to the needs of the Polish language, which is an inflected language. Hence, stemming was replaced with lemmatization due to the fact that it is a more effective tool for inflected languages (Walkowiak & Malak, 2018; Mykowiecka, 2007, p. 79).

The first stage – tokenization – consisted in dividing text into smaller parts based on white space or punctuation marks. Words were separated with reference to a space or a line break mark, so any punctuation marks were removed. In addition, the size of letters was normalized.

Then, lemmatization was carried out. This method involves replacing an inflected word with its basic form (Balakrishnan & Lloyd-Yemoh, 2014). Due to the fact that the research was conducted on a set of offers published in Polish, a morphological analyzer of the Polish language called *Morfeusz 2* was used (Kieraś & Woliński, 2017). This tool gives possible basic forms for a given word and for each of the forms it presents a set

of morphological markers. Sometimes it happens that for one word it is possible to assign several basic forms. Then, the first option from the list was chosen to facilitate the study.

The last step was to remove the stop words, i.e. insignificant words that are not key to understanding content. In Polish, these are e.g. *oraz* (Eng. and), *lub* (Eng. or), etc. For this purpose, regular expressions were used in the Python programming language.

Both tokenization and lemmatization are necessary in the preparation of text for analysis in order to turn word sequence into a matrix form, facilitating further analysis. In the columns of the matrix there are individual words, and in the rows there are offer numbers. The values in the table state how many times a word appeared in each offer. The research included only those words that appeared in more than 10 offers (281 words). It constitutes the basis for answering question 1.

To answer question 2a, it was necessary to prepare a list of positive words. For this purpose, the Positive Words Research (2020) database was used. To determine the saturation of an offer with positive words, the percentage of positive words occupying the "We offer" part was determined.

To answer questions 2b, 2c and 2d, the number of all characters in a given part of a job offer was counted in the "We offer" and "Responsibilities" parts respectively and in an entire offer. Data prepared in this way were then able to be subjected to further analysis.

3.3 Course of Research

The analysis started with data visualization. For this purpose, word clouds were created. They allow to quickly check the most frequently occurring words as well as initially verify whether the data preparation process was carried out correctly.

However, data visualization did not allow to answer question 1 (see Introduction). For this purpose, a statistical test was performed. First, it was determined in how many offers from the first group (for which no one applied) and in how many offers from the second group (for which at least 1 person applied) a given word appeared. Afterwards, the χ^2 test was carried out, which also finds other uses in text analysis (Chen & Chen, 2011; Meesad et al., 2011). In this study, this test allowed to determine whether there is a relationship between the occurrence of a given word and the number of applications. The strength of this relationship was measured using the Yule ϕ coefficient, which is a strength indicator for the 2×2 contingency tables.

To answer questions 2a-2d, a statistical test was performed to analyze the similarity of the two groups. Due to the fact that variables determining the degree of saturation with positive words and the length of text do not have a normal distribution, the Mann-Whitney U test was used (Mann & Whitney, 1947).

All calculations were carried out in the Python programming language. The adopted significance level was α=0.05.

4. Research Results

In accordance with the described course of research, in the first place there was a preliminary analysis of the occurrence of words in job offers in the "We offer" part. The result of this analysis is presented graphically in Figure 2, which features words from offers for which no application was submitted. Figure 3 shows the most frequently occurring words from offers for which at least one person applied. There were 240 offers in both groups. The larger the font, the more often a given word appeared.



Figure 1: Map of Words Appearing in the "We Offer" Part in Job Offers for Which Candidates did not Apply



Figure 2: Map of Words Appearing in the "We Offer" Part in Job Offers for Which at Least one Candidate Applied

The preliminary analysis did not allow to capture clear differences between the investigated sets of words. Both were dominated by: *umowa* (Eng. contract), *praca* (Eng. work), *rozwój* (Eng. development), *możliwość* (Eng. opportunity), *zatrudnienie* (Eng. employment), *stabilny* (Eng. stable).

In order to check whether there are words that occur much more often in one group than the other, the χ^2 test was carried out. Table 1 shows 15 words with the greatest strength of dependence, i.e. those that assume the highest values of the Yule ϕ coefficient. A qualitative analysis of offers in which a given word appeared was then carried out and the most frequent context was given.

Table 1: Words with the Greatest Strength of Dependence

Word (Polish, original)	Word (English)	Offers without applications	Offers with min. 1 application	χ^2	p-value	Yule φ	Context
staż	internship	7	37	21.04	0.0000	0.21	completion of an internship
opiekun	supervisor	3	24	15.70	0.0001	0.18	with regard to the support of a traineeship/internship supervisor
ukończenie	completion	0	16	14.55	0.0001	0.17	completion of a traineeship/internship and the possibility of further employment
praktyk	practitioner	6	26	12.09	0.0005	0.16	in the context of a traineeship
zdobyć	gain	4	22	11.75	0.0006	0.16	gaining experience
płatny	paid	8	28	10.84	0.0010	0.15	paid internship
doświadczyć	experience	36	66	10.47	0.0012	0.15	gaining experience
wakacyjny	vacation	2	16	9.75	0.0018	0.14	vacation traineeships/internships
informacja	information	1	13	8.90	0.0028	0.14	feedback
zwrotny	returnable	1	13	8.90	0.0028	0.14	feedback
cenny	valuable	6	22	8.53	0.0035	0.13	valuable experience

Word (Polish, original)	Word (English)	Offers without applications	Offers with min. 1 application	χ^2	p-value	Yule φ	Context
lipiec	July	1	12	7.91	0.0049	0.13	as the month of commencing employment
praktyka	traineeship	1	12	7.91	0.0049	0.13	completion of a traineeship
miesięczny	monthly	7	22	7.19	0.0073	0.12	in relation to several months of employment
siłownia	gym	4	17	7.17	0.0074	0.12	gym pass

In Table 1, it can be observed that all of these words appeared more often in offers that were applied for at least once than in offers for which no one submitted their application. This means that these words can increase the attractiveness of an offer. This relationship is confirmed by the p-values of the test statistics, which do not exceed the assumed level of significance.

Then, an analysis of the attractiveness of offers was carried out in relation to factors presented in table 2.

Table 2 presents also the test results (U statistics and p-value) and the medians obtained in the studied groups of offers to illustrate differences between them.

Table 2: Mann-Whitney U Test Results

Factor	U statistics	p-value	median for offers without applications	median for offers with min. 1 application
Saturation of the "We offer" part with positive words (%)	25652	0.5512	3	2
Length of the "We offer" part	27388	0.0168	275	333
Length of the "Responsibilities" part	29556	0.2944	344.5	369
Length of a job offer	26944	0.0077	1074.5	1222

As can be seen in Table 2, both in the case of offers for which no applications were submitted and offers for which at least 1 candidate applied, the median value of saturating the "We offer" part with positive words was very low. The difference between the groups was statistically insignificant. Hence, we cannot conclude that saturation with positive words is related to candidates' interest.

However, it was noted that both the length of the "We offer" part and the length of the content of the entire offer differed significantly between groups of offers. Both variables assume higher values in the case of offers for which an application was submitted.

5. Conclusion and Discussion

The article proposes ways how to manage knowledge in the field of HRM to better understand how the content of job offers affects the number of applicants in the recruitment processes.

The conducted analysis showed that in the examined job offers there are words that are significantly more often found in offers for which at least one candidate applied than in offers for which no one applied. They include *staż*, *opiekun*, *ukończenie*, *praktyk*, *zdobyć*, *płatny*, *doświadczyć*, *wakacyjny*, *informacja*, *zwrotny*, *cenny*, *lipiec*, *praktyka*, *miesięczny* and *siłownia*. The context of the occurrence of these words is very important in the interpretation. It allows to build a picture of a candidate's expectations for work. The surveyed offers were mainly addressed at people looking for a paid internship, traineeship or first job, who wanted to gain valuable experience and were interested in starting work most often during the vacation period, e.g. in July. These people looked for work for a few months. The results of the research confirmed that the platform on which the

examined offers were posted meets its own assumptions, because it is intended for pupils, students and graduates starting their professional career.

In addition to the words used, the length of the "We offer" part and the overall length of an offer, which are measured by the number of characters, are also important. It turns out that in the group of offers for which at least one application was submitted, the median number of characters in an offer and the "We offer" part is higher than in the case of offers for which no candidate applied. This may mean that a longer one is more attractive to a candidate. However, it would be necessary to investigate the reason behind it. At the same time, longer offers may have more attractive benefits or a more detailed description may also increase interest. A study by Liu (2020) shows that an important factor in assessing the attractiveness of an offer due to its length is the nature of a candidate. Some people will look for the best solution, will appreciate a detailed offer, and in case of shortages, they will look for information themselves. Others, on the other hand, look for specific information in offers and content that is too long can discourage them.

There was no significant impact of the presence of positive words on the number of applicants, although it was assumed that a more positive character would be more attractive. It is possible that for candidates the nature of content did not matter so much. In addition, some may consider saturation with positive words to be a disadvantage of an offer. Surveys show (Fisher et al., 1979) that providing negative aspects of work increases an employer's credibility. Therefore, it is possible that saturation with positive words can be both an encouraging and a discouraging factor.

6. Summary

The conducted research complements and expands the range of IT tools and statistical methods for the needs of knowledge management in HRM. It also allows to better understand their impact on the development of this scientific discipline. This impact is presented in the article on the example of inexperienced job seekers' reactions to the content of job offers, including their length and information related to benefits drawn from employment. In this way, research carried out so far in the field of HRM was supplemented, indicating, at the same time, the implications of its results on the development of knowledge management in enterprises for the needs of improving the area of human resource management.

Of course, the conducted research reveals several important limitations. The intentionally introduced limitations include the selection of a narrowly defined target group (candidates for work with little professional experience) and the subject of research which is selected content in job offers and selected features of these offers. Among the limitations independent of the authors one should mention the use of only one database of offers, and in this way focusing only on the content of offers in Polish.

These limitations did not hinder the development of a satisfactory research methodology that can be implemented in broader data sets, different target groups and content in different languages. In addition, this methodology may supplement research methods indicated in the article and proposed by other authors.

In further research, it is worth taking into account other factors influencing candidates' reactions to the content of job offers, such as, for example, working time, remuneration and other working conditions. In the database used by the authors, there were numerous deficiencies of such data. Hence, it was not possible to include them in the analyses.

Attention should be paid to the interdisciplinary nature of research and results. The postulated development of knowledge management in HRM leads to the effect of synergy in the context of achieving goals set in enterprises.

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A Framework for Analytical Demands of Alumni Capital

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Abstract: In 2020, in the Brazilian context, the postgraduate regulatory entity introduced new evaluation criteria on former postgraduate students' information for its 4,598 master's and doctoral postgraduate programs. The alumni are perceived as a permanent connection to society and reflect the social impact of their education. Thus, the postgraduate programs sought to gather information about their former students for better results in their strategic plannings as well as their evaluations. Using the Design Science Research (DSR) methodology, this research focused on bibliographic and empirical work, through an integrative literature review, to identify contributions to the construction of an artifact to explore alumni data and knowledge based on the theories of Intellectual Capital, Data Science and Knowledge Engineering. As a result, a framework was created to guide the process of analytical demands for the exploration of the intangible assets related to the postgraduate programs´ former students. The first element of this framework addresses Intellectual Capital management in Higher Education Institutions (HEIs) to identify and measure their intangible assets related to the alumni. The second element relies on Business Intelligence techniques for the creation of reports and dashboards with descriptive analyses. Data Science is the third element which contributes to generating predictive analytics. And, as the last element of the proposed framework, it is expected the use of Knowledge Engineering for the construction of prescriptive analyses. Although there is an extensive literature on tools for alumni management and management of Intellectual Capital in HEIs, it was observed a lack of practical research for the development of workflows for management and monitoring of Alumni Capital in postgraduate programs with descriptive, predictive and prescriptive analyses. Therefore, the proposed framework has the potential to assist these postgraduate programs in their analytical demands for better results in their evaluations. In addition, the data and knowledge about Alumni Capital enable better strategic planning of their actions.

Keywords: Alumni capital, Intellectual capital, Data science, Knowledge engineering, Postgraduate programs

1. Introduction

The Brazilian National Postgraduate System (SNPG) currently comprises 4,598 active postgraduate programs. According to Fernandes *et al.* (2021), these programs are part of a robust system, regulated by Higher Education Personnel Improvement Coordination (CAPES), with over one hundred thousand professors distributed among more than five hundred HEIs, and are the locus of scientific development and a high-quality training environment in Brazil. However, the training of students needs to be even more connected with the demands of professional sectors. The recognition of this successful technical-scientific system must go beyond the academic circuit and be in line with contemporary digital transformation, taking advantage of evolutionary and disruptive technologies. In this context, there is a need to analyze the education obtained from the perspective of the alumni with these technologies, who provide a bridge between the demands of society and professional sectors with postgraduate programs (Hortale *et al.*, 2014; Senger *et al.*, 2018).

Exploring alumni information is not a new topic in the literature. However, several academic studies still point out the need to deepen the exploration of alumni information in postgraduate programs and face a lack of means to carry out such activity (Ribeiro *et al.*, 2021). It is in this context that the theory of Intellectual Capital (IC) in HEIs, Data Science, and Knowledge Engineering can help through new artifacts and knowledge. The study of Intellectual Capital began in the business field, starting with the Skandia Navigator model published in 1994 (Edvinsson, 2013). The initial definition of IC was related to the sum of intangible assets that generated competitive advantage (Dumay, 2016). Over the years, IC has been the subject of great research interest, with currently more than 7,000 studies in the Scopus database. IC is one of the main sources of wealth creation in organizations, and for this reason, scholars have endeavored to create models, methods, and frameworks to identify, measure, and increase these intellectual assets (Pedro, 2018). With this growing interest, the exploration of IC has expanded to different types of organizations, including hospitals, government departments, research organizations, third sector, cultural and heritage organizations, police departments, regional groupings, and, lastly, the focus of this research, HEIs (Secundo *et al.*, 2015).

Several studies address the measurement and disclosure of IC in HEIs (Ramírez and Gordillo, 2014; Bisogno *et al.*, 2018). It is understood that there is a great convergence and complementarity between the metrics of the IC measurement models in HEIs and the indicators used by the evaluation areas of postgraduate programs by CAPES. Therefore, the various studies on IC in HEIs, especially in European HEIs, can be useful for postgraduate programs, helping them to be more comparable, competitive, dynamic, transparent, and focused on society's demands. Alumni are the subject of these IC studies in HEIs, and their analysis is mainly reflected in the components of Human Capital (HC) and Relational Capital (RC) (Pedro, 2018; Secundo *et al.*, 2018; Aversano *et al.*, 2020). In addition to these components, there is a specific one for alumni in IC, called Alumni Capital (AC), proposed by Liu (2007), which explores the relationship between educational institutions and their alumni.

While Fernandes *et al.* (2021) suggest the use of Data Science and Data Intelligence to assist in the challenging task of CAPES evaluation process in the SNPG, Dabić *et al.* (2020) suggest the creation of new interdisciplinary research projects to connect computer scientists with business management scholars in exploring IC in organizations. Therefore, Data Science and Knowledge Engineering can assist in exploring data and information from the postgraduate programs for CAPES evaluations, as well as in the study and expansion of Capital Alumni related to IC in HEIs. The triad of Intellectual Capital, Data Science and Knowledge Engineering, complements each other and allows the study of IC, through AC, to impact the postgraduate programs in exploring data and information about postgraduate students, in such a way that Data Science and Knowledge Engineering support this activity, providing appropriate technology and methodologies for supporting this analytical process. This analytical process can be understood as activities for exploring data and information from alumni through the collection, mining, and use of technology to measure, identify patterns and trends. However, as observed in the literature reviews, especially in the integrative review that addressed these themes together, there is a lack of specialized artifacts in Data Science and Knowledge Engineering to guide these analytical demands for information from the Alumni Capital in the context of postgraduate programs. This includes models, methods, technological architectures, and frameworks that enable efficient and effective management of alumni, providing postgraduate programs coordinators with relevant information without creating exhaustive demands on teachers and postgraduate students themselves.

The next section presents the theoretical framework that discusses the existing literature on these topics. Section 3 discusses the proposed methodology used for the study. Results and discussion are captured in section 4, while section 5 presents the conclusion of the study.

2. Theoretical Background

2.1 Intellectual Capital

According to Magrassi (2002), Intellectual Capital is related to the resources and potential that determine the value and competitiveness of an organization. The concept of IC has been associated with organizational knowledge and intangible resources. The term is widely discussed and a vast array of studies, across various disciplines, have created a series of definitions, properties, and attributes that can be considered as part of Intellectual Capital and intangible assets (Choong, 2008). In the context of HEIs, Gradim *et al.* (2022) discuss the importance of managing IC in HEIs and highlight that HEIs are important sources of intangible resources. The components of Intellectual Capital in HEIs follow the most common elements in the literature: Human Capital, Structural Capital, and Relational Capital (Pedro, Leitão and Alves, 2018). According to Secundo (2015), Human Capital in HEIs refers to the intangible value that lies in individual competencies, covering the experience, knowledge, and life experiences of researchers, professors, technical staff, students, and administrative employees. For Pedro (2018), in general, organizational HC is formed by the knowledge, competencies, attitudes, and intellectual agility of all members who are part of the organization. Structural Capital (SC) in HEIs consists of the organization's explicit knowledge, which is shared and disseminated internally, and can be part of the management of scientific and technical knowledge (Pedro, 2018). This knowledge can be derived from the interaction between research, management, and process organization, as well as organizational routines, corporate culture, values, development of internal procedures, software, technologies, and other technical resources available, such as bibliography, archives, licenses, databases, among others. The Relational Capital is composed of intangible resources and capabilities that generate value from the internal and external relationships of the university. These relationships include partnerships with public and private organizations, position and image in networks, academic prestige, brand, partnerships with the business sector and regional governments, involvement with nonprofit organizations and civil society in general, as well as collaborations with national and international organizations, research centers, networks, and alliances (Secundo *et al.*, 2015).

Finally, an important component of IC for this work and marginally explored in the literature is the Alumni Capital which is related to the intangible assets of alumni in an HEI. One of the first definitions in the HEIs´ context was created by Liu (2007) who defines Alumni Capital as: "the relationship between educational institutions and their alumni. According to that definition, Alumni Capital includes the achievement of alumni, their donations, cohesion, employment, and recurring education". Based on Liu's definition, we expand the definition of AC to: the intangible value that resides in the relationships with its alumni, such as satisfaction with the education received and with their financial achievement, awards and distinctions received after graduation, intellectual and technical production carried out together, the representativeness of positions held in academia, private or public sector, recurrent education at the educational institution, participation in committees, councils or research groups, donation or sponsorship of actions, and other relationships that build ties with former students.

2.2 Data Science

Data Science is a field of evidence seeking that combines data with domain information to generate new knowledge (Yu and Kumbier, 2020). Cao (2017) states that Data Science is a new field of science that emerged from pragmatic issues based on the need of companies and organizations to improve their efficiency with a focus on data. In this context, every organization needs a decision-making process and suggests that data analysis tools should be used for a better decision-making process, thus improving efficiency and effectiveness in their business production processes. According to Cao (2017), the term Data Science has been attracting more and more attention in the literature. In the author's view, Data Science develops relevant methodologies, theories, technologies, and applications for data exploration. Data Science, as a scientific field, explores everything from data capture, creation, representation, storage, search, sharing, privacy, security, modeling, analysis, learning, presentation, and visualization to the integration of complex and interdependent heterogeneous resources for real-time decision making (Provost and Fawcett, 2013; Cao, 2017; Kampakis, 2020; Yu and Kumbier, 2020). Additionally, Data Science enables collaboration, value creation, and decision-making support.

2.3 Knowledge Engineering

The Knowledge Engineering emerged from Artificial Intelligence as a subfield dedicated to the design, development, and implementation of Knowledge-Based Systems (KBS) (Studer, Benjamins and Fensel, 1998; Schreiber, 2008). Knowledge Engineering is the academic area responsible for developing models, methods, and basic technologies for knowledge representation and processing, as well as for constructing Artificial Intelligence applications (Kasabov, 1997). In the so-called Classical Knowledge Engineering, researchers aimed to "transfer" or "extract" the knowledge of the expert to a knowledge base. In this process, knowledge was extracted from experts through interviews and encoded through heuristic rules and rapid prototyping. This generated difficulty in developing large, commercial, and more complex systems, and maintenance became difficult and costly (Studer, Benjamins and Fensel, 1998). Similarly to the software crisis in the late 1960s, which culminated in the creation of the Software Engineering discipline, dissatisfaction with building KBSs led to the need for the creation of methodological approaches, resulting in the new Knowledge Engineering (KE) (Studer, Benjamins and Fensel, 1998; Schreiber, 2008). This new KE focused on "modeling knowledge" rather than "transferring knowledge" became a landmark for creating second-generation expert systems. In this new period of KE, the construction of second-generation KBSs is supported by knowledge modeling methodologies such as MIKE, VITAL, COMMET, PROTÈGÈ-II, EXPECT, and CommonKADS (Schreiber, 2008). In addition to these methodologies for knowledge modeling, ontology has gained a prominent role in KE, assisting KBSs with the domain knowledge model and with knowledge for problem-solving (inference).

3. Methodology

The Design Science Research Methodology (DSRM) was utilized for the development of this research. DSRM is a research approach that focuses on creating artifacts or practical solutions to real problems in a particular context (Peffers *et al.*, 2007). This methodology was chosen due to its process that guides researchers in initiating, developing, and measuring the impact of an artifact for solving a particular problem. The artifact created in this process must be evaluated to ensure its applicability as a new research contribution, designed to improve the effectiveness, efficiency, quality, or usefulness of an existing system, process, or service, or to create something entirely new. The rigor of the research is central to DSRM, which includes a process and a supporting knowledge base. The DSRM framework proposed by Peffers *et al.* (2007) consists of six activities, which are listed below.

- Identification and motivation of the problem: In this activity, the researcher identifies the practical problem to be solved and presents the motivation for its resolution.
- Definition of objectives for a solution: In this activity, objectives are defined to guide the process of creating the artifact. The objectives should be clear, measurable, and relevant to the identified problem.
- Design and development: The artifact is designed and developed based on a conceptual model that describes the functions and characteristics of the artifact and how it can solve the identified problem.
- Demonstration of the artifact: The artifact is demonstrated in a controlled environment to evaluate its effectiveness and usability.
- Evaluation of the artifact: The artifact is evaluated for its effectiveness, efficiency, quality, and utility in relation to the defined objectives. The evaluation can be conducted through experiments, simulations, or other evaluation techniques.
- Communication of results: The research results are communicated to relevant stakeholders, including those who can use the artifact, those involved in its creation, and researchers who may benefit from the results.

The execution of these DSRM activities in the research are described as follows. Except for the communication activity, which refers to presenting the work to researchers and interested audiences about the problem addressed.

3.1 Identification and Motivation

For this activity, an exploratory research was carried out in the literature to identify the importance of the topic of postgraduate students in postgraduate programs. This first search for works that address the topic of postgraduate students and their trajectories resulted in 20 documents, dated between 1991 and 2021. The Google Scholar® tool was used. The explored documents were scientific articles and research project reports. Works related to the exploration of profiles from public data sources and exploration of LinkedIn® data were also observed. Those works were analyzed and compiled into a) benefits of keeping postgraduate students´ information, b) how to monitor and search for postgraduate students´ information, and c) requested information. In addition, the alumni community portals of the 15 largest institutions in Brazil were analyzed according to their number of postgraduate programs. Based on the analysis of existing solutions in the context of CAPES evaluation regarding the theme of postgraduate students, and the analysis of works related to the exploratory search, a possible solution was reached: the construction of a method for defining indicators aimed at postgraduate program coordinators, adapted to the context of information to be observed about Human Capital and Relational Capital. After the exploratory literature review, a new review was carried out on Intellectual Capital in the context of HEIs. From this review, 18 documents were classified and used in the studies, including three that consisted of systematic literature reviews. These works helped to create the theoretical foundation of the research and assisted in the activity of defining the objectives of the solution, which is described below.

3.2 Definition of Objectives for a Solution

After the two exploratory literature reviews, it was decided to conduct a structured literature analysis using the integrative literature review method. The method was chosen for using systematic procedures and allowing the inclusion of studies with different methods (experimental and non-experimental, theoretical, and empirical), thus providing greater breadth in the literature review. The steps of this integrative review consist of: identifying the theme and selecting the research question; defining the inclusion and exclusion criteria for studies; identifying the pre-selected and selected studies; characterizing the selected studies; analyzing and interpreting the results; and synthesizing the knowledge or presenting the review.

The chosen databases for the study were Scopus, Web of Science (WoS), and the Brazilian Digital Library of Theses and Dissertations (BDTD). During this review, 9 studies out of 71 were selected that jointly addressed the theory of IC, Data Science, or Knowledge Engineering, and Alumni. The studies were classified and described into categories: a) concepts about Intellectual Capital and/or Knowledge Management; b) Management or mapping of IC in HEIs or postgraduate programs; c) systematic or integrative review, bibliometric analysis, or extensive exploration of existing literature; d) data collection instrument, indicators,

or metrics about Intellectual Capital; e) technologies related to Data Science and/or Knowledge Engineering. At the end of the reviews, three objectives were established for the proposed solution:

- Define an analytical approach for managing the Alumni Capital of postgraduate programs, based on the theories of Intellectual Capital, Data Science, and Knowledge Engineering.
- Develop a framework to guide the activities of collecting and processing data, information, and knowledge to support analytical demands for Alumni Capital management.
- Instantiate the proposed framework and evaluate it from the perspective of knowledge contribution of Design Science Research.

3.3 Design and Development

The project and development of an analytical approach to explore information related to the Alumni Capital was elaborated based on the solution objectives defined during the DSRM execution. The approach resulted in the creation of a theoretical solution and subsequently, a framework that guides the construction of analytical solutions for managing the Intellectual Capital related to alumni in postgraduate programs. Both the theoretical solution and the framework use the theories of Intellectual Capital, Data Science, and Knowledge Engineering to present a complete cycle for managing and constructing solutions that measure the Alumni Capital and enable advanced analysis of this IC component. From this proposed theoretical solution, the framework development began, which defines and guides the management (planning, evaluation, and communication) and engineering (measurement and analysis) processes for constructing analyses that provide a complete view of the postgraduate programs Alumni Capital. This framework, called Alumni Capital Data and Knowledge (ACDK), has four pillars described in the proposed theoretical solution: management, measurement, projection, and prescription.

3.4 Demonstration

The proposed ACDK framework was instantiated for demonstration purposes in a postgraduate program in Brazil. The chosen program provided a strategic planning regarding the actions related to its alumni. Regarding the demonstration of the processes, the measurement and analysis of the postgraduate program included data sources from the CV Lattes and LinkedIn®. The sources were used for conducting descriptive and prescriptive analyses.

3.5 Evaluation of the Artifact

Using the theoretical framework of Design Science Research, the descriptive method of artifact evaluation proposed by Hevner (2004) was used to evaluate the contribution of the results with argumentation and scenarios. Regarding the argumentation for the relevance of the proposed framework, the following section presents the results obtained in the planning, measurement, and analysis processes of the ACDK execution in the proposed context. The presented results are promising and demonstrate that the use of the ACDK framework by postgraduate programs allows for direct action in the management of Alumni Capital. Thus, resulting in instruments to respond more effectively and efficiently to the evaluation criteria of CAPES.

4. Results

The research resulted in two artifacts. The first is part of the theoretical solution, where the pillars for the proposed framework are established. The proposed solution seeks to improve the state of the art by integrating the theories of Intellectual Capital, Data Science, and Knowledge Engineering for managing and exploring data, information, and knowledge in analytical demands of Alumni Capital. The pillars presented guide the construction of the proposed framework, allowing for a complete cycle of analytical demands of Alumni Capital in postgraduate programs, from management to recommendation of actions based on evidence through descriptive, predictive, and prescriptive analyses. Below we present a detailed explanation of each pillar of the solution and an overview of the proposed theoretical solution in Figure 1.

- Management: This pillar is the basis for the other proposed pillars. Supported by the theory of Intellectual Capital, it seeks to identify and map the intangible assets related to Alumni Capital in a postgraduate program.
- Measurement: The second pillar of this theoretical solution is supported by the knowledge base of Data Science, which proposes to measure the intangible assets related to Alumni Capital. The measurement plan provides indicators that must be objectively answered, with reports and

dashboards. This pillar recommends the construction of results comparable to traditional Business Intelligence systems.

- Projection: In the third pillar of this theoretical solution, the application of predictive analysis is done with the support of the knowledge base of Data Science. Predictive analysis aims to determine what is likely to happen in the future and why it can happen based on historical data and information.
- Prescription: In the fourth pillar of the theoretical solution, the use of prescriptive analysis is made with the support of the knowledge base of Knowledge Engineering. Prescriptive analysis focuses on providing recommendations as decision support to achieve specific objectives. Essentially, it involves the use of an analytical model to help guide decision-makers with recommendations or to automate parts of the decision-making process.

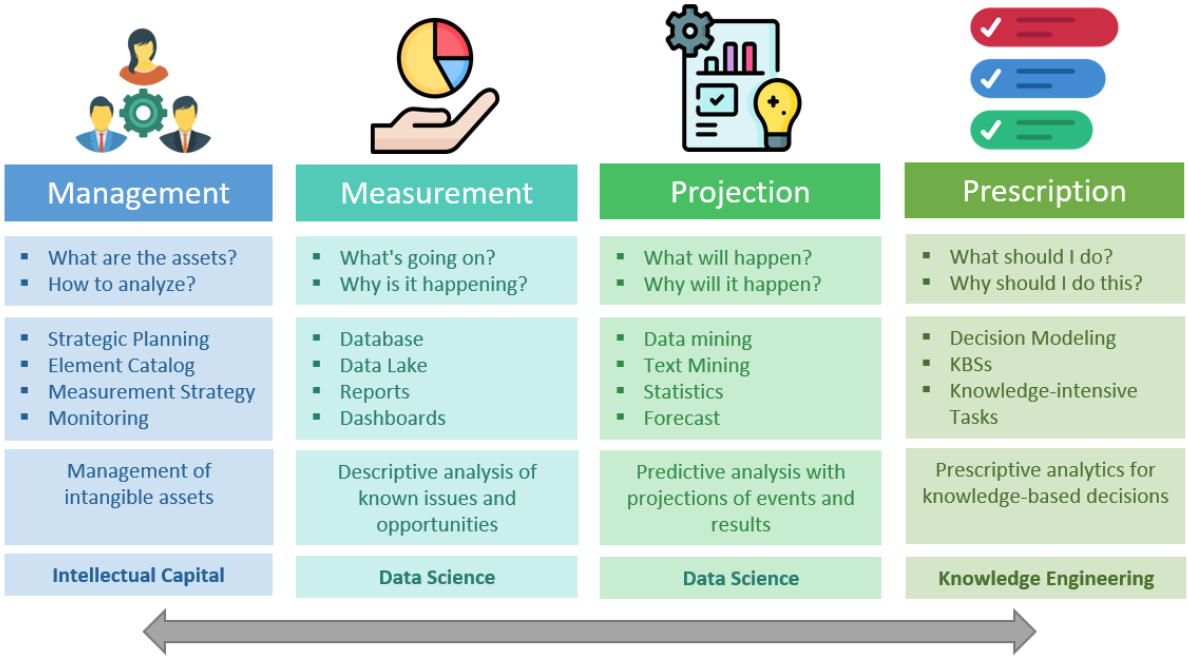


Figure 1: Vision of the Theoretical Solution of the Proposed Framework

Based on the constructs of the theoretical solution, we present the proposed framework. The ACDK guides the planning, measurement, analysis, evaluation, and communication activities related to the Capital Alumni of the postgraduate program. The common step to start the activities supported by the framework is the planning process. In addition, the standard sequence would be executed in the measurement, analysis, evaluation, and communication processes, with the communication process being the last one executed. However, the framework allows different processes to be triggered as needed. The interactive use of these processes is envisaged, without necessarily having an end. Below we present the processes of ACDK with Figure 2 showing the overview of the framework in sequence.

- Planning: directs actions effectively and focused on tangible and measurable results related to the Alumni Capital of postgraduate programs. It is necessary to think about objective actions to measure the intangible assets related to alumni, which assets should be measured, which indicators and resources (e.g., reports with list of alumni) should be proposed, which relevant sources of information should be studied, and what will be the allocation of resources to ensure these objectives.
- Measurement: corresponds to the processes of data acquisition and transformation that respond to analytical demands related to the Alumni Capital of postgraduate programs. It is necessary to verify if the information sources thought in the planning phase are adequate, think about the task of collecting, preparing, and transforming data, creating analytical repositories, and generating reports.
- Analysis: allows for a deeper understanding of the collected and measured data. The result of the analysis should be able to generate valuable insights for decision-making and improvement of Alumni Capital management strategies. Tasks are oriented towards the creation of descriptive, predictive, and prescriptive analyses from the database or data lake generated in the measurement process.

- Evaluation: allows ensuring the quality of the information and knowledge generated throughout the planning, measurement, and analysis processes. A careful evaluation of the results obtained from the measurement plan is performed, verifying if all the steps were executed correctly and if the measurements performed are in accordance with expectations.
- Communication: the objective is to clearly present the results generated from the analysis, evaluation, measurement, and planning processes related to the postgraduate programs Alumni Capital so that everyone can understand the results.

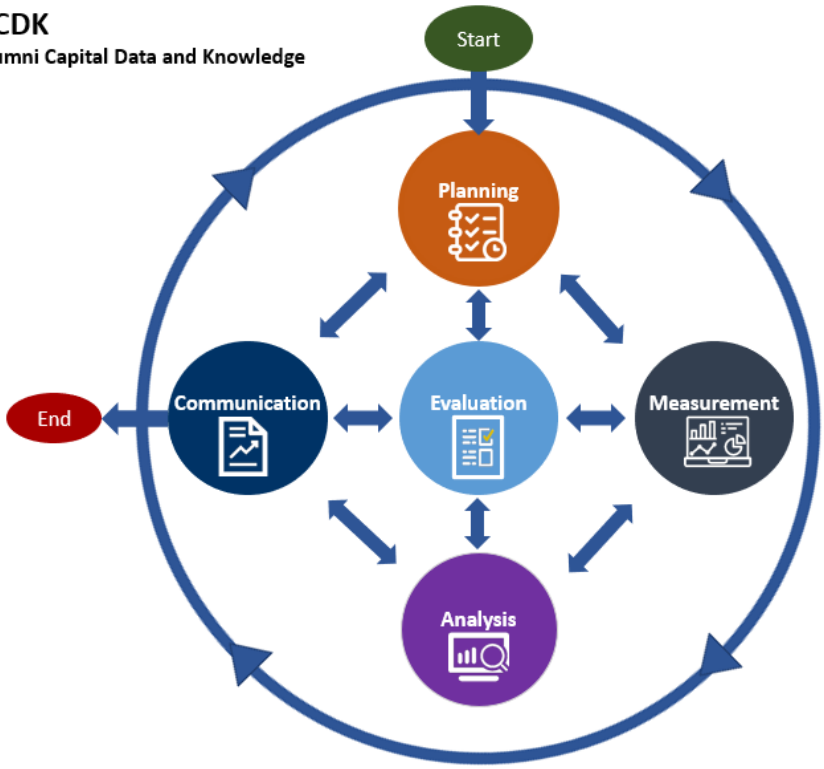


Figure 2: Vision of the Processes of the ACDK Framework

Next, we will discuss the results of the proposed framework and the conclusion of this study.

5. Discussion and Conclusion

As a result of this research, a framework proposal was created to guide the process of managing analytical demands related to Capital Alumni in postgraduate programs. The instantiation of the framework brings important contributions. The first is related to the knowledge of intangible assets related to the Alumni Capital of the analyzed program. The instantiation of the framework brought insights that can be presented to the postgraduate program and can be worked on with more data sources for a better analysis. Regarding the theoretical foundation of the literature, this research integrates different theories and proposes a common path for managing Alumni Capital. This concept of AC is also expanded in this research with elements of postgraduate education, which also allows the expansion of literature related to Intellectual Capital. Additionally, this research presents Data Science as an emerging theory that can contribute to Knowledge Engineering to understand and analyze real-world phenomena with domain data and information to generate new knowledge. This combination of Data Science and Knowledge Engineering enables the creation of intelligent systems.

5.1 Limitations and Future Research

The processes of ACDK can be treated in a generic way to adapt this framework to the management of Intellectual Capital in HEIs, in a broader context. To achieve this generalization, it is suggested to use indicators from the context of HEIs and to present examples related to this new context. This work provided a detailed description of the ACDK in different processes that will be further developed in future works. Lastly, the

instantiation of the proposed framework should be detailed in further works to demonstrate the benefits of using the ACDK.

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Practices that Mitigate Organizational Knowledge Hiding: A Systematic Literature Review

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Abstract: The importance of Knowledge sharing (KS) within organizations is well recognized. Despite efforts by firms to facilitate KS, employees are sometimes unwilling to share their knowledge. Inefficient KS can lead to reduced productivity and innovation and increased employee frustration. Knowledge hiding (KHi) occurs when someone withholds knowledge when asked to share it. While the literature contains much about the antecedents of KHi, our systematic literature review found very few articles that discuss how to mitigate it. Hence, this study sought to associate KS practices with organizational KHi motivations and to find ways to mitigate the behavior. To do so, a systematic literature review was conducted in two main sources: Scopus; and Web of Science. The collected data were then subjected to content analysis. The results show KS practices designed to reduce organizational motivations for KHi are based on HR practices (recruitment, training, and mentoring) and organizational structure (teamwork, interdependence between tasks, job rotation, knowledge mapping, best practices, and communities of practice). KS practices such as face-to-face interaction and informal conversation appear to build trust and reduce KHi. Organizational antecedents of KHi, such as workplace bullying and incivility, are related with the organizational culture, and leadership is relevant to avoid negative events. Explicit and tacit KS practices can mitigate KHi. This research offers academic and managerial contributions on the KHi and how to mitigate it. Building on this study, future research could empirically test the relationship between KHi motivations and KS practices to mitigate KHi.

Keywords: Knowledge hiding, Knowledge sharing practices, Knowledge hiding mitigation, Systematic literature review, Knowledge hiding antecedents

1. Introduction

Knowledge Management (KM) began to gain the attention of business executives in the late 1990s (Hansen *et al*., 1999), when knowledge sharing (KS) was identified as a source of sustainable competitive advantage (Mahdi and Nassar, 2021). However, employees may not always be willing to share their knowledge, even when the company wants to facilitate it, resulting in ongoing issues with KS (Gagné *et al*., 2019). This is where the concepts related to knowledge hiding (KHi), which occurs when someone withholds knowledge when requested (Connelly *et al*., 2012), come into play and the reason why researchers continue to discuss KHi behavior today (Ruparel *et al*., 2021; Koay and Lim, 2021).

Although organizations may encourage knowledge sharing (KS), these efforts often fail (Hislop, 2002). There are various reasons for this, including abusive supervision (Khalid *et al*., 2018), unethical leadership (Qin *et al*., 2021), organizational politics (Malik *et al*., 2019), and employee exclusion (Miminoshvili and Černe, 2021). As a result, there is a lack of both KS and knowledge retention. Knowledge hiding (KHi) negatively affects employee creativity (Malik *et al*., 2019) and other important constructs.

Panopto (2018) found 60% of employees in surveyed companies struggle to access the knowledge they need from their colleagues. Jiang *et al*. (2019) found that 17% of individuals who hide their knowledge tend to be unsuccessful at work. Additionally, Myers (2017) reported that companies on the Fortune 500 list lose $31.5 billion per year due to ineffective knowledge sharing by employees. Again, according to Panopto (2018), inefficient knowledge sharing also results in productivity losses of $47 million each year for large US businesses. Other studies have shown that 81% of employees feel frustrated when they cannot access the knowledge they need to complete their work, and they spend an average of 5.3 hours per week waiting for support or collaboration from their colleagues (Panopto, 2018).

The literature has identified various antecedents of knowledge hiding (KHi), including the predictive effect of abusive supervision (Islam *et al.* 2021) as well as six broadly related categories, namely psychological, behavioral, interpersonal, performance, motivational, organizational, and moral and belief factors (Garg *et al.* 2021a). This study focuses on the organizational antecedents, as it is the responsibility of the organization to mitigate KHi. To minimize KHi, Di Vaio *et al.* (2021) suggest there is a need to understand why and when people hide

knowledge, and adopt strategies accordingly. However, while the literature on KHi antecedents is extensive, few studies have addressed how to mitigate KHi. Therefore, the objective here is to link knowledge sharing (KS) practices to KHi motivations in the organizational category, with the aim of reducing KHi.

2. Knowledge Hiding, KHi Mitigation and KS Practices

2.1 Knowledge Sharing

Knowledge sharing (KS) is an important process in which both tacit and explicit knowledge are exchanged, leading to the generation of new knowledge (Hooff and Ridder, 2004). This two-way process involves both the donation and collection of knowledge, with one side requesting knowledge and the other supplying it. For firms to acquire competitive advantage, this exchange of knowledge is essential. Knowledge donation occurs when knowledge is transmitted without a specific request, while knowledge collection occurs when someone requests knowledge from another and it is shared (Hooff and Ridder, 2004).

Mechanisms or practices have a crucial role in facilitating the interaction between tacit and explicit knowledge. These mechanisms can be defined as intentional ways of disseminating knowledge that support KM processes Oliveira *et al.*, 2014). Meetings (Nonaka, 1994), videoconferencing, mentoring, and other forms of interaction enable the sharing of tacit knowledge and its conversion into explicit knowledge (Nonaka and Konno, 1998). Explicit knowledge can be organized through repositories or other means (Nonaka, 1994). Individuals can internalize knowledge through lessons learned, best practices, and storytelling. KS mechanisms include mentoring, socialization, simulation, staff meetings, cooperation, community of practices (COP), discussions, training, workshops, and many others (Raudeliuniene *et al*., 2020).

Numerous studies have explored knowledge sharing (KS) and its prerequisite conditions (Nonaka and Konno, 1998). However, despite the attention given to KS practices, they are still not commonly implemented in organizational environments (Aljuwaiber, 2016). To analyze this situation, KHi has emerged as a useful construct. In the next section, we will explore and detail this concept.

2.2 Mitigating Knowledge Hiding

Building on the previous section's concept of KS as a process of donation and collection, KHi can be seen as a counterproductive behavior that hinders the knowledge collection aspect of KS. Essentially, KHi arises when someone withholds knowledge that is being requested by another individual. To understand this concept more clearly, one can simply ask oneself: Do I have the knowledge that is being requested? If the answer is yes, and I agree to pass on the knowledge, it is shared through the process of collection. However, in the case where I have the knowledge, and decide to withhold the knowledge, I am engaging in KHi. As a result, the knowledge collection process is obstructed, and KS does not occur as effectively (Oliveira *et al*., 2021).

Few studies have focused on understanding how firms can mitigate KHi (Butt *et al*., 2020; Butt, 2021; Men *et al*., 2020). For instance, Butt (2020a) identified five managerial characteristics that can help to diminish KHi in a buyer-supplier relationship: self-monitoring; self-efficacy; professional commitment; personal friendship; and, intrinsic motivation. Additionally, shared goals have been found to decrease KHi among individuals (Butt *et al*., 2021a), while cultivating a collaborative environment has been shown to be beneficial in reducing KHi (Xiong *et al*., 2021). Table 1 provides a summary of suggested strategies for KHi mitigation from various authors (Abdillah *et al*., 2020; Koay and Lim, 2021; Men *et al*., 2020; Butt, 2020b; Nadeem *et al*., 2020; Xiong *et al*., 2021; Butt *et al*., 2021a; Dodokh, 2020; Arain *et al*., 2020; Oubrich *et al*., 2021; Jasimuddin and Saci, 2022) based on the organizational category presented by Garg *et al*. (2021a).

Table 1: Suggestions for Mitigating KHi (Organizational Category)

Suggestions for mitigating KHi	Types
Leader's unselfish action and voluntary helping behaviour, leadership development programs (Abdillah et al., 2020); leaders should lead by example, ethical leadership behaviour, leaders' ethical behaviour as part of the performance appraisal (Koay and Lim, 2021); to establish fairness through the distribution of tasks (Oubrich et al., 2021).	Leader
KS culture (Butt, 2020b); procedures to foster KS behaviour (Arain et al., 2020);	KS culture

Suggestions for mitigating KHi	**Types**
team mastery climate (Men et al., 2020): learning, cooperation, skill development.	
Including KS criteria when revising employee work contracts (Butt, 2020b; Butt *et al*., 2021a); rapid promotion in the career, career progression (Jasimuddin & Saci, (2022); procedural instructions for work decisions (Oubrich et al., 2021); non-discriminatory HR policies (Arain et al., 2020); hiring people who have altruistic attitudes and behaviour (Abdillah et al., 2020); performance appraisal (Koay and Lim, 2021; active encouragement (Jasimuddin & Saci, (2022).	HR practices
Reduce hierarchical layers, open space workstations and reducing chain of command (Butt, 2020b; Butt *et al*., 2021a); interaction with top management (Oubrich et al., 2021).	"Open doors"
Training for knowledge and information management (Arain et al., 2020); training programs to develop Emotional Intelligence (de Geofroy and Evans, 2017); ethics training (Koay and Lim, 2021; Men et al., 2020).	Training
Information-sharing practices (Dodokh, 2020); developing informal interaction (Butt, 2020b; Butt *et al*., 2021a); communicate shared goals (Nadeem et al. (2020); institutionalized platforms for communication and Knowledge Exchange, and formal and informal mentoring programs (Men et al., 2020); supporting conference attendance, patents, and publishing papers (Jasimuddin & Saci, (2022).	Interaction

3. Method

To identify the antecedents of KHi behavior and the mechanisms or practices that could be used to mitigate it, a Systematic Literature Review (SLR) was conducted. Scopus and Web of Science, which are the main sources for this area/theme, were used to conduct the SLR. Multiple queries were run on both databases to define the corresponding research string for each. The final query used on the Scopus database to date was: (TITLE-ABS-KEY(("knowledge hid*" OR "knowledge conceal" OR "knowledge withhold*")) AND TITLE-ABS-KEY(("practic*" OR "mechanism*"))) AND (LIMIT-TO(DOCTYPE, "ar")) AND (LIMIT-TO(LANGUAGE, "English")). As of October 11th, 2021, the Scopus database yielded 160 articles.

The corresponding research string format used on the Web of Science database was: ((TI=("knowledge hid*" OR "knowledge conceal" OR "knowledge withhold")) OR (AB=("knowledge hid*" OR "knowledge conceal" OR "knowledge withhold")) OR (AK=("knowledge hid*" OR "knowledge conceal" OR "knowledge withhold"))) AND ((TI=("practic*" OR "mechanism*")) OR (AB=("practic*" OR "mechanism*")) OR (AK=("practic*" OR "mechanism*"))) AND (DT=(Article)) AND (LA=(English)). This query was executed and yielded 130 items in the Web of Science database as of October 11th, 2021.

To remove duplicate items, we used Excel to sort the articles by alphabetical order. There were 124 duplicate articles between Scopus and Web of Science. Six articles that were only present in the Web of Science database were added, bringing the total number of articles to 166. After removing the duplicates, the titles and abstracts of the remaining articles were read to determine their relevance to the subject under investigation. Forty (40) articles were found to be unrelated to the subject and were removed, leaving 126 articles. After reading these articles in full, the researchers selected 24 articles for organizational antecedents of KHi and 19 articles for mechanisms, resulting in a total of 42 articles (one of which discussed both antecedents and mechanisms).

The data analysis process followed the Content Analysis method (Bardin, 2009), which involves pre-analysis, exploration of the material, and treatment of the results. During the pre-analysis, the antecedents of KHi were matched with KS mechanisms by two different researchers. Any differences between the choices were discussed

by the same researchers until a consensus was reached, as recommended by Krippendorf (1980). This two-step process ensured the accuracy and reliability of the analysis.

4. Data Analysis and Results

The systematic literature review (SLR) revealed several factors that motivate organizational KHi, as well as many pertinent knowledge sharing (KS) practices. To address each of the antecedents that contribute to KHi, we matched a KS practice that can help reduce the likelihood of this behavior. In Table 2, the first column lists the antecedents that increase KHi, while the second column lists the KS practices that can help mitigate this behavior.

Table 2: KHi Antecedents and Proposed KS Practices to Mitigate Their Effects

ANTECEDENTS OF KHi	KS PRACTICES
Leadership (transformational/ ethical/ empowering/ knowledge) Abdillah *et al.* (2020); Anser *et al.* (2021); Ladan *et al.* (2017a); Ladan *et al.* (2017b); Lin *et al.* (2020); Men *et al.* (2018); Xia *et al.* (2019)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020). (c) Face-to-face interaction - Al-Ghassani *et al.* (2005); Lang (2001). (d) Mentoring - Al-Ghassani (2002); Egbu *et al.* (2003); Henriques and Curado (2009).
Workplace incivility Arshad and Ismail (2018); Irum *et al.* (2020)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).
Abusive supervision Hamza *et al.* (2021); Jahanzeb *et al.* (2019); Khalid *et al.* (2018)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).
Workplace ostracism Riaz *et al.* (2019); Zhao *et al.* (2019)	(a) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020). (b) Face-to-face interaction - Al-Ghassani *et al.* (2005); Lang (2001). (c) Teamwork - Kong and Thomson (2009). (d) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011).
Organizational identification Yao *et al.* (2020); Zhao *et al.* (2019)	(a) Face-to-face interaction - Al-Ghassani *et al.* (2005); Egbu *et al.* (2003); Lang (2001). (b) Teamwork - Kong and Thomson (2009). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Communities of Practice - Ruggles (1997); Egbu *et al.* (2003); Al-Ghassani *et al.* (2005).
Organizational justice Abubakar *et al.* (2019)	(a) Face-to-face interaction - Al-Ghassani *et al.* (2005); Egbu *et al.* (2003); Lang (2001). (b) Teamwork - Kong and Thomson (2009). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).

KM systems; Organizational policies; culture; job insecurity Serenko and Bontis (2016)	(a) Face-to-face interaction - Al-Ghassani *et al.* (2005); Egbu *et al.* (2003); Lang (2001). (b) Teamwork - Kong and Thomson (2009). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020). (e) Mentoring - Al-Ghassani (2002); Egbu *et al.* (2003); Henriques and Curado (2009).
Organizational psychological ownership Ladan *et al.* (2017b)	(a) Knowledge mapping - Yasin and Egbu (2010). (b) Interdependence between tasks - Garg *et al.* (2021b). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Job Rotation - Lu and Yang (2015).
ANTECEDENTS OF KHi	**KS PRACTICES**
Lack of recognition Jha and Varkkey (2018)	(a) Communities of Practice - Ruggles (1997); Egbu *et al.* (2003); Al-Ghassani *et al.* (2005). (b) Best Practices - Benbya and Belbaly (2005). (c) Face-to-face interaction - Al-Ghassani *et al.* (2005); Egbu *et al.* (2003); Lang (2001).
Restrictions from senior management, norms, and expectations of the firm Butt and Ahmad (2019)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Mentoring - Al-Ghassani (2002); Egbu *et al.* (2003); Henriques and Curado (2009).
Perceived organizational politics Malik *et al.* (2019)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).
Leader-signaled KHi Offergelt *et al.* (2019)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).
Job tension Riaz *et al.* (2019)	(a) Face-to-face interaction - Al-Ghassani *et al.* (2005); Egbu *et al.* (2003); Lang (2001). (b) Teamwork - Kong and Thomson (2009). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Mentoring - Al-Ghassani (2002); Egbu *et al.* (2003); Henriques and Curado (2009).
Task conflict and relationship conflict Boz Semerci (2019)	(a) Face-to-face interaction - Al-Ghassani *et al.* (2005); Egbu *et al.* (2003); Lang (2001). (b) Teamwork - Kong and Thomson (2009). (c) Informal Conversation (Happy-Hours, informal meetings) - Hansen *et al.* (1999); Hautala (2011). (d) Mentoring - Al-Ghassani (2002); Egbu *et al.* (2003); Henriques and Curado (2009).
Leadership demands Butt *et al.* (2020)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).

Workplace bullying Yao *et al.* (2020)	(a) Recruitment - Tan *et al.* (2010); Al-Ghassani *et al.* (2005). (b) Training (leadership development programs, ethics program, KS) - Al-Ghassani *et al.* (2005); Koay and Lim (2021); Abdillah *et al.* (2020).

This category of antecedents, which includes workplace bullying and workplace incivility, is closely connected to the organizational culture. Effective leadership plays a critical role in preventing such negative incidents. This aligns with the views of Koya and Lim (2021), who recommend that leaders should serve as role models for their staff.

5. Conclusion

This study has sought to focus on means of mitigating KHi by identifying KS practices that address organizational motivations for KHi. To achieve this goal, both explicit and tacit KS practices, as well as formal and informal interactions, were considered. The identified KS practices were essentially HR related, such as recruitment, training, and mentoring, as well as organizational structure practices such as teamwork, interdependence between tasks, job rotation, knowledge mapping, best practices, and communities of practice.

Based on our analysis, face-to-face interaction and informal conversation appear to be effective means of avoiding KHi because they build trust. Specifically, face-to-face interaction was associated with most of the identified KHi motivations (8 out of 12). However, the shift towards remote work has made it challenging to rely on face-to-face interaction as a means of mitigating KHi. Nevertheless, KS practices such as training, mentoring, and task relatedness were found to be effective in facilitating task execution while also mitigating KHi.

In summary, the main academic and managerial contribution of this research is the aggregation of knowledge on how to mitigate KHi. However, the study is limited as it only focuses on the Organizational category. Future research can build on this study by exploring the other categories proposed by Garg *et al*. (2021a) and employing empirical research to verify the relationship between KHi motivations and KS practices.

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Engagement of Actors in Expert Communities

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Abstract: Recent scientific approaches and practical work-life developments aim to increase actor engagement to form expert communities. Solving common issues motivates stakeholders to collaborate and build trust to enable the co-creation of knowledge. This research is based on reading materials to understand how the engagement of actors in expert communities becomes viewed. The purpose of research-based development is to include actors in co-creation contexts. Gap analysis can be used to aid the planning of training implementation. Development processes are continuous and cyclical in nature. An open mind for change and a desire to learn are key to building competence. A plan for implementing development measures can help select learning methods that promote knowledge sharing and searching for new information. Measuring and evaluating learning can provide valuable feedback, which is needed to identify critical competencies and competence risks, and to promote the creation of a culture of learning.

Keywords: Competence, Knowledge, Learning, Management, Development

1. Introduction

Recent scientific approaches and practical work-life developments have aimed at increasing actor engagement to form expert communities. Solving common issues motivates stakeholders to collaborate and build trust to enable the co-creation of knowledge, which can offer significant innovation opportunities (Ruoslahti, 2018). For example, Pirinen (2013) emphasizes that the integrative process e.g., student-centred research and development is based on and included in collective research and development.

Pedagogy emphasizes social interaction, collaborative learning, discussion, meaning negotiation, and meaning building in practical contexts. In the constructivist conception of learning, the importance of learner activity is emphasized and teaching is not the transfer of knowledge but the control of the learning process (Loyens and Gijbels, 2008). Design information can help determine the current and future states and functionalities of an organisation (Nonaka and Toyama, 2003), and process knowledge supports the organization with change processes that are based on the participation of actors using theories and models (Griffiths and Guile, 2003).

Due to an increase in teamwork, the need for inclusive leadership and the new role of leadership in human resource development have also been understood. Competence management is seen more deeply and more broadly than before. Competence is based not only on knowledge and doing, but also on participation and learning, and development processes should be developed and managed holistically in the work organization (Bhasin and Sharma, 2018). An inventory of the current state of competence can help draw plans to create new operating models to ensure the continuity of competence development (Corell, 2019).

According to (OECD LEED, 2006), the driving force of competition is integrated competence, which is created through various partnerships and value networks. The starting point for teaching is the learner's existing knowledge, perceptions, and beliefs about the things to be studied. Particular attention is paid to the learner's metacognitive knowledge and strategic self-regulatory skills.

Constructivist learning environments aim to avoid memorization and repetition and focus on comprehension rather than memorising. Different interpretations are considered and exploited using learning methods where interpretations have to face each other in social interaction. (Loyens and Gijbels, 2008).

The research question (RQ) of this paper is: how is actor engagement in expert communities viewed in literature?

2. Methods

This research is a desktop study that is based on reading materials and familiarization with previous research on the topic (Denzin and Lincoln, 2011). The material for this study is collected from scientific literature, recommendations, guidelines, and other authority publications to provide a varied source of data (Eisenhardt, 1989; Yin, 2009). In content analysis, the researcher "analyses the narrative, temporal, and dramatic structures of a text, forsaking the rigor of counting, for a close, interpretive reading of the subject matter at hand" (Denzin and Lincoln, 2011, p.358). The case is focused on the engagement of actors in expert communities.

3. Research Based Development

Methods of research and development of the concepts and the orientation of work life engage the actors of the expert community to promote understanding of how to implement activities (Mäki, 2009). As stated by (Moilanen, Ojasalo and Ritalahti, 2022) knowledge and the use of different methods play an important role in development work.

Literature makes a distinction between 'research and development' and 'research-based development', which may also be referred to as 'development work'. Research work can be described as a systemic activity to increase available information and use this information to find new applications. Development work, on the other hand, is described as creating new and better products, production equipment or methods and services (OECD, 2015). Research-based development, as a process, focuses on developing work life. This is done with an approach that combines real work-life development with the application of structured research methodology, including both data collection and analysis (Jääskelä and Nissilä, 2015). Scientific research aims at forming new and better theory, while professional research and development activities aim to create an improved practice based on new knowledge (Nonaka and Takeuchi, 2007)

Research-based development expert communities are integrated into the research and development process calls for methodological expertise. It starts with the identification of the development target, followed by successful delimitation of key concepts, and analysis of existing knowledge related to the topic, coupled with appropriate information acquisition skills that help distinguish the essential from the mass of data (Moilanen, Ojasalo and Ritalahti, 2022). (Harvard Business School, 2021) note that professional information acquisition should utilize many different channels, which become anchored in underlying value goals, to produce the desired accurate, convincing professional information.

The inventory process of competence identification, mapping, plan, and new operating model can be carried out by compiling competence profiles linked to job descriptions and comparing the results obtained with the current training of individuals to map the need for additional and in-service training requirements (Ruoslahti and Tikanmäki, 2022). Co-creation of knowledge for innovation is active multi-stakeholder participation which calls for collaboration, a common problem, and open communication where stakeholders need to be actively engaged, which takes time and effort (Ruoslahti, 2018).

3.1 Development Processes

Understanding the development processes as continuous cyclical models can help integrate expert communities into research and development processes. The five step quality cycle DMAIC (Define, Measure, Analyse, Improve, Control), for example: its first step defines the problem, the second step is the measure, the third step identifies the cause of the problem, the fourth verifies improvement, and the fifth and final step maintains the gains and pursue perfection, so that the cycle may start again (de Mast and Lokkerbol, 2012). To build a basis for the creative development, the expansive learning process consists of seven phases: questioning existing practices, analysis of existing practices, modelling a new solution, exploring the new solution, adopting the new solution, evaluating the process, and solidifying and expanding new practices (Engeström, Kerosuo and Kajamaa, 2007).

The quality cycle by William Edwards Deming shows similar cyclicity in an even simpler form of only four phases that can be used to improve competence (The W. Edwards Deming Institute, 2022). The Deming quality cycle is also referred to as the PDCA (Plan, Do, Check, Act) development cycle (Moen and Norman, 2006) and it is used in ISO standards aiming at business continuity. Phase 1 Plan: according to need and goal; process & organization, resources, criteria, constraints; Step 2 Do: identify resources and test, pay attention, gather information, and put it into practice; Step 3 Check: action plan and its implementation, learn, analyse, check, measure to if as planned; Step 4 Act: evaluate the implementation and if necessary correct, innovate, improve, appropriate reform; after revisions the cycle begins again from Plan.

Development processes can be divided into seven-steps (Marović, Adomeit and Golub, 2018); step one identifies the overall vision for improvement as a starting point for plans and goals to achieve the desired goal. The second step is to determine what will be measured, whether new skills and tools are needed, and where the information can be found. The determination of the indicators must focus on the essentials so that the purpose of the measurement is not lost. The third step is to gather the necessary data. The issues to be defined are the data collector(s), how, when, and how often the data will be collected. The above is based on the set operational goals. In the data processing phase, data from several different sources is processed and a context is provided for the data for comparison. The information is edited in the desired format for a specific

target group. In the analysis phase of the data collected, conclusions are drawn to the impact of the results obtained on the operation, whether changes are needed, whether the objectives have been achieved and whether there are any structural problems. The purpose of the sixth phase is reporting. The results are presented to the target group to support decision-making. The reporting must highlight both the issues that need to be developed and those that have emerged as positive. In the implementation phase (improvement implementation phase), processes are optimized, improved, and corrected based on the acquired knowledge.

(Kallio and Lappalainen, 2015) divide collaborative service development, which they see as an organizational learning process, into five phases: the need for change – evaluating earlier practice, planning, and ideating by scenario building, experimenting by prototyping, implementation or applying in daily practice, and generalizing, which is evaluating the lessons learned. Competency development process progresses from performing a competent survey through a development plan to transfer development measures to the individual's goals. (Kontoghiorghes, Awbre and Feurig, 2005; Le Deist and Winterton, 2005).

In competence mapping, special areas of competence are identified, existing knowledge is mapped, and the skills developed and the means to achieve them are specified (Volpentesta and Felicetti, 2011). There is a distinction between the need for information and the allocation of information work life innovation. Design information is processed to create knowledge that finally becomes disseminated to serve other organizations and actors, such as working life development experts (Ojasalo, 2012)

4. Identifying Competence and Development Planning

Expert communities become integrated into the research and development process through appropriate competences, which are built on knowledge, skills, will, contacts, and experience, the role of which in building overall competence is significant (UNESCO, 1984). An open mind for change and especially the desire to learn are key to maintaining competence, as the right attitude, with creating and maintaining interactions are part of competence, as are using different information acquisition channels (Regehr and Mylopoulos, 2008). In dynamic operating environments, the most important competitive factor for an organization is the continuous increase in knowledge capital (Hakanen and Soudunsaari, 2012).

The perception of work and profession by the employee has become even more important, and professional identity has become a necessary and central task throughout his/her professional career (Eteläpelto et al., 2014). Ensuring necessary skills and competencies can help organizations prepare for successful research and development processes.

Competence mapping, or a compilation of essentials into personal learning plans as a minimum, is needed to verify the direction and impact of competence development (Bhasin and Sharma, 2018). An alternative way of mapping competence risks is to find out what are the 2-3 worst competence risks in terms of the organisation's strategy/goals and what the realization of these risks causes at worst. An organization can be a unit, a sector, an individual, or a group (Durst and Zieba, 2019). Analysing and identifying one's skills is key to analysing professional identity: What are your personal development and training goals? What are the motives, goals and needs? (Eteläpelto et al., 2014). Complementary knowledge can be based on individual interests (Griffiths and Guile, 2003). Organizations seem to be able to prepare for research and development processes by ensuring that they have the necessary skills and competencies.

4.1 Developing the Work and Operational Environment

Integrating expert communities into a research and development process may be guided with work tasks that determine a person’s current needs regarding one’s areas of professional competence. What skills are needed depend on one’s work tasks, how one sees the need to learn new knowledge and skills, and what skills are needed in one's work community? Basic work life skills need to be supplemented and renewed as one’s work role changes. The goals of the work community set requirements on what competences are needed, which are based on the organisation’s vision and goals, where each member of the work community should be aware of how to develop their skills to contribute to the achievement of common goals (Regehr and Mylopoulos, 2008).

Competence management is how organizations deal with the competence of enterprises, groups, and individuals. The purpose of which is to define and permanently maintain competence in line with the objectives of the enterprise (Berio and Harzallah, 2005). EU define competence as “a combination of knowledge, skills and attitudes appropriate to the context” (European Parliament and the Council, 2006, p.14).

Competence is part of human capital, which includes e.g., the level of education of the personnel and the measured competencies, job satisfaction and state of health (Lepak and Snell, 1999). An individual's

competence consists of knowledge, skills, experience, contacts, and values and attitudes (Savanevičienė, Stukaitė and Šilingienė, 2008). Two types of knowledge and skills can be identified: explicit, which can be expressed as information and tacit, which is difficult to specify as it is built into the organization and its people (Nonaka and Takeuchi, 2007). (Otala, 1995) recommends drawing up a plan for implementing development measures, finding the right learning methods, sharing one's knowledge, as well as searching for new information, and to measure and evaluate learning. Working conferences, change laboratories, futures dialogue, and research-based applied theatres as methods of identifying silent signals can help overcome friction factors that prevent the utilization and accumulation of tacit knowledge (Järvinen, 2012).

Information gathering and feedback on the different learning methods can be achieved by assessing the learning outcomes and evaluating the functionality of the process (Kraiger, Ford and Salas, 1993). Annual appraisals can be used as a competence develop tool, to highlight both organisational and individual training needs. However, often many matters agreed upon in the appraisals, may be left to wait for the next appraisals, which means that development depends on the activity of the supervisor and subordinate (Levinson, 1976).

4.2 Creating a Culture of Learning

To meet an organization's perceived needs for expertise, individuals should acquire the knowledge and skills necessary, which help successful integration of expert community members to research and development processes. To be transformed into organizational know-how information must be acquired, understood, internalized, and shared within the community (Eisenberger, Malone and Presson, 2016). The competences of an organisation's personnel, consisting of practices, processes or systems that store and accumulate new know-how, forms a common knowledge base for an entire company (Fagerberg, Fosaas and Sapprasert, 2012).

Meetings, training sessions, group work, etc. can be used to share information. When the information becomes understood at the organizational level, the suitability of the information for practice can be tested for organizational learning. It can become reflected in the structures and practices of the organization and its written instructions (Levitt and March, 1988). On the report of (Otala, L., J. Jaskari, and M. Vartiainen, 2004) strategic competences can be determined by identifying strategic starting points, required competencies and capabilities, future competence needs and drawing up competence profiles, so that the work community and organization form a network that supports learning.

Apprentice-master learning processes involve long-term and systematic formal training and guidance, where the results of many years of study build expertise in practice as learners receive reflection and social support from and gives them to others (Westermann, 2011). A significant part of expert knowledge is so-called tacit information, so by learning to utilize internal sources of institution- and market-based tacit knowledge (Järvinen, 2012). Tacit knowledge can express information on work life situations which is not usually openly expressed or presented, and it can be an important resource for the functioning and management of an organization (Westermann, 2011).

Defining a vision, strategy, core competencies, and competence development needs can locate the differences between the current situation and the competence needs, and a development plan helps target, implement, and monitor the measures; monitoring and evaluating development measures can support management guide the organizational operations and make a follow-up plan for competence development (Bergenhenegouwen, 1996). Creating student-expert alliances can connect science, culture, and experts with work life activities to create learning environments together (Westermann, 2011). The collective individual competences of the personnel accumulate organizational competence, which can form permanent and secure organizational knowledge capital, not just the competence of individuals (Hakanen and Soudunsaari, 2012).

An important part of learning is finding one's individual ways of working and developing one's personality through self-knowledge. Learning is made possible by applying alternative ways of studying in different learning and operating environments, to which the network of working life and competence corresponding to competence is closely connected (Pirinen, 2013).

The emergence of innovations is influenced by strong links between actors, as well as by the essential new knowledge brought by beginners, which develops and deepens community activities (Ojasalo, 2012). Knowledge and information are shared in an open atmosphere, symmetrically through and between both old professionals and newcomers provides support to competence management in changing the way an organization operates, and the emergence of know-how because of work life cooperation to be key (Wan et al., 2020). Management practices should support and enable radical, collective learning (Kallio & Lappalainen, 2015).

Knowledge and know-how are the intellectual capital of a network. Competence, learning, and innovation are closely linked. Social capital and the ability to work together are things that can be learned and developed like other abilities. Social capital is learned by doing and advancing in short steps and with controlled risks. (Ojasalo, 2012). A network's own strong competence and openness to face external challenges create a basis for work and, for example, innovation. The challenge of competence management is to lead to the emergence of new competence; the content does not yet exist and thus, cannot be precisely defined.

However, in addition to the application of new technologies, new skills are needed to manage complex and large-scale projects. The ability to innovate are the resources of a modern competitive company, one innovation is not enough, one must be able to innovate continuously (Carnabuci and Operti, 2013). To achieve the desired result, the actions of different people in action must be coordinated in terms of goals and timing.

5. Conclusions

Organisations can prepare for research and development processes by ensuring necessary skills and competencies. The recent scientific and practical trends of increasing the engagement of actors to form expert communities promote e.g., research-based development which works to include actors in co-creative settings. Solving common issues can build trust and motivate stakeholders toward deeper collaboration to enable co-creation of knowledge. Understanding these principles may help guide the integration of expert communities to research and development processes and create strategies that human resources departments can use to foster expert communities. These findings contribute to the DYNAMO-project, where humans can be seen as forming expert communities in innovative business continuity management processes in the healthcare, energy, and maritime transport sectors.

Development processes are continuous and cyclical in nature. An open mind for change and a desire to learn are key to building competence. Process knowledge can help supporting the organization to carry out change processes based on the participation of actors using theories and models (e.g., Griffiths & Guile, 2003). A plan for implementing development measures can help select learning methods that promote knowledge sharing and searching for new information. Gap analysis can be used to aid the implementation of training planning. Measuring and evaluating learning can provide valuable feedback, which is needed to identify critical competences and competence risks, and to promote the creation of a culture of learning.

Training aims to produce professional personnel for the company's needs, to maintain and develop professional competences and to enable the financial use of human resources. Competence profiles linked to job descriptions and the results obtained from them are compared to the current training of individuals to identify the need for in-service training.

Training needs can be divided into all common and task-related training and requirements. The annual appraisal updates the need for competence and training for each person. Competence development can be divided into three areas: 1) implementation of the competence survey, 2) preparation of the development plan and 3) transfer of development measures to the goals of the persons. The competence survey is carried out as a self-assessment. After the self-assessment, the supervisor evaluates each person's competence to the target profile and identifies competence gaps by comparing current competence with future competence needs.

By renewing the operating concept, change can focus on enhancing the financial value of the business. Financial incentives are used to encourage the achievement of management objectives. In the development and learning of the organization's operational capability, the personnel are involved in the change process. Renewal of operations is learning, which depends on the extent of personnel participation and thus, the commitment of personnel plays a big role in implementing change.

Developing and reorganizing help implementing new infrastructures which management practices should support to enable radical, collective learning. Preparing development plans, call for measures to identify and fill competence gaps and to measure the implementation of the development plan. The implementation of the plan is regularly monitored with the follow-up to action plans. Appraisals and competency mapping are carried out in person with each employee. These measures can be taken in accordance with the development plan, and a personal development plan is drawn up based on the person's goals and the development plan. The training needs and development plan are recorded in the appraisal form. The implementation of the plan is monitored regularly. Engagement is a crucial factor in the success of expert communities, and future study is recommended to investigate how this occurs in more detail.

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Knowledge Management and Cryptocurrencies: Review and Reflection

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Abstract: In this paper we try to reflect on how one of the financial phenomena of the last twenty years, namely cryptocurrencies, has been analysed by the scientific community of the Knowledge Management (KM) field. The issue is relevant because the raise of cryptocurrencies as an economic asset has been occurring in a time in which KM gained social prominence. And also because the evolution of cryptocurrencies should be also related to knowledge about their own value. Within this context, we present a literature review on papers that exist in the SCOPUS database about cryptocurrencies and KM. After analysing those papers, the general idea is that KM is very far away from the cryptocurrency phenomenon; the reason may be that it is very difficult to use the more common models available on KM to analyse cryptocurrencies; also the economic and social agents that might be interested in KM are not those who invest in cryptocurrencies; finally, the data available on cryptocurrencies are mostly speculative, and it is very difficult to make any scientific study on them. These conclusions may be of interest for the KM community at large, because they indicate a new subfield of research, and for practitioners, because they mean that there is not much science in the evolution of cryptocurrencies themselves. Finally, for policymakers, the findings mean the expanding the possibility of use of cryptocurrencies in societies may be extremely risky given their volatility and the lack of precise scientific knowledge about them. The paper is original because it relates to concepts that have only very seldom and scarcely put together.

Keywords: Cryptocurrencies, Knowledge management, Economic assets

1. Introduction

Some twenty years ago, strange news began to emerge in the economic sections of journals about a new kind of “currency”; the fact the mentioned “currency” is really a “currency” is nowadays a topic of debate (see section 2). The “currency" was based on a “code”. And there was not even a certainty on the person that had created the “code”. The Human Species being bound on curiosity, the mystery arose interest in the “currency” and suddenly its value raised from 1 dollar to 100, then 10000 and even more. Suddenly “cryptocurrencies” multiplied and became known as a “investment of the middle class” attracting many youngsters whose appetency for technology was very big. Matters came to a high point when Elon Musk the world richest man decided to join the party. The Deutsche Bank said that “Cryptocurrencies are the new gold”. And, during COVID-19 bitcoin attained the value of 54.000 euros / 60000 dollars in November of 2021. At the time the forecast was that bitcoin would reach 500 000 dollars by 2030. Then suddenly, all went wrong, and in economic terms “the bubble burst”: in one year bitcoin devaluated by 75%. Countries that had accepted bitcoin as official money (like El-Salvador and Central African Republic) went into big trouble. And on the internet many so-called “experts” kept promoting the benefits of this new and “free of governments” “currency” that would serve as a definitive promoter of economic development and social prosperity.

Given the background that was just exposed, in this paper we want to explore what can KM science tell us about cryptocurrencies. For that we will analyse the papers that have been published on the topic in the SCOPUS database. We also will discuss the findings based on other outside sources. Therefore, the paper will be composed by the following six sections: 2. Concepts; 3. Theory on Cryptocurrencies; 4. Basic data on Cryptocurrencies; 5. Method; 6. Results; 7. Discussion; 8. Conclusions.

2. Concepts

Cryptocurrencies are digital creations, that, when traded, acquire value, which in turn makes possible to use those assets to buy goods and services. Some of these assets, in some specific circumstances are directly accepted as a form of payment. Otherwise, an owner of a cryptocurrency may try to sell that asset and use the cash he receives to buy other goods and services. In summary *“A cryptocurrency is a digital record of ownership of nominal balances m that can be used to pay for transactions; . For any transaction, the buyer gives instructions to transfer ownership of a certain amount of his balances to the seller*.” (Chiu, Kooeplt, 2018)

Cryptocurrencies are created using blockchain technology. Cryptocurrencies are created by private agents with no public intervention.

The most famous cryptocurrency are Bitcoin, followed by Ethereum among many others.

3. Theory on Cryptocurrencies

The price of a cryptocurrency is defined by what economists call "market forces", and namely the following (Bloomenthal, 2022): "*the supply of the asset and the market's demand for it, the cost of producing a crypto currency through the mining process, the number of competing cryptocurrencies, regulations governing its sale and use and finally media and news."*

It is also very interesting to note that the immediate effect on cryptocurrencies is microeconomic, because the asset in owned by a single economic agent, but there are also some macroeconomic effects namely: potential financial instability, consumer protection issues, safety, energy intensity, that may be compared to the possible economic growth that might be generated by those assets (White. 2023).

Finally, in monetary economics "a coin" is a financial instrument that has the following characteristics: it may be used as a form of change, it may be used as a unit of count, it has immediate liquidity, it has no risk, other that the possible depreciation, and, finally, it does not generate any return. Put against that reference framework, bitcoins and other cryptocurrencies are not exactly "coins"; in fact, they are much more like "shares" that are traded in the stock market. This happens, mainly because these rather special "currencies" are valued as any other "asset" in the stock market, and in fact it is precisely because crypto may rise so much in value that they are seen as a "good investment" and an attractive one by so many people.

4. Basic data on Cryptocurrencies

In terms of price, Bitcoin started to be traded at virtually nothing in 2010, and in the beginning of 2011 it was worth one dollar; then the rise began, the asset going from 2000 dollars to 20000 in 2017, and then to 3000 at the end of 2018, and then rising to 64 400 in April 2021, then falling back to half of that one month later, rising again to 66000 in November 2021, and decreasing back to 15000 dollars last November. Currently (mid- August of 2023), the value of a bitcoin is in the 296000 dollars. What a rollercoaster.

5. Method

We search the SCOPUS database for papers with the following keywords:

Keyword 1	Keyword 2	Total	Business and Management	Management related	Excluded
Cryptocurrency	Knowledge Management	13	0	7	6
Bitcoin	Knowledge Management	19	0	8	11
Ethereum	Knowledge Management	8	2	3	5

We ended up only with 18 papers It is this set of papers that we will analyse in the following section.

6. Results

The impact of blockchain technology in organizational KM has been studied among others by Suciu and al, 2020, who created a model on the application of private Blockchains to knowledge evolution, ownership and transfer; socio-economic and cultural aspects of integrating blockchain in the knowledge transfer systems were also discussed.

In fact, the analysis of cryptocurrencies has been done in quite exploratory ways:

- On visualization: Yue, Shu, Zhu, Papadopoulos, and Liu, (2019,162), present BitExTract, "an interactive visual analytics system, aimed at exploring the evolutionary transaction patterns of Bitcoin exchanges from exchange versus exchange and the exchange versus client perspective. In particular, BitExTract observes the transactions between exchanges over time via a massive sequence view, depicting the trading network of exchanges and their temporal transaction distribution. BitExTract also examines and compares the evolution patterns of transactions between different exchanges."
- On forecasting: Dzenopoljac and,Bontis (2020) analyzed the hability of twitter to predict the evolution of the cryptocurrency market. They found that public information arrivals have a positive impact on

the volatility returns, but they cannot eliminate the variability of the volume. Snihovyi, Ivanov, and Kobets, (2015) managed to forecast more than 70% of the price variation of cryptocurrencies using Machine Learning algorithms. Soloviev, and Belinskij (2018) constructed indicators of critical and crisis phenomena in the volatile market of cryptocurrency, and tested those indicators successfully in the last five crisis to date; Lunesu and Marchesi (2016) analysed the relation of Bitcoin's trading and the web search and social volumes about Bitcoin and also if public sentiment, expressed in large-scale collections of daily Twitter posts, be used to predict the Bitcoin market, obtaining significant cross correlation outcomes. Matta, Lunesu, Marchesi (2015) studied the relationship between Bitcoin's trading volumes and the queries volumes of Google search engine, achieving significant cross correlation values, demonstrating search volumes power to anticipate trading volumes of Bitcoin currency.

- On decision making: Adsawinnawanawa and.Keeratipranon, N (2022,1) propose an algorithm for sharing similar knowledge on Monte Carlo algorithm (SSKMC) "to help to decide the action when the agent faces a new experience (unseen state), resulting a small growth in the forecast net worth growth"; Boonpeam Werapun, and Karode (2021,768) analyze the phenomena of "arbitrage" related to cryptocurrencies. They find that "high profit, derived from exploiting market inneficiencies, is correlated with the high risk, and therefore, risk-reducing in the cryptocurrency investment is a crucial topic made even more important because there is a high learning curve for beginners in this market." Afanasev, Dneprovskaya, ,Kliachin, and Demidko (2018,1) consider that "a huge amount of computer power is used improperly, and namely to run the cryptocurrency mining algorithms, 17 % of the entire global computer power is currently used; with the development of digital technologies, new opportunities arise for a dramatic improvement in data processing and knowledge mining; big corporations should learn how to use distributed computer power and to control themselves while using technology"; Kaur, Sahdev, Singh, Garg, (2021) analyse bitcoin as a concept and from the point of view of the consumer; they compare bitcoin with other assets on variance and correlation, and analysis its dependency on technology; the question of the "Digital Gold" is addressed and the discussion assumes particular relevance since that fall in value that occurred in 2021.
- On privacy and regulations: In the early days of the bitcoin phenomenon, (Ben Sasson and al, 2014 and Androulaki, and Karame, 2014) proposed Zerocash and ZeroCoin as trading devices guaranting privacy; more recently (Lee, Kim, and Oh (2023) proposed Azeroth on Ethereum; after that, Xu, Chen, Gao, Carbunar, ad Shi (2020,316) propose a privacy-preserving exchange scheme, PrivateEx, "in order to preserve the privacy of the exchange of different assets and guarantee the correctness, fairness, and privacy of exchange of assets in the system." Jourdan, Blandin, Wynter, and Deshpande (2019) show that it is very easy for identities to be leaked within the financial transactions of bitcoin and even a weak attacker with little knowledge about mining can do it. Finally, Kanday Batth (2021) analyse the use of hindi mnemonics as a way to generate private keys to wallets
- On regulation: To counter that variability that makes the market very vulnerable, Kim and Lee 2018 suggest policy risk management methods using international standards such as ISO.

7. Discussion

It clearly seems that cryptocurrencies are not an issue that have interested the KM community so far. No paper has been published in any academic journal with relation to the phenomenon. Only one paper (Afanasaev and al, 2018) was published in a Conference Proceedings of a major conference on KM. The main reason for this situation is, we believe, that KM is mainly focused on organizational issues, and in consequence cryptocurrencies fall absolutely outside the KM realm. This occurrence is in itself a pity, because, as all the literature we found points out, the correct management of cryptocurrencies is all about the use of knowledge and in fact, the only way to make a profit, be it individual, organizational or societal from the use of cryptocurrencies is to use knowledge well.

The topics addressed by the literature relating KM to cryptocurrencies – namely visualization, forecasting, decision making, privacy and regulations and regulation, are important if not decisive for the agents that invest in the new currencies but have nothing to do with the KM models. One paper (Adsawinnawanawa and.Keeratipranon, 2022) addressed the knowledge sharing phenomena, but only as feature of an algorithm.

Therefore, we believe that cryptocurrencies could open a new a very interesting field of theoretical possibilities for the KM science because the theory would have to be adopted so that it would be possible to address the phenomenon in scientific terms. This could be a very significant step to bridge the gap between KM science and

Economic science, and also to make KM more relevant not only in organizational terms but also in economic and societal terms. Sometimes it feel as if KM is just seen as "another tool" to address organizational problems, and not "THE TOOL" to analyse the use of knowledge in society, a bit like with happens with Human Resource Management and Development in relation with competences and HR. So in the end, the analysis of cryptocurrencies might be strategically useful for the KM community.

8. Conclusions

According to the SCOPUS database, the analysis of KM relating to cryptocurrencies have been done only in a handful of papers, The topics addressed (visualization, forecasting, decision making, privacy and regulations and regulation), are important if not decisive for the agents that invest in the new currencies but have nothing to do with the KM models. It would be therefore interesting and essential to try to define how the more common and known KM models – like the SECI model or others – might be used in relation to the cryptocurrencies. This would mean that we would know exactly what is the knowledge that is involved in the transaction of cryptocurrencies, a fact that in itself in not clear at all. In fact one idea that might explain the lack of scientific studies related to cryptocurrencies in the KM is the absence on theories that explain the evolution of the cryptocurrencies value. Up to now there is too many data, much information and almost no knowledge, let alone wisdom. Currently there are many models in the KM arena that might me used to address cryptocurrencies, and that might be useful. However the two communities seem to be going in separate ways, and ultimately it is the society that loses. The use of KM in cryptocurrencies would make the crypto market more transparent and efficient.

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Knowledge of the Business Ecosystem and the Implementation of a Circular Economy

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Abstract: Part of the European Green Deal is the Circular Economy Action Plan. Among other things, this plan formulates priorities for the design of products and production processes so that they are climate-neutral, correspond to a resource-efficient and circular economy (CE) and lead to a reduction of waste. These actions require companies not only to make changes to their organisational and management systems, but also to make investments. For this reason, these changes do not encourage companies to introduce the principles of the circular economy. Such encouragement can come from the business ecosystem. The aim of this article is to answer the question of whether companies gain such knowledge about the ecosystem in which they operate that encourages them to replace harmful technologies with friendly ones, to use their waste in their own production processes and those of other companies, and to neutralise their waste. This includes knowledge relating to the regulatory, economic, social, environmental and technological segments, as well as knowledge gained from buyers, suppliers and also competitors. The research hypothesis of the paper is that the greater this knowledge is, the more companies engage in the introduction of CE principles. In order to verify this hypothesis, an empirical study was conducted in 150 medium and large-sized companies belonging to 19 industrial sectors. Data were obtained using an interview questionnaire and were processed using a Kruskal-Wallis ANOVA and post hoc test. The results obtained allow us to conclude that knowledge of changes occurring in macro-environmental segments is more influential than knowledge obtained from buyers, suppliers and competitors. Companies that have knowledge of the changes taking place in the ecosystem perceive and exploit these changes and actions towards a circular economy as business opportunities. The research results obtained are useful for indicating the practical steps that leaders in the introduction of circular economy principles are taking in order to acquire the necessary knowledge about the ecosystem. They can also provide some contribution to the development of a sustainable product policy legislative initiative by the European Commission using the performance of these leaders.

Keywords: Knowledge obtaining, Circular economy, Business ecosystem, Designing sustainable products and processes

1. Introduction

Enterprises and organizations, interconnected by cooperation, collaboration, and also competition, together with the conditions created by the macro-environment in which they operate, form an ecosystem. It is not an institution, but a natural creation within which enterprises modify their activities and benefit from participation in it. Its boundaries are not defined and the number of participants that make up the ecosystem changes as companies develop their potential, products, technologies, and their own networks. In the ecosystem, knowledge is created, collected, and distributed. This is, however, a natural process and not one that is controlled by some central hub, even though the development of the ecosystem is usually influenced by companies that are leaders in their sector in some respect. Such a hallmark could be the implementation of solutions specific to the circular economy (CE). The decision to transform into a CE has a political character in the European Union and is triggered by the need for environmental transition.

The aim of this article is to answer the question of whether companies gain such knowledge from the ecosystem in which they operate that encourages them to replace harmful technologies with friendly ones, to use their waste in their own production processes and those of other companies, and to neutralize their waste. The knowledge that encourages or even impels the implementation of a CE can come from buyers who expect green products, from suppliers and subcontractors who offer materials and technologies that minimize waste and energy consumption, and from segments of the business macro-environment. The latter includes, in particular, the political-legal segment that regulates green activities and the circular economy, as well as the economic, socio-demographic, environmental, and technological segments. The acquisition of knowledge from these segments and also from segments of the industrial micro-environment is carried out by scanning them. These segments, especially the regulatory and technological ones, are the hypothetical drivers of the circular economy (CE). In this article, we pose and verify the hypothesis that the greater this knowledge is, the more companies engage in the implementation of CE principles.

To verify this hypothesis, we carried out empirical research on medium-sized and large companies operating in Poland. The research was aimed at determining whether there is a relationship between sourcing knowledge from the ecosystem and implementing a circular economy.

2. Literature Review

The ecosystem concept dates back to 1930. Initially applicable to sciences such as ecology or social science, it was introduced to management in the early 1990s by Moore (1996) and provided a bridge between systems thinking and evolutionary economics. An economic ecosystem is understood as "an economic community supported by a foundation of interacting organizations and individuals - organisms of the business world that produce goods and services of value to customers who are themselves members of the ecosystem" (Karhiniemi, 2009). Therefore, managers should consider companies as elements of the ecosystem (Eriksson & Vidén, 2018).

The essence of this concept is the self-organization of entities, differing in size and scope of activities, around the idea of creating and serving markets in a way that could not be achieved by a single organization alone (Valkokari, 2015). The ecosystem is made up of leading manufacturers, suppliers, distribution channels, companies selling complementary products, and customers, but also other stakeholders (e.g. shareholders, investors, government agencies, industry associations) delivering value to customers. Their capabilities and roles evolve over time, adapting to the development of the ecosystem, which is often governed by a vision created by leading companies (Karhiniemi, 2009). By combining the multiple skills, knowledge, and resources available in such ecosystems, innovative solutions can be more effectively co-created to meet basic human needs and face emerging challenges. A key aspect of the long-term success of an ecosystem is the diversity of the actors involved and the synergies arising from their collective ability to learn, adapt and innovate (Kelly, 2015).

Ecosystems are influenced by factors from the following segments of the macro-environment: political (like political stability, acute crises, monetary policy, fiscal policy, economic situation), regional (availability of materials and labour, physical distances, norms, and values), and regulatory (changes in regulations creating opportunities or threats) (Karhiniemi, 2009).

In the ecosystem, knowledge is exchanged and cooperation between its actors takes place, which makes it possible to address jointly important societal challenges. Knowledge as an intangible resource is of great importance in creating the organisation's value (Krawczyk, 2022). One such challenge is to prevent the pollution of the environment, to which also companies contribute. In this article, we focus mainly on activities related to the CE, as one of the approaches to tackle this problem, which aims to address it through fostering more responsible use of resources, reducing the consumption of materials, and generation of waste by industrial companies.

One source of environmental problems, such as emissions of carbon dioxide and other greenhouse gases, loss of biodiversity, and water scarcity (EEA, 2019), is the mismanagement of materials and products made from them. Due to socio-economic and technological changes, global material consumption is projected to increase by 1.5% per year until 2060, almost doubling from 2017 (from 33 kg in 2017 to 45 kg in 2060). Waste generation could increase by up to 70%. The environmental impact is projected to double, with the largest impacts expected for the use of iron, copper, concrete and aluminium (OECD, 2021).

Clothing, footwear and home textiles are also among the product categories that consume the most primary raw materials, water, land and emit greenhouse gases in the EU and globally. It is estimated that the clothing and footwear industry is responsible for 8% of global greenhouse gas emissions. Only a small share of end-of-life textiles are currently recycled, while the majority is landfilled, incinerated or potentially recycled, but for less valuable uses (the so-called downcycling) (OECD, 2021).

Improving the situation is possible by moving towards a closed-loop (i.e. circular) economy, a flagship initiative of the European Commission. The circular economy (CE) is a production and consumption model that involves sharing, borrowing, reusing, repairing, refurbishing, and recycling existing materials and products for as long as feasible and reasonable. This extends the life cycle of products and reduces waste generation. When a useful product's life cycle comes to an end, the raw materials and waste resulting from it should be maintained in the economy through recovery and recycling. They can be successfully reused, thus creating additional value (European Union, 2020).

Environmental impact is mainly determined at the product design stage (Visotskya et al., 2017). A number of closed-loop business models, through which companies can close their production cycles, slim down resource flows and decouple resource use from production, are available. Sustainable product design and Design for

Environment (DfE) are key concepts applied in the following models (OECD, 2021): Closed-loop supply models, Resource recovery models, Life extension models, Unused capacity or sharing models, Product as service models.

In line with the recent EU initiatives linked to the Green Deal and its relevant environmental legislation, products should be designed to meet the requirements of the CE and climate neutrality. Established sustainability principles regulate various aspects such as improving product durability, reusability, repairability, and energy efficiency while reducing the use of hazardous compounds and increasing recycled content (European Union, 2020). Implementing a circular economy involves applying the 3Rs principle, i.e. reduce, reuse, recycle.

Companies that try to meet this challenge may face, however, a number of obstacles (Lamenta & Grzybowska, 2023). One of them is related to implementing the "zero waste" strategy, and the question of its real achievability. For many materials, their multiple reprocessing can lead to a decrease in quality (Golkaram at al., 2022) and the need to use higher shares of virgin materials again. Another issue links to costs, which in some cases can be higher for recycled materials than for virgin ones. Thus, reaching a one hundred percent recyclability rate is sometimes seen as counterproductive from the business' point of view (Lewandowski, 2016). Another aspect encountered problematic by businesses is the lack of a social dimension in the core framework of the CE that is mainly focused on technological, economic, and environmental dimensions of sustainability (Khalamayzer, 2017; Lewandowski, 2016). Further barriers encompass organisational aspects such as restructuring costs and the related risks, or the unwillingness of stakeholders who benefit from the linear business model (Oghazi & Mostaghel, 2018). Last but not least, the lack of clear guidelines and standardisation is an issue which makes the transition from a linear business model to a circular one more challenging for companies (Atiku, 2020).

To remove or reduce the barriers to a circular economy (CE), knowledge management can be applied in the ecosystem to incorporate the sustainability dimension (Weina & Yanling, 2022) and the principles of circular early into the product design. This involves the creation, organisation, accumulation and sharing of knowledge among multiple parties and involves actors from both the macro-environment and the interior of the ecosystem. Knowledge content may be derived from both inside and outside the organization, thus underlining the holistic nature of KM (Siuko at all., 2022). For this purpose, we used the research model presented in Figure 1.

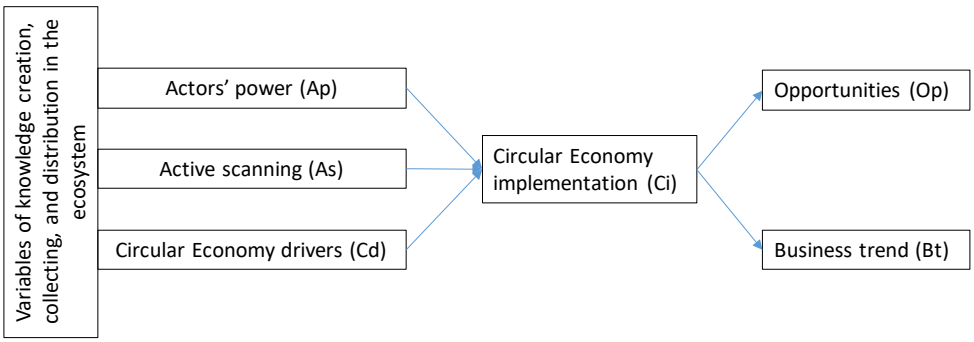


Figure 1: Research Model

3. Methodology

The empirical research was carried out in December 2022 in 150 enterprises located across Poland, 90 thereof medium-sized and 60 large ones. These companies were assigned to 19 industry sectors according to similarities in their businesses.

Data were collected by means of an interview questionnaire with closed questions, using the CAPI (Computer-Assisted Telephone Interviewing) method. All 150 surveys were positively returned. The respondents were: presidents/managing directors; technical directors and other employees with relevant competence and area of responsibility. Each of the surveyed companies answered 18 questions. The questionnaire questions were divided into seven groups of variables. The reliability of the variables was tested using the Cronbach alpha test.

The following group of dependent variables for the implementation of the circular economy (Ci) was adopted: Use of third-party waste materials (Ci1); Replacement of harmful with environmentally friendly technologies (Ci2); Use of our waste in other own processes (Ci3); Use of our waste in manufacturing processes of other companies (Ci4); Neutralisation of waste harmful to the environment (Ci5).

Whereas the remaining variables, referring to various aspects of knowledge acquisition, were divided into six groups:

Power of ecosystem actors (Ap) in terms of conditions to be met by products and technologies: Buyers' purchasing preferences (green products, energy-efficient products) (Ap1); Bargaining power of domestic buyers (Ap2); Bargaining power of foreign buyers (Ap3); Bargaining power of domestic suppliers (Ap4); Bargaining power of foreign suppliers (Ap5).

Active scanning regarding environmental issues (As): Scanning the regulatory segment of the environment (As1); Scanning the economic segment of the environment (As2); Scanning the social and demographical segment of the environment (As3); Scanning the natural environment segment (As4); Scanning the technological segment of the environment (As5); Scanning the customer segment of the environment (As6); Scanning the supplier segment of the environment (As7); Scanning the competitors' segment (As8); Research on customer needs (As9); Research on customer satisfaction (As10); The present market needs analysis (As11); New markets needs analysis (As12).

Circular economy drivers (Cd): Regulation on environmental protection (Cd1); Energy efficiency regulations (Cd2); Availability of funding for R&D (Cd3); Availability of licences and patents (Cd4); Offer of country R&D centres for products and technologies (Cd5); Offer of foreign countries R&D centres for products and technologies (Cd6); Patent protection (Cd7).

Opportunities (Op): opportunity recognition (Op1); Opportunity exploitation (Op2).

Business trend (Bt) – single variable.

The data collected in the interview questionnaire was processed using the following tests: Cronbach's alpha test - to check the reliability of measurement scales, Spearman's rank correlation test - in order to determine whether the variables related to the creation and use of knowledge are correlated with the implementation of the Circular Economy (CE) and whether the CE is an opportunity for enterprises implementing it; Kruskal-Wallis test - to determine whether the intensification of activities related to the creation and use of knowledge is statistically significant for the implementation of CE; Multiple comparison test - to determine what levels of intensity of these activities have different impact on the implementation of circular economy. The last three tests are non-parametric, as the variables were expressed on a rank scale.

4. Results and Discussion

4.1 Results of Descriptive Statistics

Based on the respondents' answers, it was found that:

Ci1: 21% of companies do not use or use other companies' waste materials to a very small extent, while 25% use them to a large or very large extent.

Ci2: 21% of companies do not replace environmentally harmful technologies with friendly technologies or replace them to a very small extent, while 36% of companies do so to a large or very large extent.

Ci3: 37% of companies do not use or use their own waste to a very small extent in their other processes, while 17% do so to a large extent. No company uses its waste to a very large extent.

Ci4: 41% of companies do not provide or provide a very small portion of their waste for use by other companies, while 21% provide a large or very large portion.

Ci5: 21% of companies do not neutralize or neutralize a very small share of their waste, while 43% neutralize a large or very large share of their waste.

For each variable, the number which is the complement of the sum of the given frequencies to 100% corresponds to the moderate involvement of the company.

4.2 Results of Correlation Analysis

Table 1 presents the correlation between variables, with Ci (Circular economy implementation) variables treated as dependent variables.

Table 1: Correlation of Circular Economy Implementation Variables With Knowledge Ecosystem Variables

Variable		Cronbach alpha	Circular economy implementation Cronbach alpha = 0,72				
			Ci1	Ci2	Ci3	Ci4	Ci5
Actors' power	Ap1	0,87	**0,738**	**0,238**	**0,285**	**0,209**	0,013
	Ap2		**0,417**	**0,345**	**0,287**	**0,233**	-0,061
	Ap3		**0,417**	**0,345**	**0,287**	**0,233**	-0,061
	Ap4		**0,417**	**0,345**	**0,287**	**0,233**	-0,061
	Ap5		**0,417**	**0,345**	**0,287**	**0,233**	-0,061
Active scanning	As1	0,94	**0,189**	**0,313**	**0,323**	**0,304**	0,098
	As2		0,138	**0,233**	**0,181**	**0,177**	0,055
	As3		0,136	**0,306**	**0,217**	**0,251**	0,068
	As4		0,066	**0,409**	**0,260**	**0,287**	0,016
	As5		0,090	**0,178**	0,078	0,072	0,075
	As6		-0,141	0,052	-0,068	-0,011	0,152
	As7		0,066	0,025	-0,052	-0,019	**0,178**
	As8		0,036	**0,222**	0,021	0,101	0,094
	As9		**0,178**	**0,313**	**0,188**	**0,219**	**0,229**
	As10		0,104	**0,205**	0,143	**0,199**	**0,276**
	As11		-0,040	0,135	-0,022	0,059	0,142
	As12		0,142	**0,296**	0,136	**0,187**	0,160
Circular Economy drivers	Cd1	0,97	1,000	**0,199**	**0,182**	0,153	-0,040
	Cd2		1,000	**0,199**	**0,182**	0,153	-0,040
	Cd3		**0,634**	0,079	0,087	0,037	0,145
	Cd4		**0,634**	0,079	0,087	0,037	0,145
	Cd5		**0,634**	0,079	0,087	0,037	0,145
	Cd6		**0,634**	0,079	0,087	0,037	0,145
	Cd7		**0,634**	0,079	0,087	0,037	0,145
Opportunities	Op1	0,85	**0,493**	**0,171**	0,114	0,063	0,070
	Op2		**0,499**	**0,166**	**0,174**	0,144	**0,161**
Business trend	Bt	-	**0,316**	0,138	-0,006	-0,043	**0,252**

4.3 Influence of Actor's Power (Ap)

Actor's power (Ap) was found to have the greatest influence on the implementation of activities represented by variables Ci1, Ci2, Ci3, and Ci4. The preferences of customers and the bargaining power of buyers and suppliers regarding product and technology conditions were identified as key factors. The Kruskal-Wallis test and multiple comparison test revealed qualitative differences in commitment to Ci1 and Ci3 activities when buyers strongly articulated their purchasing preferences (Ap1). Additionally, commitment to all Ci activities increased when the bargaining power of domestic and foreign buyers (Ap2 and Ap3) as well as domestic and foreign suppliers (Ap4 and Ap5) increased.

4.4 Impact of Active Scanning (As)

Active scanning of the macroenvironment (As1-As5) and industry environment (As6-As9) to gain knowledge about opportunities and threats, including those related to environmental activities, was found to have a significant impact on Ci implementation. Knowledge from the regulatory segment (As1) in the

macroenvironment was particularly important for Ci1-Ci4 activities. Knowledge from the economic, social, demographic, and natural environment segments also played a significant role in Ci2-Ci4 activities. The intensity of macroenvironment scanning was found to be important for companies' commitment to implementing the circular economy.

4.5 Influence of Industrial Environment (As)

Among the variables in the industrial environment (As6-As12), knowledge acquisition through surveys of customer needs (As9), customer satisfaction (As10), and new markets' needs (As12) had the greatest impact on the implementation of the circular economy. Knowledge acquisition about competitors (As8) was significant for Ci2 (Replacement of harmful with environmentally friendly technologies). The intensity of these activities was found to qualitatively affect their impact on the implementation of the circular economy.

4.6 Circular Economy Drivers (Cd)

Circular Economy Drivers (Cd1, Cd2, Cd3, Cd4, Cd5, Cd6, Cd7) showed moderate significance in the implementation of the circular economy. Regulation on environmental protection (Cd1) and energy efficiency regulations (Cd2) were found to be statistically significant for Ci2 and Ci3. The other factors included in Circular Economy Drivers were statistically significant only for the implementation of Ci1 (Use of third-party waste materials). The perception of changes in the environment and the technological segment of the macro-environment played a role in the implementation of technologies for the use of third-party waste materials.

4.7 Opportunities (Op)

The implementation of the circular economy was seen as an opportunity for companies. Variables Op1 (Opportunity recognition) and Op2 (Opportunity exploitation) were positively and relatively strongly correlated with Ci1 and Ci2. The majority of companies recognized the use of third-party waste materials (Ci1) as a good or very good opportunity. However, a significant proportion of companies did not perceive it as an opportunity or found it completely unattractive. Similar findings were observed for Ci2.

4.8 Utilization of Own Waste and Neutralization (Ci3, Ci5)

Use of own waste in other processes (Ci3) and neutralization of waste harmful to the environment (Ci5) were also considered as opportunities (Op2), but the correlation between these variables, although statistically significant, was relatively weak. The utilization of own waste materials (Ci3) to a high or very high degree was observed in a significant percentage of companies. However, the lack or a small degree of neutralization raised concerns, and further research is needed to determine the reasons behind it.

These findings provide insights into the factors influencing the implementation of the circular economy and highlight the importance of actor's power, active scanning, industrial environment, circular economy drivers, and opportunities for companies in adopting circular practices.

5. Conclusions

5.1 Achievement of Objectives and verification of the Hypothesis

The results obtained allow us to conclude that the knowledge created, collected and distributed in the ecosystem has an impact on the implementation of the circular economy by companies. It has the greatest impact on the replacement of environmentally harmful technologies with friendly technologies (Ci2). It equally influences firms' use of waste materials from other companies (Ci1), the use of their own waste materials (Ci3), and the use of a company's waste materials by other companies (Ci4). In contrast, it has a marginal effect on the neutralization of environmentally harmful waste (Ci5). It seems that this obligation is widely known hence knowledge regarding this issue does not affect the activity of companies in this regard. In general, it can be concluded that we obtained positive answers to the research questions set forth in this work.

Between the variables treated as independent (Ap - Actors power; As - Active scanning; Cd - Circular economy drivers) and the dependent variables (Ci - Circular economy implementation) there are 55 statistically significant and positive correlations out of 120 possible. This implies that our research hypothesis has been positively verified. The greatest influence on the implementation of CE has the knowledge obtained from the actors of the ecosystem (Ap), that is, buyers and suppliers. Through their bargaining position or good example, they force the involvement of enterprises in the implementation of CE. The second most important group of drivers is Active scanning (As) with a greater importance given to knowledge extracted from the business macro-environment than from the industrial environment. In the Circular economy drivers group (Cd), knowledge about changes

taking place in the natural environment has a greater influence on CE than knowledge about changes in technological segment of the macro-environment.

It is positive to see that managers perceive the implementation of the circular economy as an opportunity and are exploiting that opportunity. Presumably, this is not just a question of business benefits but also an issue of a company's reputation for being seen as environmentally friendly, modernizing its manufacturing capacity or organizational development. Our research shows that this attitude to the transformation to the circular economy has a positive impact on the business development trend. Despite the turbulence in the macro-environment caused by the Covid pandemic, the war in Ukraine, and very high inflation, as many as 58% of companies rate this trend as favorable or very favorable, of which 57% are medium-sized companies. Only 13% of companies rate the trend as strongly negative or unfavorable, of which 84% are also medium-sized companies.

5.2 Research Implication

In order to make significant progress in implementing the circular economy, managers ought to gain knowledge and draw motivation from a variety of sources. It seems that relatively the fastest progress can be made in replacing environmentally harmful technologies with friendly ones (Ci2). Our research shows that this effect is supported by the largest number of activities belonging to the Ap, As, Cd groups. There is relatively equal support for the use of third-party waste materials (Ci1), the use of our waste in our other processes (Ci3) as well as the use of own waste in manufacturing processes of other companies (Ci4). In all of these cases, critical is listening to the opinion of buyers and suppliers and also acquiring knowledge from the segments of the business macro environment (regulatory, economic, socio-demographic, environmental).

Although the correlations between Ap, As, Cd and Ci are positive, the results of the Kruskal-Wallis test and the multiple comparison test showed that there are differences in the impact on Ci of activities of different intensities measured on the Likert scale. For example, there is no difference between the impact of scanning the socio-demographic environment (As3) when its intensity on the Likert scale is 1 (no scanning) and when it is 2 (very small intensity) but there is a difference when it is 3 (moderate intensity), 4 (high intensity) or 5 (very high intensity). This implies that managers need to engage in different activities with the appropriate intensity to achieve a satisfactory level of implementation of the circular economy. This appears to be the direction of the incentives aimed at companies by European Comission (2020, p.7), which has established rewarding products based on their improved sustainability performance.

5.3 Research Limitation

The research results we present are part of a broader study that we conducted on the same population of enterprises, regarding the agility of these companies and the implementation of Industry 4.0. These issues introduced a certain analytical context for the respondents, which could be transferred to answering questions about the implementation of CE. Although we do not believe that such disruption of the semantic context has a significant impact on our results, we cannot rule it out. If it did, it could limit the representativeness of the obtained results.

Another limitation results from the methodology of obtaining answers to questions from the interview questionnaire. The answers were given on an ordinal Likert scale and although qualitative measures were assigned to the numerical ratings, this allows for arbitrariness in the respondent's answers. Some justification, however, is that this methodology is widely accepted and used in the social sciences. Nevertheless, in the future we intend to obtain at least some of the data expressed on a quotient scale.

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Knowledge in the Discovery of Market Opportunities

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Abstract: An opportunity is a relationship between a company's objectives, the resources at its disposal, and the situation in the environment, such that it favours the achievement of the objectives with the available resources. Opportunities arise in a changing environment. The dynamics of change causes the life cycle of an opportunity to shorten and companies that discover the opportunity and can exploit it gain a competitive advantage. Opportunity discovery means that opportunities exist but the company does not know about them. Opportunity discovery is the subject of several scientific disciplines. They are dealt with by strategic management using the methods of strategic analysis. They are also of interest to agility theory, which focuses on reacting quickly to market opportunities. In addition, entrepreneurship theory deals with them, which addresses the issue of cognitive traits in their discovery. New possibilities in discovering opportunities are created by artificial intelligence. The article aims to present the opportunity discovery model understood as the relationship between three vectors: the company's goals, its resources, and the external environment in which it operates. The discovery of the opportunity consists in finding such a value of the environment vector at which the desired value of the vector of goals is achieved at a given value of the resource vector. The article answers the question of how the knowledge necessary to find such a relationship between these vectors must be structured so that this relationship reflects the opportunity. It was hypothesized that this structure can be modelled using a network of cause-and-effect relationships leading to the determination of the relationship between demand and supply. This hypothesis was verified using artificial intelligence with the Monte Carlo algorithm, Markov chain, and the Metropolis-Hastings algorithm. The results obtained confirmed the validity of the model structuring the knowledge. The article presents the result of a pilot study. The results concerning knowledge structuring are useful for opportunity discovery both in the case of traditional approaches i.e. using the achievements of strategic management theory, corporate agility and entrepreneurship theory, and in the case of using artificial intelligence. In the first case, the target audience for these results is business executives while in the second case, the research community working on this problem and IT companies.

Keywords: Opportunity discovery, Strategic analysis, Cognitive traits, Artificial intelligence

1. Introduction

The turbulent and unpredictable environment of modern business generates not only threats but also opportunities. Their use gives enterprises a competitive advantage. To take advantage of an opportunity, it must first be created or discovered. Creating opportunities requires creativity and innovation. The development of these features requires knowledge, especially about the technological segment of the macro-environment. Knowledge about new technologies allows entrepreneurs to see their use in areas that have not been explored before. This leads to the creation of new industries and products that later imitators and buyers were unaware of. Google, SpaceX, and Netflix are examples of this.

Opportunities can also be discovered. This means that they exist but entrepreneurs do not know about them. Searching for existing opportunities, companies conduct strategic analyses of the macro-environment and industry environment, as well as conduct marketing research. In this way, they acquire knowledge that helps to identify underserved market segments, market gaps, and sources of low efficiency of their activities. This knowledge lays the groundwork for opportunity recognition. It is very useful, but even when the needs of the market are known, it does not mean that the opportunity exists. Identification of opportunities requires confronting these needs, or more broadly - the situation that exists in the macro-environment and in the industrial environment with the goals that the company wants to achieve and with the resources at its disposal. If the existing or anticipated situation in the environment is conducive to achieving the company's goals with the use of available resources, then the recognized situation creates an opportunity. However, determining whether the relationship between objectives, resources and the situation in the environment creates an opportunity is not a simple matter, especially in small and medium-sized enterprises (SMEs). These companies have limited knowledge about conducting such analyses and limited analytical potential. As a result, the information they have about the macro-environment segments (political, regulatory, economic, socio-demographic, natural, and technological environment) and about the segments of the industry environment (customers, suppliers, companies interested in entering the sector, competitors, substitute products) is modest. It is general and fragmentary. It is even more difficult to transform this information into knowledge. This requires a methodologically and intellectually advanced analytical potential, thanks to which events taking place in the environment are associated with situations conducive to achieving goals with the use of available resources, i.e.

opportunities. Therefore, the fact that some companies see opportunities and others do not, depends, among other things, on the cognitive characteristics of entrepreneurs, their experience, intuition, stubbornness and not being discouraged in the event of failure. As a result, SMEs discovery of opportunities is often associated with art rather than scientific management. This applies mainly to the theory of entrepreneurship.

A methodical approach to this problem consists in determining the system of factors influencing the emergence of a market opportunity, which may be expressed by a situation when demand is higher than supply. This means that there is a gap in meeting the needs and thus an opportunity for the producer. In this case, the systemic approach consists in determining the cause-and-effect linkage chains between these factors, affecting demand on the one hand and supply on the other. Such a model can be called the feedback network of opportunity drivers model. It structures the knowledge that is the basis for discovering opportunities in a traditional - analytical way. Such an analytical approach is characteristic of strategic management.

It seems that the use of artificial intelligence (AI) methods creates new opportunities for discovering opportunities in conditions of limited knowledge and poor data. In particular, it is about Monte Carlo methods, MCMC algorithms, and the Metropolis-Hastings algorithm that play essential roles in AI by enabling probabilistic modelling, uncertainty quantification, and inference in complex systems. These techniques help AI systems handle uncertainty, approximate solutions and make informed decisions based on available information. We hypothetically assumed that the feedback network of opportunity drivers model, in which the relationships between the factors shaping the opportunity are not explicitly defined, may be the basis for discovering the opportunity using the above-mentioned techniques. To verify this hypothesis, we conducted a simulation experiment, the results of which confirmed our belief that the developed model is promising and that research on the use of AI should be continued.

2. Literature Review

Discovering opportunities is the domain of various scientific disciplines. In strategic management, opportunities and chances are sought in the environment of the organization and then, by confronting them with the strengths and weaknesses of this organization, a strategy is developed to use the opportunities and avoid threats. This process is supported by methods that are dedicated to the analysis of the macro-environment, industrial environment, and the inside of the organization (Trzcielinski et al, 2023).

In agile enterprise theory, an opportunity is viewed as an advantageous situation that requires a quick response. In today's fast-paced and rapidly changing business environment, organizations that are able to quickly identify and respond to new opportunities are more likely to succeed and remain competitive. An agile enterprise is well-suited to identifying and exploiting new opportunities because it is designed to be bright, flexible, intelligent and shrewd, and responsive to change (Trzcielinski, 2007; Trzcielinski, 2021).

In the theory of entrepreneurship, opportunity is a central element of entrepreneurial activity. This theory suggests that successful entrepreneurs are those who are able to identify and exploit opportunities that others have overlooked or failed to capitalize on. A lot of cognitive traits have been identified as important for effective opportunity recognition. Among them are:

- Creative thinking that helps entrepreneurs think outside the box and thus identify unique opportunities (Baron, 2006),
- Cognitive flexibility that refers to the ability to adapt thinking and approach problems from different perspectives. It enables entrepreneurs to recognize opportunities in diverse contexts (Sarasvathy et al, 2003),
- Perceptual acuity that involves the ability to notice and interpret subtle cues and signals in the external environment. It helps entrepreneurs identify emerging trends and opportunities (Shane and Venkataraman, 2000),
- Efficient information processing skills, such as pattern recognition and information synthesis, are crucial for recognizing and evaluating opportunities (Ardichvili et al, 2003),
- Prior knowledge and expertise in the relevant domain that equips entrepreneurs with tools to recognize opportunities within their field and leverage their existing knowledge (Shane, 2003).

Based on her research, Trzcielinska (2021) found that among the 17 entrepreneurial traits, the following have the greatest impact on discovering opportunities: courage in decision-making, dedication and hard work, risk propensity, and assertiveness.

In the traditional approach to discovering opportunities using these theories, knowledge is a key factor. Through domain expertise, market intelligence, technological awareness, networking, continuous learning, and adaptive thinking, entrepreneurs can effectively identify and capitalize on opportunities. However, it is always to some extent an art dependent on human intelligence, creativity, intuition, and the ability to process information.

New possibilities are created by the development of artificial intelligence (AI), which increasingly supports business activities and this process is at the stage of intensive growth. This also applies to discovering opportunities.

AI technologies, such as machine learning, natural language processing, and computer vision, can analyse large volumes of data to identify patterns and trends that may indicate opportunities for innovation and growth (Priporas et al, 2020).

One area where AI is being used to discover business opportunities is market research. By analysing social media data, customer feedback, and other sources of information, AI can help businesses identify new market trends, customer preferences, and areas where there is unmet demand. Among others, AI algorithms can support understanding sentiment, opinions, and trends. This information helps businesses gain insights into customer preferences, brand perception, and public sentiment. Also they automate the analysis of survey data, extracting key insights and identifying patterns in responses (Hossain et al, 2018).

Another area where AI is being used is in product development. By analysing customer feedback and user behaviour data, AI can help businesses identify opportunities to improve existing products or create new products that better meet the needs of customers. AI algorithms and machine learning techniques are used to optimize product designs, automate design iterations, and simulate product performance. This helps identify optimal design configurations and reduces time-to-market. The algorithms analyse market data, customer insights, and historical trends to predict demand for new products. AI-powered natural language processing techniques analyse customer feedback, reviews, and social media data to understand customer needs, preferences, and sentiment. These insights help inform product development decisions (Thies et al, 2018). AI is used also to automate quality control processes, such as visual inspection and defect detection. Computer vision and machine learning algorithms identify defects, improve accuracy, and enhance product quality (Deng et al, 2020).

AI is also being used in supply chain management to identify opportunities for cost savings and efficiency improvements. By analysing data on inventory levels, transportation routes, and supplier performance, AI can help businesses identify areas where they can reduce costs and improve operations. They are used to demand forecasting and inventory optimization. This enables better inventory management, reduces stockouts, and minimizes excess inventory. Another functionality is predictive maintenance and equipment optimization. This helps minimize downtime, optimize maintenance schedules, and improve equipment efficiency (Deng et al, 2019). AI-based analytics and decision support systems assist in supplier selection, procurement negotiations, and contract management. This streamlines the procurement process, improves supplier performance, and reduces costs (Wu & Tang, 2019). They optimize transportation routes, considering various factors such as distance, traffic, and delivery constraints. This reduces transportation costs, improves delivery efficiency, and enhances customer satisfaction (Vahdani & Tavakkoli-Moghaddam, 2019).

Authors dealing with the problem of discovering opportunities with the use of AI more often point to the potential implementation of this technology than to the actual cases of its use. The probable reason for this is that the significant increase in the efficiency of business ventures supported by AI means that many solutions are not made publicly available. However, it is known that, for example, consulting firms such as Deloitte and McKinsey have already developed some intelligent tools that offer monitoring and sensing of an organization's external environment, enabling semi-automated strategy articulation (Jarrahi, 2018).

The potential or actual applications of AI for opportunity discovery mentioned in the literature require Big Data processing, which significantly limits the use of these technologies by small and medium-sized enterprises (SMEs). On the one hand, these companies usually do not have large data sets, on the other hand, they do not have staff with methodological preparation and the potential to conduct analyses of the macro-environment and the industrial environment in a traditional way, i.e. by human teams supported by creative thinking techniques.

The problem we have undertaken fits into the gap between the traditional approach to discovering opportunities and the use of AI based on Big Data processing. We described the knowledge needed to recognize opportunities using the model of feedback network of opportunity drivers and business model matrix, while the AI algorithms

we use neither require a large sample of input data nor an explicit mathematical formula describing the relationships between the data.

3. Model of the Research Problem

We define an opportunity as a relationship between the goals that the company wants to achieve, the resources it has at its disposal, and the situation in the environment such that it is conducive to achieving these goals with the help of the available resources (Trzcieliński and Trzcielińska, 2011). Consequently, recognizing an opportunity is either creating such a situation or discovering it. Opportunity creation is a creative and innovative activity, while discovery is an analytical activity.

Figure 1 presents a model of the opportunity discovery problem. The symbol S (Figure 1a) denotes the current situation of the enterprise being the result of the vector of the goal achieved Gc, available resources Rc and the vector of the recognized situation in the external environment Ec. The sizes of these vectors are denoted by /Gc/, /Rc/, and /Ec/, respectively. The vector Gc can move in the space of satisfying goals SG, the resource vector - in the space of available resources SR and the vector Ec in the space of states of the environment SE. Vector Gc may be outside the space SG or its value (Gc) may not be satisfactory. In this case, expected goals are set, described by the Ge vector (Figure 1b). The opportunity discovery problem consists in finding such a situation in the SE environment that the resultant "O" of the vector Ge, the environment vector Ee and the resource vector Re will be an opportunity for the enterprise. In other words, it is about identifying such states /Ee/ in the SE space that will be conducive to achieving the defined goals /Ge/ using the available resources from the SR space. This may require the transformation of the Rc vector into the Re vector, i.e. the use of resources with a new configuration.

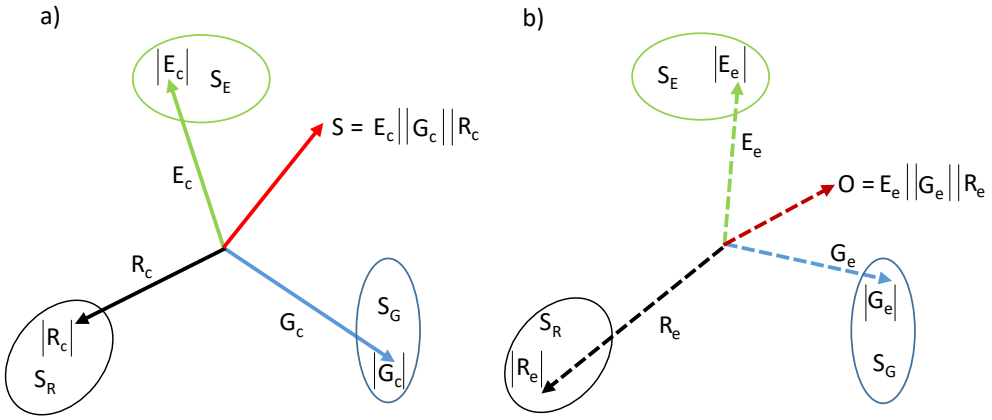


Figure 1: Model of the Opportunity Discovery Problem

4. The Experiment

4.1 Methodology

To answer the research question, an experiment was conducted in which the problem described above was adapted to the refrigeration industry. The opportunity model is presented in Figure 2. It takes into account the situation that existed in the market of producers and buyers in the refrigeration industry in 2020. It shows in a systemic way the cause and effect relationships leading to the creation of an opportunity for the producer (demand is greater than supply). These dependencies structure the areas of knowledge that must be acquired in the process of discovering opportunities. This type of structuring is a good basis for verifying whether the discovery of opportunities can be assisted by artificial intelligence (AI).

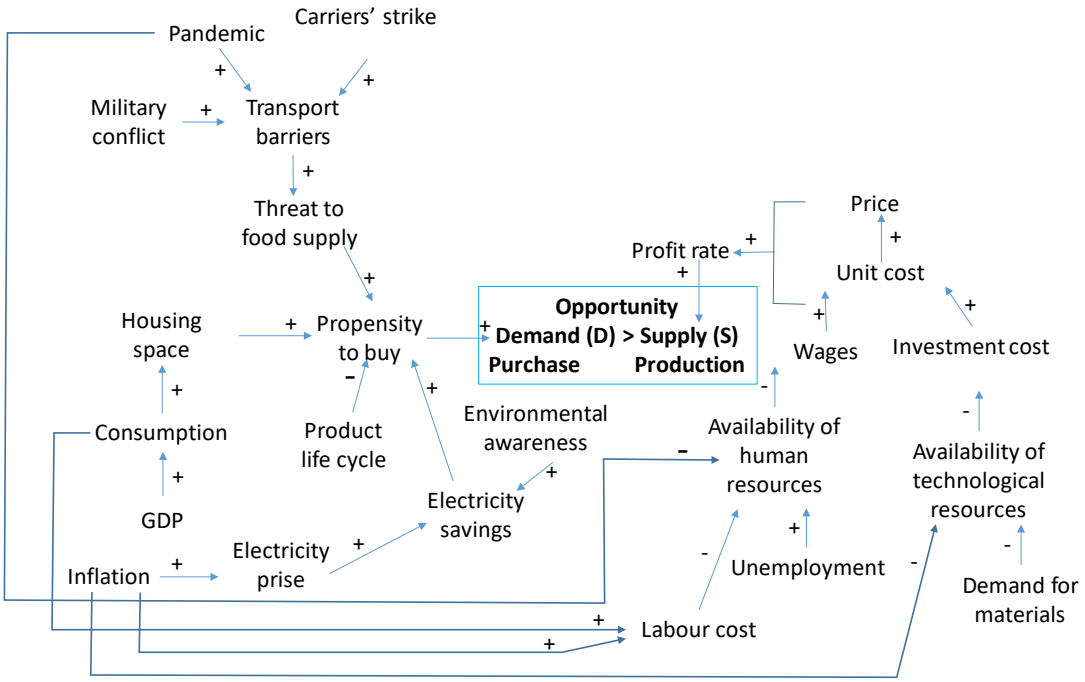


Figure 2: Feedback Network of Opportunity Drivers in the Refrigeration Industry

Due to the high complexity of this model, the experiment testing the use of AI was limited to only four factors directly influencing the propensity to buy, i.e. demand. These are the following factors (Figure 3):

- threat to the food supply - increases the willingness to buy refrigerators in order to stock up on food for fear of interrupting supply chains,
- housing space - increases the willingness to buy a refrigerator with larger dimensions or a second refrigerator by buyers who increase their living space,
- product life cycle - increases the willingness to buy due to the need to replace the refrigerator,
- electricity savings – increases the willingness to buy a newer generation refrigerator that consumes less electricity.

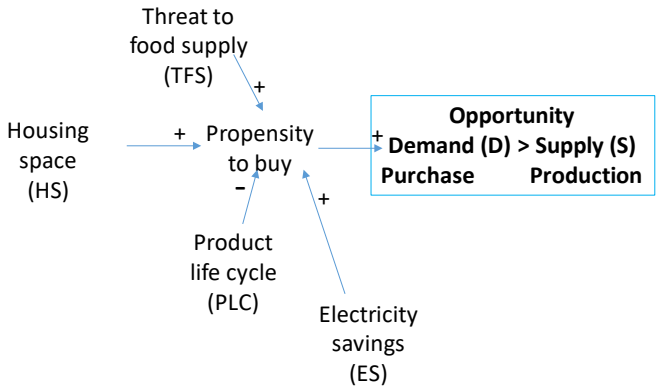


Figure 3: Factors Directly Affecting the Propensity for Buying a Refrigerator

According to these factors, buyers for whom a particular factor is a leading motive for purchase were named: scaremonger (TFS), developer (HS), innovator (PLC), and ecologist (ES). Assuming the existence of these four buyer groups, a business model matrix was developed (Table 1). These four types of buyers form fractions of the "MF" market. The size of these fractions is not known, but each can take values in the range <0, 1>. The probability "p" that a given fraction occurs is also unknown, but the sum of these probabilities is 1.00. This means that the market is formed by at least one fraction of buyers. On the other hand, if a given fraction does occur, then the probability "w" of a given type of buyer purchasing in each market is known. It is worth noting that obtaining knowledge of this probability is relatively easy using marketing research.

Table 1: Business Model Matrix

Type of purchaser MF	Market's fraction MF(TFS,HS,PLC,ES) Sum = 1,00	Probability of market fraction occurrence P(TFS,HS,PLC,ES)				
		p_{TFS} ϵ <0, 1>	p_{HS} ϵ <0, 1>	p_{PLC} ϵ <0, 1>	p_{ES} ϵ <0, 1>	Sum = 1,00
		Probability of a purchase decision W(TFS,HS,PLC,ES)				
		w_{TFS}	w_{HS}	w_{PLC}	w_{ES}	Sum
Scaremonger: TFS	MF_{TFS} ϵ <0, 1>	0,60	0,10	0,10	0,20	1,00
Developer: HS	MF_{HS} ϵ <0, 1>	0,20	0,70	0,00	0,10	1,00
Innovator: PLC	MF_{PLC} ϵ <0, 1>	0,20	0,10	0,60	0,10	1,00
Ecologist: ES	MF_{ES} ϵ <0, 1>	0,30	0,20	0,00	0,50	1,00

The data categories contained in the business model matrix were used in an experiment testing the use of AI to discover opportunities. With the introduced simplifications of the problem, identification of the opportunity consists in finding the structure of the product portfolio, due to the particular types of buyers. With very poor data, as shown in Table 1, it is not possible to solve this problem using optimization methods. Therefore, a simulation approach was used.

The simulation was carried out using the Markov chain Monte Carlo method (MCMC) and the Metropolis-Hastings algorithm in 1000 steps. Markov chain algorithms generate a sequence of random variables where each variable depends only on the previous variable in the sequence. The Metropolis-Hastings algorithm generates a Markov chain that converges to the target distribution by accepting or rejecting proposed samples based on specific acceptance criteria. The Metropolis component of this algorithm evaluates the gain or loss in a single step, while the Hastings component evaluates the gain or loss in the entire process of system state changes. The adopted simulation methodology does not require large samples of input data because the method generates its own set of data (non-relational databases of the NOSQL type) that can be analysed using AI methods.

Using the mentioned algorithms, the static point in which the chain reaches a stationary or equilibrium distribution, which represents the desired probability distribution, was determined. The static point refers to the most probable state of the system, i.e. the most probable combination of buyer transitions between market factions (MF). Since the graphical representation of the system state in 4D is not possible, the PLC - Innovator fraction has been omitted.

In order to determine the structure of buyers, and thus the structure of the product portfolio, the state of the system was projected onto the vectors MFTFS, MFHS, MFPLC, and MFES. This required solving in each step of the simulation the matrix equation W(TFS,HS,PLC,ES)*MF(TFS,HS,PLC,ES)=B, where B=P(TFS,HS,PLC,ES), i.e.

MFTFS*0.6 + MFHS*0.2 + MFPLC*0.2 + MFES*0.3 = PTFS

MFTFS*0.1 + MFHS*0.7 + MFPLC*0.1 + MFES*0.2 = PHS

MFTFS*0.1 + MFHS*0.0 + MFPLC*0.6 + MFES*0.0 = PPLC

MFTHS*0.2 + MFHS*0.1 + MFPLC*0.1 + MFES*0.5 = PES

4.2 Results and Discussion

A given type of MF buyers may make purchases with the probability "w" also in other market fractions. Each combination of probabilities of buyers' transitions between market fractions determines the state of the system. A sampling of the system states was carried out randomly using the Monte Carlo method, and the transition of the system from state to state was carried out with the determined probability according to the Markov sequence method. The state of the system was thus a random variable. The most probable state of the system is called the "stationary point". The stationary point was reached using the Metropolis-Hastings algorithm. The simulation gave a stationary point P(TFS, HS, PLC, ES) → 0.3333, 0.25, 0, 0.4166. These are the probabilities of the occurrence of market fractions corresponding to particular types of buyers.

The size of the market fraction was obtained by solving the matrix equation W(TFS,HS,PLC,ES)*MF(TFS,HS,PLC,ES)=P(TFS,HS,PLC,ES) with the "Innovator" (PLC) fraction omitted. It gave the result MF(TFS,HS,ES) → 0.14444444, 0.12407407, 0.73555556, which means that the forecast distribution of the

customer fraction is as follows: 14% of customers are "Scaremongers" (TFS), 12% are "Developers" (HS), 0% is "Innovators" and 74% is "Ecologists" (ES) (Figure 4).

Assuming that Scaremonger is interested in large refrigerators, Developer in modular refrigerators that can be expanded, and Ecologist in equipment with the highest energy class, the structure of the product portfolio is as follows: 14% is large-size refrigeration equipment, 12% is modular equipment and 74% of A+++ and A++ energy class refrigerators.

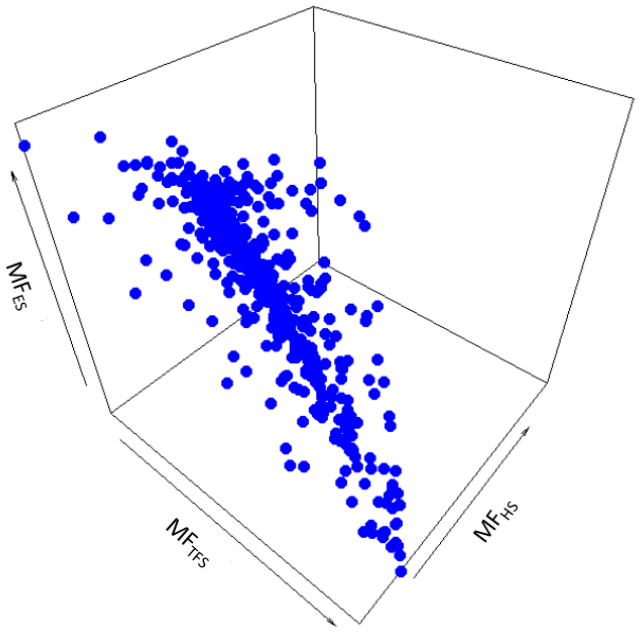


Figure 4: System State Diagram

5. Conclusions

5.1 Applicability

Pilot studies have shown that by using AI, it is possible to discover market opportunities with very little knowledge about the factors shaping the demand for products. However, it is necessary to have a model of knowledge about the mechanisms shaping demand and supply. In our case, this mechanism was described using the feedback network of opportunity drivers. The only "hard" data concerned the probability of buyers switching between market fractions of a given industry. These are easily obtained through an interview questionnaire used in marketing research. Such a situation of very limited knowledge about the mechanisms of the influence of the external environment on the emergence of opportunities occurs mainly in small and medium-sized enterprises. Therefore, the addressee of the results, which are announced by our pilot studies, is the management staff of SMEs. The knowledge structuring model we have verified is useful for discovering opportunities both in the traditional approach and with the use of AI. In the first case, it can rationalize the intuition of entrepreneurs, while in the second, it leads to results that seem impossible to obtain only with the use of human intelligence. Unlike the use of AI involving the processing of huge data sets, the approach we use consists in obtaining data from the business model in mathematical terms, using Monte Carlo simulation procedures. The advantage of this approach is that:

- a large sample of input data is not necessary,
- no specific structure of observable data is necessary - we operate directly with the effective variables of the model (in the sense of Bayesian variables),
- the method generates its own set of data that can be analysed using artificial intelligence methods.

Problems with such characteristics are classified as "Data Imputation" because MCMC techniques generate missing or incomplete data sets that incorporate uncertainty and capture the underlying patterns of the available data. This approach is used in industries such as healthcare (Choi et al, 2017; Ranganath et al, 2016), finance (Breymann et al, 2003; Jia et al, 2018), and social sciences (Nowak et al, 2018). In all these areas, the

successful application of MCMC and Metropolis-Hastings methods relies on appropriate modelling choices, understanding the problem domain, and ensuring the generated data accurately represents the desired characteristics for analysis using artificial intelligence methods. We believe that our research is another example that operationalizes these requirements and can be an inspiration for other researchers and IT companies tackling data imputation problems.

5.2 Limitations

While we believe that limited data is not an obstacle for AI to discover opportunities, based on the conducted experiment, we cannot assess whether the product portfolio structure obtained is indeed an opportunity. This is due to:

- including in the feedback network of opportunity drivers model only the factors directly influencing customers' propensity to buy the product,
- the restriction to the demand side of the model only,
- the exemplary definition of market fractions,
- the exemplary nature of the probabilities of buyers moving between market factions.

5.3 Prospective Research

In order to eliminate or at least reduce the listed limitations, it is necessary to use actual data either from the entire refrigeration industry or from an individual manufacturer of these products. This applies to both demand and supply factors. Data on the probability of buyers switching between market fractions is also needed. As a result, we expect to estimate the value of the opportunity.

The results obtained so far are promising and can be the basis for an in-depth analysis using AI tools. We will develop our research in terms of cluster analysis and anomaly discovery. The most interesting seems to be the analysis of clusters in multidimensional space, consisting of the search for separate areas with increased entropy. These are usually areas related to repetitive (in different periods) trends or a longer but one-off, temporary trend, which is undoubtedly interesting from a business point of view. Such clusters are already observed in the preliminary results of the experiment.

Taking into account the complexity of the model, the existence of non-standard solutions should be expected. Anomaly detection can be a useful tool to determine deviations in cyclically repeated experiments. This allows to determine the conditions for obtaining particularly good results from the point of view of the objective function.

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Conflicts of Interest: The authors declare no conflict of interest.

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Impact of Business Intelligence Systems on Profitability: An Empirical Study

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Abstract: There is a research gap regarding the impact of Business Intelligence (BI) implementation on banks' profitability ratios. In particular, this relates to the financial profitability ratios of banks operating under the conditions of the Polish economy after 2015. The main research problem addressed in this study is whether the implementation of Business Intelligence systems has a positive impact on the profitability indicators of commercial banks. The main hypothesis formulated is that the use of a Business Intelligence management system between 2009 and 2020 improves the profitability of Polish commercial banks. The First Differences Generalized Method of Moments (FDGMM) panel dynamic model estimation method was used to evaluate this impact. The parameters of the models based on financial indicators were calculated for each of the selected indicators, and the analysis used those models for which the lagged BI variable, related to the timing of system implementation, proved statistically significant. Based on the obtained parameters of the models, long-term multipliers were calculated. The study determined the probability of the impact of using the business intelligence system on the selected indicators. The study was conducted on a group of the five largest out of the thirteen commercial banks listed on the Warsaw Stock Exchange in 2020. The assets of the surveyed banks comprise 50% of the assets of commercial banks in Poland. The study identified the impact of BI system use on selected profitability indicators of commercial banks. The generalized results of the study enable us to identify causal relationships between the use of the BI system in commercial banks and profitability, as measured by ROE and ROA. The research implications of this study may suggest to top management that implementing business intelligence systems can benefit the organization.

Keywords: Business intelligence,Impact of business intelligence, Financial condition, Bank

1. Introduction

Business Intelligence (BI) systems have become an integral part of conducting business in the 21st century. This is primarily due to the increasing need for organizations to analyze, interpret, and process data. A BI system proves to be helpful in fulfilling these tasks. Business Intelligence refers to the concept of utilizing an information system to gather and process information, enabling accurate business decision-making. Its purpose is to support and streamline decision-making processes, ultimately enhancing organizational efficiency (Hussinki, 2022). However, it is important to note that the implementation of a BI system alone does not guarantee satisfactory results. The key to success lies in a series of decisions aimed at improving the organization based on the insights obtained from the BI system (Tunowski, 2019).

In Poland, studies of the impact of business intelligence system on the profitability of commercial banks have not been widely reported so far. In the literature, it is hard to find cross-sectional studies of the impact of BI use on the profitability of commercial banks in Poland. The published works refer to individual cases of BI implementation in individual banks, without using statistical methods that allow generalization of research results. In terms of cross-sectional studies, the exception is the publication (Tunowski, 2019) which is based on data up to 2015, where no impact of the BI system on 2 of the 3 profitability indicators (ROE, operating profit margin) was found. A partial, positive impact was confirmed for the ROA indicator. Thus, the author notes that there is a research gap regarding the impact of BI implementation on banks' profitability ratios. In particular, it relates to the financial profitability ratios of banks operating in the conditions of the Polish economy with respect to the period after 2015. Filling the outlined research gap is a challenge for this study, the statistical method would be used to aim that goal.

The main research problem of this study is to investigate the impact of implementing Business Intelligence systems on the profitability of commercial banks in Poland. The study aims to test the following main hypothesis:

> *H0: The use of a Business Intelligence management system between 2009 and 2020 improves the profitability of Polish commercial banks.*

The paper specifically chooses the Return on Equity (ROE) and Return on Assets (ROA) indicators, which are widely recognized and extensively discussed in the literature (Almaqtari et al., 2019; Al-Homaidi et al., 2020). These indicators provide valuable insights into the financial performance of banks. Furthermore, the selection of commercial banks as the focus of the study is justified by their significant role in the economy. Banks serve as a crucial component of the economic system, acting as a vital "lifeline" that supports the proper functioning

of various elements within the modern economy (Jaworski, J., Czerwonka, L., 2022). The performance of banks has a direct impact on the pace and quality of development for other enterprises, as well as accessibility to banking services and products. Any dysfunctionality within the banking sector can lead to severe crisis consequences, as evidenced by the financial market turbulence and economic difficulties experienced during the 2008-2009 crisis following the collapse of Lehman Brothers in September 2008 (Coleman, Feler, 2015). Therefore, it is crucial to explore solutions that can support bank management, including the adoption of modern Business Intelligence systems.

The second and third parts describe the selection of research objects (commercial banks) and provide a detailed discussion on the research method, specifically using the FDGMM dynamic panel model. Special attention was given to the model's form, incorporating the BI dichotomous variable to indicate the implementation of the BI system. Additionally, the verification method for the estimated models was thoroughly discussed.

In the Findings section, the results of the empirical study using the previously discussed method are presented. The results are also compared with the average levels of ROE and ROA as well as their average percentage increase, so that the obtained results can be correctly interpreted. The summary and discussion section confirms the hypothesis of a positive impact of the BI system on profitability indicators in polish commercial banks. However, a number of limitations of the study were also pointed out, which the author is aware of. Further directions of the study were also indicated, which, from the author's point of view, will be an interesting development of the obtained results. In the last part, possible practical use of the results of the study is indicated.

2. Method of Selection of Research Objects

The study included a selection of commercial banks (N objects) based on the following criteria. The banks had to operate as commercial banks and be listed on the Warsaw Stock Exchange at the end of 2022. These banks provided financial statements on a quarterly basis, which was necessary to obtain the required number of observations. Additionally, the selection was narrowed down to banks that publicly disclosed information about the implementation date of their business intelligence (BI) system for business analytics. Banks without this information were excluded from the study, as it was assumed that despite the lack of public disclosure, they likely had a business intelligence system.

Based on the above criteria, five banks were chosen. Two of these banks had a BI system in place before 2009, while the remaining three implemented it between 2009 and 2020. The selected banks represented approximately 50% of the assets in the commercial bank sector in Poland. The study utilized quarterly data from 2009 to 2020, spanning a total of 44 periods (quarters).

3. Methodology

Panel models are econometric models that are estimated using panel data. In the context of modern econometrics, "panel data" refers to data formed by combining time series observations (T periods) with cross-sectional observations for multiple objects (N objects) (Osińska, Kośko, Stempińska, 2007). Dynamic panel models assume that the formation of the dependent variable (Y) is influenced by lagged values of the dependent variable itself, the explanatory variables (X), and additional unobservable factors that are constant over time but specific to each group. These group-specific factors are known as group effects. Due to the time constancy of these group effects, different estimation methods are required for dynamic panel models compared to static models. In the literature, three main methodologies have been proposed: the Instrumental Variables Method (Anderson, Hsiao, 1981; Anderson, Hsiao, 1982), the Maximum Likelihood Method (Hsiao, 2003), and the Generalized Method of Moments (GMM).

The Generalized Method of Moments (GMM), specifically the First Differences Generalized Method of Moments (FDGMM) introduced by Arellano and Bond (1991), is one of the most widely used methods for estimating panel dynamic models. In this study, the FDGMM method is employed to estimate the panel dynamic models.

The idea of the FDGMM method can be described in the following steps (Dańska-Borsiak, 2009):

- 1. first differences model is calculated to remove time fixed group effects,
- 2. in the next step, the explanatory variables in the first differences model are replaced by instruments, which are the levels of variables lagged by two or more periods,

- 3. then the estimators of structural parameters are obtained by applying GMM to the first differences model.

The general form of the dynamic panel model is as follows (Dańska-Borsiak, 2009):

$$y_{it} = \gamma y_{i,t-1} + X_{it}^{T}\beta + \propto_i + \varepsilon_{it} \quad i = 1, \ldots, N, t = 1, \ldots, T. \tag{1}$$

where X_{it}^{T} is a vector of explanatory variables (in the article it will be the dichotomous variable BI), β is a vector of parameters, the same for all I and t. $\propto_i$ o signifies a group effect, random or non-random, while the random component has a normal distribution $\varepsilon_{it} \sim N(0, \sigma_a^2)$ for all i, t.

When studying the relationship between the financial profitability of banks and BI, it was assumed that the cross-sectional data would be the profitability ratios calculated for individual banks included in the panel. Temporal data are observed at a quarterly frequency. Taking into account the criterion of the number of observations (dozens) and the number of objects (several), the panel data belong to the category of macro-panels. The paper will use a model in which X_{it}^{T} is a dichotomous variable (in level and latency). This variable is labeled BI and will take the following values:

1 - in quarters in which the bank had a business intelligence system,

0 - in quarters in which the BI system was not used.

Methods using lagged dichotomous explanatory variables in combination with dynamic panel models have already been described in the literature by Lachenmaier and Rottmann (2011) and by Ryamond, Mohnen, Mairesse, and Palma (2015). The dynamic panel model for the period takes the form:

$$y_{it} = \gamma y_{i,t-1} + BI_{i,t}\beta + BI_{i,t-1}\beta + \ldots + BI_{i,t-12}\beta + \propto_i + \varepsilon_{it} \tag{2}$$

where i = 1, …, N, t = 1, …, T = 12, N – the number of facilities (banks), T - the number of quarters, and the explanatory variable Y represents one of the two selected profitability indicators.

As a result, an attempt was made to estimate two econometric models - a separate one for each of the two indicators under analysis (ROE and ROA) in 2009 - 2020. The parameters of the models estimated in cases for which the lagged BI variable turned out to be statistically significant. When the BI variable with the largest lag turned out to be statistically insignificant, then this variable was omitted and a new model with a lagged BI variable smaller by a unit was estimated. Based on the obtained parameters of the models, long-run multipliers were calculated according to the following formula (Ossowski 2007):

$$\text{Long} - \text{term multiplier} = \frac{\beta_0 + \beta_1 + \cdots + \beta_i}{1 - \gamma_0} \qquad i = 1, \ldots, N \tag{3}$$

The interpretation of the above long-run multiplier is as follows: if the long-run level of the BI variable increases by a unit, this corresponds to a change in the long-run level of the selected financial indicator by the value of the long-run multiplier. After the estimation of the parameters of the panel model was completed, the procedure for verifying its statistical properties was carried out. For this purpose, the Sargan test and the test for autocorrelation of the increments of the residual component were used. The Sargan test examines whether the instruments in the estimation method were properly selected. Testing the properties of the GMM model is based on testing whether the instruments are appropriate, that is, uncorrelated with the random components. The null hypothesis of the Sargan test is that the instruments have been properly selected, while the alternative hypothesis is that the selection of instruments is incorrect. Using the probability value p-value, a result greater than the accepted level of significance means that there is no basis for rejecting the null hypothesis and thus authorizes the conclusion that the instruments were selected correctly (Tunowski, 2019).

The second diagnostic test of the models will be the Arellano-Bond test examining the presence of autocorrelation of the random component. The test answers the question of whether the instruments used during estimation are appropriate or, in other words, whether the conditions of moments are satisfied or not (Dańska-Borsiak, 2009). In the course of the study, the result of the test was calculated for first-order and second-order autocorrelation. However, from the point of view of the first-difference model, the test for second-order autocorrelation is important. First-order autocorrelation in a first-differences model is an expected phenomenon, while the occurrence of autocorrelation of an order higher than 1 in a first-differences model means that the conditions of moments are not met, so the instruments used in GMM estimation are not appropriate (Dańska-Borsiak, 2009).

The null hypothesis of the Arellano-Bond test is that autocorrelation does not occur (Mileya, 2007). Translating this into desirable p-values, they should be greater than 0.1; 0.5 and 0.01, respectively, depending on the level of significance adopted - the paper adopts a designation for three levels of significance: *** - significance of 1%, ** - significance of 5%, * - significance of 10%.In this case, there are no bases for rejecting the null hypothesis thus stating that autocorrelation does not occur. In conclusion, on the basis of the results obtained by the method of dynamic panel models, it will be possible to determine the probability of impact (its statistical significance) of the implementation and use of a business intelligence system on selected profitability indicators, as well as the long-term impact of BI implementation on a given financial profitability indicator (values calculated using the long-term multiplier) (Tunowski, 2019).

4. Findings

The estimated parameters of the dynamic panel models are reported in Table 1, focusing on selected profitability indicators, namely Return on Equity (ROE) and Return on Assets (ROA). The columns representing the financial profitability indicators correspond to the parameters of the model, which were estimated using the FDGMM method as described earlier.

Table 1: The Impact of Business Intelligence System Implementation on Commercial Banks Profitability Indicators - FDGMM Method Using Dynamic Panel Model

	Return on equity (ROE) (model 1)		Return on assets (ROA) (model 2)	
Y (lag Q1)	0,0793		0,1454	***
BI	-0,0024	***	-0,0005	***
BI (lag Q1)	-0,0012	***	-0,0001	***
BI (lag Q2)	0,0063	***	0,0010	***
BI (lag Q3)	-0,0070	***	-0,0009	***
BI (lag Q4)	0,0014		-0,0003	
BI (lag Q5)	0,0013		0,0005	
BI (lag Q6)	-0,0067		-0,0012	
BI (lag Q7)	-0,0005		0,0000	
BI (lag Q8)	0,0033	**	0,0005	***
BI (lag Q9)	0,0033	***	0,0005	***
BI (lag Q10)	-0,0094	***	-0,0010	**
No. of observations	144		140	
Sargan test - value (degrees of freedom)	147,555 (132)		143,411 (128)	
Sargan tets - p-Value	0,168		0,166	
Autocorrelaction test AR (1) - value	-1,220		-1,220	
Autocorrelaction test AR (1) - p-Value	0,222		0,222	
Autocorrelaction test AR (2) - z value	0,747		0,747	
Autocorrelaction test AR (2) - p-Value	0,455		0,455	
Long-term multiplier	-0,012545977		-0,001793044	

*** - significance 1%, ** - significance 5%, * - significance 10%

Source: own elaboration.

The model estimated by the FDGMM method is characterized by a number of parameters that require explanation before proper interpretation. Y (lag 1) is the parameter standing next to the lagged Q1 of the explanatory variable, i.e. the selected ROE or ROA. The variables BI, BI (lag Q1), BI (lag Q2), etc. are the

parameters standing by the BI variable and its lags. The number of observations means the number of observations that was used in the estimation of a particular model. Sargan test value (degrees of freedom) is the value of the Sargan test statistic along with the number of degrees of freedom in parentheses and along with the significance rating by the number of asterisks (*** - 1% significance, ** - 5% significance, * - 10% significance). Sargan p-Value, on the other hand, is the p-value for the Sargan test.

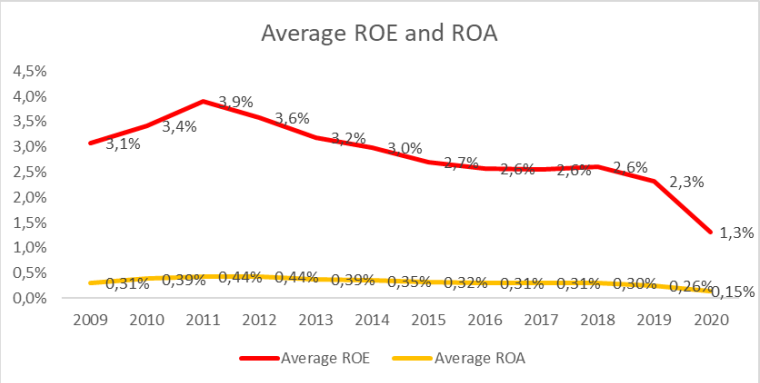
The next designations are for 1st and 2nd order autocorrelation tests. Autocorrelation test AR (1) value is the p-value of the first-order autocorrelation test statistic along with the significance rating by the number of stars (*** - 1% significance, ** - 5% significance, * - 10% significance). In turn, AR (1) p-Value - the p-value of the test for first-order autocorrelation. Similarly, Autocorrelation test AR (2) value denotes the p-value of the test statistic for second-order autocorrelation, along with the significance rating by the number of stars (*** - significance of 1%, ** - significance of 5%, * - significance of 10%). AR (2) p-Value refers to the p-value of the test for second-order autocorrelation. The last indicator is the long-run multiplier, which denotes the value of the long-run multiplier.

Diagnostic tests for both models on ROE and ROA profitability ratios are positive. This applies to both the Sargan test and the test for second-order autocorrelation. This demonstrates the proper choice of instruments in the estimation method used. Note that the statistically significant parameters at the BI variable are those standing at the lagged BI variable, which would indicate the lagged effect of the business intelligence system on the level of the profitability index. The statistical significance of the lagged BI variables indicates the impact of the system 1 year after implementation (Q1-Q3 quarters) and 3 years after BI system implementation (Q8-Q10 quarters).

The estimated long-term multiplier indicates a 1.25% reduction in Return on Equity (ROE) and a 0.179% reduction in Return on Assets (ROA) as a consequence of the Business Intelligence (BI) system.

Initially, the observation of a negative long-term multiplier value may raise concerns as it suggests a decline in both profitability indicators, which contradicts the intended purpose of implementing the Business Intelligence (BI) system. The expectation behind implementing a BI system is to enhance the organization's analytical capabilities and, consequently, improve profitability. Therefore, further analysis and interpretation of the results are required to understand the underlying dynamics and potential reasons for this unexpected outcome.

An analysis of the dynamics of both Return on Equity (ROE) and Return on Assets (ROA) indicators from 2009 to 2020 reveals that while the implementation of the Business Intelligence (BI) system contributes to a decrease in their growth rates, it ultimately has a positive effect by slowing down the decline. Figure 1 illustrates the levels of ROE and ROA over the specified period.

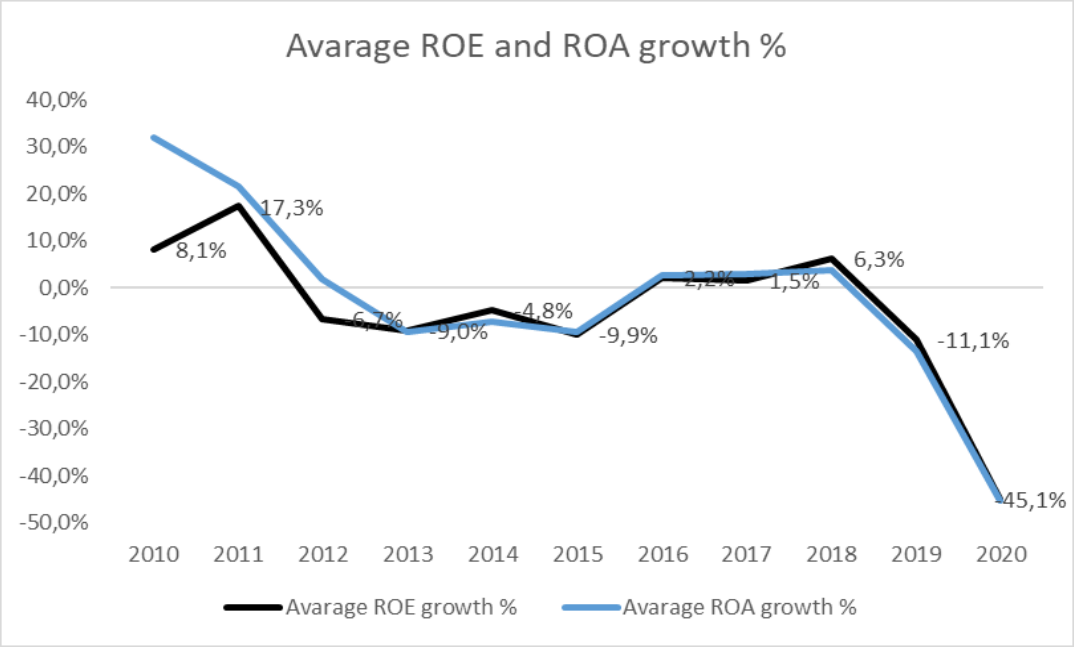


Source: Own elaboration.

Figure 1: Average ROE and ROA Over 2009-2020 for 5 Selected Commercial Banks

During the analyzed period, both the Return on Equity (ROE) and Return on Assets (ROA) ratios experienced a decline from year to year. The average level of ROE decreased from over 3 percentage points observed during the period of 2009-2014 to 2 percentage points in the subsequent years after 2015. Moreover, there was a further drop in ROE during 2019-2020. As a result, the average ROE for the five analyzed banks in 2020 was 1.3 percentage points.

The trend of decreasing profitability becomes even more apparent when examining the annual dynamics of ROE and ROA growth. Figure 2 presents the data depicting this trend.



Source: Own elaboration.

Figure 2: Average ROA and ROA Growth % over 2010-2020 for 5 Selected Commercial Banks

During the period of 2012-2018, the annual dynamics of the analyzed profitability indicators for the five selected commercial banks fluctuated between -10% and 10%. However, there was an exception during the initially successful period of 2010-2011, where the dynamics of both indicators exceeded the 20% threshold on an annual basis.

On the contrary, the average level of ROE and ROA dynamics experienced a significant decrease, reaching as low as -45% on an annualized basis during the final two years of the analyzed period, namely 2019-2020.

These observations highlight the varying dynamics and overall declining trend in profitability for the selected commercial banks during the specified period.

The analyzed levels of profitability indicators indeed indicate a general reduction in their values. However, the long-term multiplier obtained from Model (1) and Model (2), which suggests a decrease in the indicators' values in the long term due to the implementation of a Business Intelligence (BI) system, indicates that the implementation of BI can have a positive impact on profitability. This observation may seem contradictory considering the overall decline in ROE and ROA.

The explanation for this apparent contradiction lies in the fact that the implementation of BI slowed down the rate of decline. In other words, the decline in profitability ratios would have been even more significant without the implementation of BI, surpassing the values obtained for the long-term multiplier of the BI variable (1.25% and 0.0179%, respectively).

Therefore, although the profitability indicators decreased over time, the presence of the BI system mitigated the decline to some extent, suggesting a positive effect on profitability.

5. Discussion and Conclusions

Based on the findings, the main hypothesis (H0) stating that the use of a Business Intelligence (BI) management system between 2009 and 2020 improves the profitability of Polish commercial banks is supported. The analysis and results of the study provide evidence that the implementation of a BI system has a positive impact on profitability indicators in the context of Polish commercial banks.

The obtained models for both profitability ratios (ROE and ROA) showed statistical significance of the BI variable or its lags. Additionally, each model successfully passed the Sargan test and the second-order

autocorrelation test, indicating that the instruments were appropriately chosen during estimation using the first-differences method. A summary of the results obtained is presented in Table 2.

Table 2: Summary of Findings - Impact BI on ROE and ROA on Commercial Banks in Poland

Indicator name	Model no.	Statistical significance of the BI variable	Statistical significance of the model	Delay of BI impact in quarters	Impact of BI system	Long-term multiplier	Average growth of the YTY indicator from 2009 to 2020
ROE	(1)	Yes	Yes	0,1,2,3,8,9,10	Yes	-1,25%	-3,7%
ROA	(2)	Yes	Yes	0,1,2,3,8,9,10	Yes	-0,0179%	-0,8%

Source: Own elaboration.

In both models, the column "statistical significance of the BI variable" indicates that it was possible to obtain a model in which the BI variable or its lags were statistically significant at the 10% level or better. The column "statistical significance of the model" refers to the results of the Sargan test and the test for second-order autocorrelation and takes the value "Yes", in the cases analyzed both tests came out positive for each of the two models. It appears that the inclusion of the BI variable in the models had a significant influence on the profitability indicators, and the models themselves demonstrated statistical validity and reliability.

An interesting finding of the research is the determination of the time horizon at which the effects of the Business Intelligence (BI) system can be expected. This information is provided in the "delay of BI impact in quarters" column. The results indicate that the statistically significant delays associated with the BI variable were most commonly observed in the 1st and 3rd year after the implementation of the BI system. This implies that the effects of the BI system on profitability, as measured by ROE and ROA ratios, can be expected within approximately one year (0-9 months) and after three years (24 to 30 months) following its implementation. It is important to consider that this result indicates the time frame in which the Business Intelligence system begins to impact profitability. Understanding the specific time horizon at which the effects of the BI system become apparent can be valuable for organizations in assessing the effectiveness and return on investment of implementing such systems.

- The column "Impact of BI system" indicates whether an impact of the BI system has been identified based on the estimated model. It takes the value "yes" if the BI variable is statistically significant and the model passes the diagnostic tests successfully, with positive values for both ROE and ROA. This confirms the presence of a significant impact of the BI system on the profitability indicators. The column "long-term multiplier" provides information on how the level of the studied indicator is expected to change in the long term as a result of implementing the BI system. This value should be compared with the column "average growth of the year-over-year (YTY) indicator." The results obtained suggest that the implementation of Business Intelligence may contribute to slowing down the decline of both ROE and ROA, which aligns with the general trend observed in the commercial bank sector from 2009 to 2020.
- The study indicates a high probability of a positive impact of implementing the BI system on the profitability of commercial banks. The obtained results allow for a positive verification of the research hypothesis set in the introduction. However, the following limitations should be taken into account:
- The study was based on a limited number of cases (5 banks), and other banks were not included (the article describes the criteria for site selection). It is possible that the relationship between BI implementation and financial profitability may have a different direction and strength in those excluded banks.
- The profitability of a bank is influenced by various factors apart from BI implementation and general economic conditions, which were not isolated in this study.

- The method used to analyze the impact of BI implementation on bank profitability applies to the selected period of 2009-2020. Therefore, different results can be expected in other time periods, considering the advancement of business intelligence system technology and changes in external factors such as high inflation, high interest rates, pandemics, and armed conflicts in neighboring regions. Unambiguous and definitive verification of the indicated hypothesis, therefore, requires expanding the scope of the study, both in terms of the time horizon and the number of study subjects. In the future, the author plans to analyze organizations from other industries as well and take into account other factors that shape the impact of business intelligence systems on profitability indicators. These aspects will be the subject of further inquiries by the author.

Given the lack of research on the impact of BI systems on the profitability of Polish commercial banks after 2015, the following practical implications have been formulated and confirmed as still actual:

- The results of the study indicate that the implementation of Business Intelligence systems brings tangible benefits to the profitability of financial organizations, such as commercial banks.
- The research implications of this study may suggest to top management that implementing business intelligence systems can benefit the organization.

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Digital Innovation Through Cybersecurity Learning Factories

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Abstract: Globally, the cybersecurity workforce changes tremendous challenges. Shortages in specialised cybersecurity staff members essentially puts organisations at risk. New graduates can face difficulties in entering the cybersecurity domain due to a lack of experience and knowledge. However, with the advent of newer techniques for knowledge development, we find that learning factories offer a fresh perspective. Learning factories provide a mechanism to remove the barriers in the field of cybersecurity and cultivate a nurturing training environment. This paper looks at the modernisation of traditional training by covering the application of learning factories in the cybersecurity field. It aims to show how knowledge can be geared into more practical schemes to empower participants and expose them to critical cybersecurity skills. Through the paper, it will be demonstrated that learning factories can be used for real-world learning and information sharing. Learning factories embody the principles of knowledge sharing and promotes more efficient knowledge management. With the use of nominated tools and technologies cyber security learning factories can help measure the effectiveness of worker training as well provide for consistent facilitated training. Overall, learning factories can help to transform training and build knowledge application. Learning factories may be set up to tackle real industry challenges and are particularly useful in the field of cybersecurity. Using learning factories there is an opportunity to advance multi-dimensional cybersecurity skills and develop innovation in the field. Due to the added advantages of Information and Communication Technology (ICT) being virtually accessible, there is the added benefits of agility, responsiveness and increased engagement. Using a variety of modes, cybersecurity learning factories can combine the techniques of gamification, videos, multi-media and simulation. All of this provided an augmented and enriched experience for participants. Learning factories are a low-cost solution to replicating working environments thus assisting in skills development. Through the application of learning factories, a skilled workforce can be developed and cultivated.

Keywords: Learning factory, Experiential learning, Cybersecurity

1. Introduction

Staff shortages can be felt across the spectrum in cybersecurity. There is an urgent need to train and nurture new graduates who possess the minimum qualifications and aptitudes required in the cybersecurity profession (Angafor, Yevseyeva, & He, 2020.) In its 2022 Cybersecurity Workforce Study, (ISC)2 found that 3.4 million more skilled cybersecurity professionals are currently needed globally (ISC2, 2022). Without suitable staff to support systems and organisations, the risk factor can increase. Misconfigured systems can remain undetected, patching times can be slow, risk assessments can be rushed and omissions on policies may creep in. Skilled professionals are needed to deal with arising issues like data breaches or a ransomware attack. Together with technologies and processes, people-centred solutions are also needed to handle cybersecurity issues.

When graduates emerge out of tertiary educational institutions, they may be keen to enter the workforce. However, practical technical knowledge and expertise in the domain of cybersecurity may be lacking. Learning factories are proposed as a means of bridging the gap between scholastic concepts and technical knowledge. A learning factory is a simulated working environment where individuals can practice applying concepts, tools, and cognitive skills to solve real-world problems (Veerasamy et al. 2023). This type of training is intended to prepare individuals for actual workplace situations by providing hands-on experience in a controlled setting. Learning factories have been a topic of great interest in the last couple of years and using learning factories can be highly beneficial to train employees (Merz, Hoch & Drexel, 2020).

To explore the potential that learning factories offer, the purpose of this is to look at :

- The general cybersecurity skills shortage
- Usefulness of Learning Factories
- Use of ICT in Learning Factories

The research methodology followed entailed a brief literature scan of the field to understand how learning factories emerged from the manufacturing cluster. This is mainly covered in the Overview section of the paper as well as the section looking at the Usefulness of Learning Factories. The authors have also run learning factories training sessions. Based on the experiences of practical learning factory training sessions, the authors have compiled the section on ICT use in Learning Factories and their innovative contributions to the digital space. The

results found in the ICT section are based on observations and practical application of running learning factory training sessions.

2. Overview

The term learning factory was first coined and patented in 1994 when the National Science Foundation (NSF) in the US awarded a consortium led by Penn State University a grant to develop a "learning factory (Abele et. al., 2017). It referred to interdisciplinary hands-on senior engineering design projects with strong links and interactions with the industry. Over the years, learning factories have predominantly been applied to the manufacturing sector due to the strong challenges in training and correlating competency requirements. Another challenge was the adaptation and enhancements to their education concepts and methods.

In order to succeed within the fourth industrial revolution, companies of the producing sector have to prepare their employees for these competences (Prinz, Morlock, Freith, Breitkopf, Kreimeier & Kuhlenkötter 2016). The key feature of the fourth industrial revolution is digitalisation and therefore technological modernisation. Critical to these concerns is how to handle the vast volumes of data and information as well as the incorporation of new methods and technologies for work in Industry 4.0.

Society has grown increasingly dependent on technology which makes cybersecurity an even greater priority. The pace and breadth of technological progress are increasing at a surprising rate (Roodt & Koen 2020). For sustainable growth, it is critical that cybersecurity becomes a key concern in this growing digitised and connected world. Tapping into the potential of learning factories, workers and job seekers can gain access to practical knowledge that promote innovation and transformation. Attracting good talent and retraining are crucial for growing skills and providing development opportunities.

Figure 1 shows an overview of how learning factories can be applied to cybersecurity. Due to the remote, virtual and hybrid capabilities of ICT, learning factories in the field of cybersecurity can ideally provide a platform to nurture talent. Members can interact with various learning platforms containing simulations, games, videos, exercises, animation, scenarios and applications to learn about the latest technology area and familiarise themselves with the content. Thus, organisations can broaden talent and enable transformative work practices with in-skills training. In addition, by providing the opportunity for further education and skills development, members can grow in experience. Learning factories setups can innovate cyber security skills development due to the digital capabilities and revolutionary delivery methods like virtual reality, gamification, simulation, animations, and the broad spectrum of multimedia. It also enables information sharing and real-world application learning.

The main goals of learning factories are either technological and/or organizational innovation (if used for research), or an effective competency development (if used for education and training), i.e. the development of the participants' ability (including motivational and emotional aspects) to master complex, unfamiliar situations (Abele, Metternich, Tisch, Chryssolouris, Sihn, ElMaraghy, Hummel & Ranz 2015)

Furthermore, as technological advances transform jobs, people may need to retool their skillsets to better prepare for their roles. Because of the increased complexity of state-of-the art technologies educational institutions need to provide practice- orientated teaching methods in learning factories to help engineers of today understand the impact of those developments (Komenda, Reisinger and Sihn, 2019). Training and upskilling are imperative to remaining current to digital innovations. Learning factories offer the opportunity for members to improve their knowledge base by exposing them to practical training in an interactive environment. Learning factories present a promising environment for education, training and research (Abel et. al., 2017).



Figure 1: Overview of Cybersecurity Learning Factories

Future learning factories are set to drive continuous improvement, innovation and knowledge creation. Human capital development should explore knowledge generation and harnessing experiential learning for growth and development. Furthermore, training should promote independent problem-solving skills amongst workers and the capability to perform across various areas. Training must be supported and endorsed by HR policies. HR policies must incentivise and promote training. Training offerings should aim to be multi- dimensional, diverse and integrate various capabilities. For example, technical skills, interpersonal skills, planning skills can be combined to show wider application areas. For such integrated training to be possible, there must be suitable training facilities. Furthermore, worker participation in the workplace is highly recommended, therefore participation-enhancing training must be offered. The emerging idea is that learning factories are a possible solution to the needs of practical skills training and promote experiential learning.

The Centre for Teaching and Learning explains that experiential learning allows the following processes (2022):

- reflection, critical analysis and synthesis;
- opportunities for students to take initiative, make decisions, and be accountable for the results;
- opportunities for students to engage intellectually, creatively, emotionally, socially, or physically; and
- a designed learning experience that includes the possibility to learn from natural consequences, mistakes, and successes.

Figure 2 shows how the learning factory can be applied to the cycle of learning in that members are able to have direct exposure/concrete experience. Thereafter, after the initial observations, it can be related to previous experience and knowledge. Application of new ideas and skill practice is also facilitated. Eventually, the participant can distil the experience based on the contact with practical and abstract concepts.

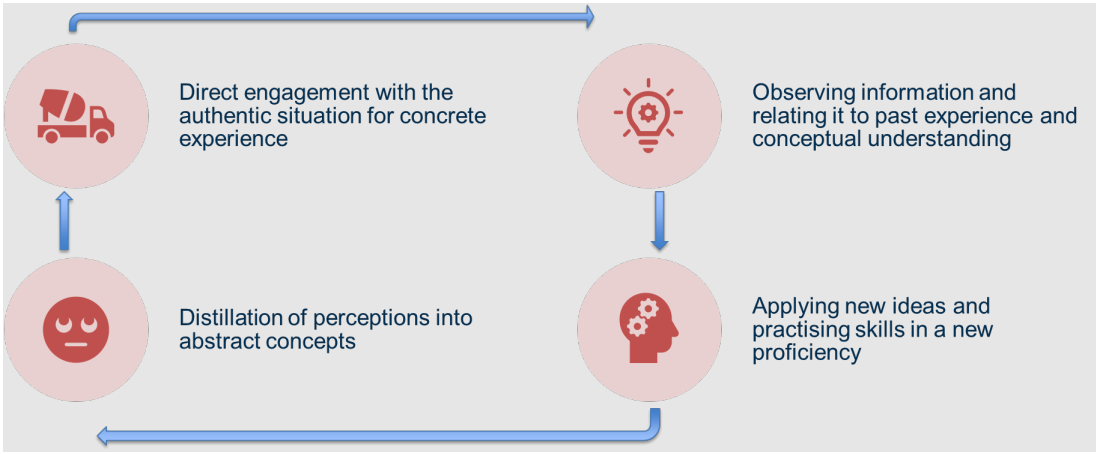


Figure 2: Cycle of Learning

Together with a high degree of knowledge, companies expect their employees to utilise their knowledge and operationalise this knowledge in unimaginable situations (competencies) which shows the requirements for

future and actual employees having to act in real problem situations (Cachay, Wennemer, Abele & Tenberg, 2012). More action- orientated learning approaches are needed.

Traditional learning equips one with the knowledge and principles which may or may not be received and applied by the trainee in the intended manner. However, LF provide an additional layer of learning in the form of "hands-on experiential learning". Experiential learning goes beyond teaching to training participants through practical and direct engagement with the knowledge being imparted. Other notions like "knowledge factory", model factory" and "teaching factory" can be used to describe similar kinds of learning systems (Tisch, Hertle, Abele, Metternich & Tenberg, 2014).

Learning factories provide experiential learning by simulating a real work environment to trainees. Simulation as an immersive teaching and learning method has proved to be effective in captivating, engaging and intriguing participants as they learn. This is due to participants being able to implement the imparted knowledge and seeing its effects in real time and environment. The LF's setup and tools, the simulated conditions may be tweaked to represent real workplace challenges, while the participants apply the imparted knowledge in their unique way to solve these realistic challenges.

Learning Factories pursue an action-oriented approach with participants acquiring competencies through structured self-learning processes in a production-technological learning environment (Tisch, Hertle, Cachay, Abele, Metternich, & Tenberg, 2013). Thus, users can be taught necessary competencies in a practical manner that promotes knowledge growth, experiential interactions, and actionable engagement.

3. Usefulness of Learning Factories in the Workplace

According to research from LinkedIn, staff within the technology sector have the highest turnover of over 13% (Lewis, 2023). The constant entering and exiting organisations is costly as organisations need to re-train employees. Furthermore, due to technological changes, employees need constant training. Integrating learning factories into the workplace could assist in upskilling employees continuously.

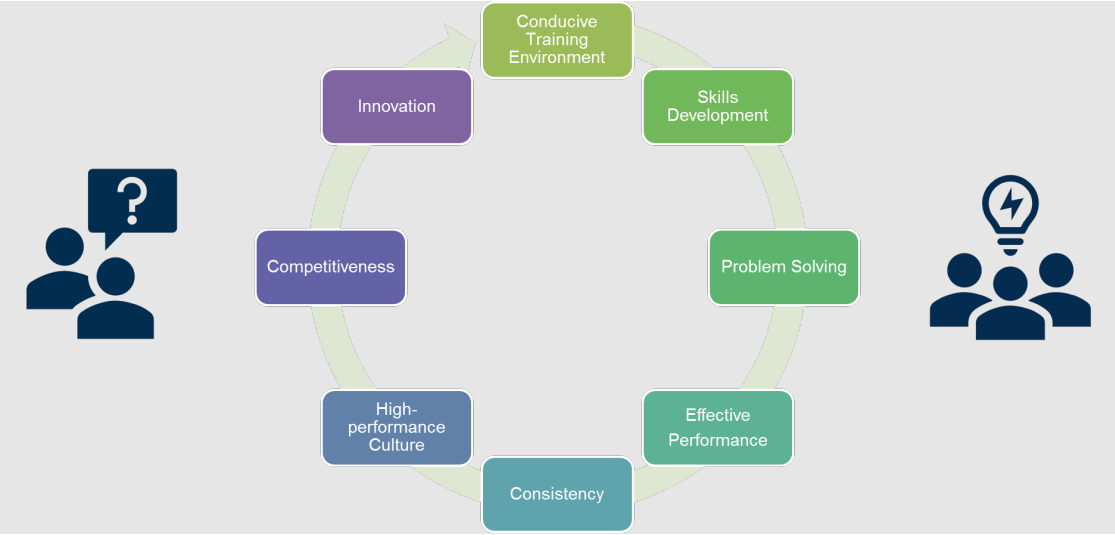


Figure 3: Usefulness of Learning Factories

Figure 3 shows the usefulness of learning factories in the workplace. These include:

- Conducive training environment – training platform/ classroom contains relevant material to expose participants to concepts. Learning factories also offer a high potential for blended learning setups, where the learning factory serves as a meeting place and application scenario (Tisch, Hertle, Abele, Metternich & Tenberg, 2016).
- Skills development – practical exercises promote skills development and knowledge growth. The key to competency development is the ability to master knowledge, this comprises cognition and comprehension of knowledge (Cachay, Wennemer, Abele & Tenberg, 2012).
- Problem solving – application of knowledge and skills for problem solving. Learning Factories can have different learning modules, formal and informal learning processes during learner situations in which participants master unknown problem situations (Enke, Mladineo & Monetti 2016)

- Effective performance – exposure and practical training can help improve performance. In line with the human capital perspective, raising the skills of the labour force is seen as important in contributing to the spread of ``high-skill'' work practices and thus enabling higher productivity growth (Barton & Delbridge, 2001).
- Consistency- best practices can be shown, thus resulting in more uniform responses.
- High-performance culture – support and reskilling encourage culture of high performance.
- Competitiveness- improved skills provides organisation with edge over competitors. In addition, members may enjoy the benefits of friendly competition to achieve and strive for better results in training exercises, quizzes and other measured activities.
- Innovation- use of progressive techniques encompassing digitised technologies can provide more forward-looking solutions. This also helps transform training. Especially, innovative learning environments must be able to react training mentioned challenges in an interdisciplinary manner (Abele et. al., 2017).



Figure 4: Cybersecurity Learning Factories Features

For cybersecurity learning factories, some key characteristics are captured in Figure 4. Due to the remote options in the ICT field, cybersecurity learning factories can be set up in a laboratory environment as well as online. Many training aspects can be on-line, or software/application based and thus participants can gain access from many locations. In person participation in a learning factory is also an option. Thus, hybrid options are available for cybersecurity learning factories.

Part of the offering of a cybersecurity learning factory will be an immersive experience. Adversary thinking is an essential skill for cybersecurity experts, enabling them to understand cyber-attacks and set up effective defenses (Švábenský, Vykopal, Cermak & Laštovička, 2018). When it comes to specific offensive and defensive practices related to the cybersecurity field, there are options for adversarial thinking. Particularly when looking at areas like penetrations testing and threat hunting, the goal is to walk in the shoes of an opponent and consider invasive activities. In various other aspects like risk evaluations and vulnerability assessments, adversarial thinking is also key to identify stronger controls.

Learning factories can provide an emulation of the work environment. For example, intrusion detection tools can be forming part of the training. The actual tool usages and use cases can be worked through. This provides for action-based participation and interactive training whereby users gain hands on experience with real world experience. Learning factories provide a suitable forum for knowledge generation in that the everyday platforms can form part of the training and help users gain valuable experience.

A key characteristic of learning factories is that it offers a useful stage for experiential learning. New graduates or workers may lack experience in certain areas. However, with learning factories they can interact with a variety of training mediums that provide for practical knowledge and skills development. The next section will look at

the use of ICT in cybersecurity learning factories and how users can benefit from a wide variety of training material.

4. ICT in Learning Factories

Tisch and Metternich (2017) outline challenges for a LF: i) they are resource intensive in space, equipment and personnel, ii) appropriate selection of a research/teaching topic, iii) limited scalability, and iv) unknown effectiveness.

Since the advent of the third and fourth industrial revolutions in addition to the recent global pandemic Covid19, the world has been gradually innovating from traditional methods of productivity to emerging ones that leverage on the power of digital ICTs. As a result, productivity can be achieved at a rapid pace and at low costs. A cybersecurity learning factory is an instance of such, as it promotes cybersecurity education by leveraging on interconnected ICTs, emerging technologies and the internet. As a result, knowledge is widely accessible and sharing simplified. Emerging innovative teaching methodologies include the use of gamification, virtual or hybrid collaborative platforms, animation and simulation techniques to influence learning behaviours. Since ICT has flexible communication and scalable features cyber security learning factories can overcome many of the challenges found by Tisch and Metternich (2017). Topic selection can be provided based on different modules and users performance can be measured which can show improved effectiveness. Based on a Cybersecurity Learning Factory Contextual Attribute Model proposed by Veerasamy et al. (2023) all the above-mentioned inexhaustive teaching techniques may be incorporated (see Figure 5).



Figure 5: Contextual Attributes of Learning Factories (Veerasamy et al, 2023)

Figure 5 presents the attributes and relative qualities of a cybersecurity learning factory:

- Function describes the purpose of a learning factory;
- Mode describes the objectives of a learning factory;
- Benefits are the advantages of a learning factory;
- Methodology describes the teaching and learning techniques of a learning factory; and
- Features describe the setup of a learning factory.

It is mainly the Features and Methodology that highlight the use of ICT in a cybersecurity learning factory.

Gamification entails implementing the creative techniques that are used in gaming when teaching, to promote intriguing challenges, engagement, the will to proceed, and rewards in the learning process. As such, gamification in a learning factory would creatively integrate video, audio, animation, quizzes, simulation, puzzle-based challenges, rewards, etc, into game-based lessons and application tasks to facilitate in-depth learning (Raisi et al., 2021). Employing gamification in the learning process transforms it from a monotonous and laborious process into an engaging and dynamic experience. Learning becomes entertaining, collaborative and competitive, helping to foster a deeper understanding of the subject matter (Raisi et al., 2021). Interactive training sessions, including educational games, are expected to have the highest learning effect among the applied learning methods because of providing opportunities for exploration, experimentation and problem solving (Ratan & Ritterfield 2009)Emerging technologies such as machine learning can be incorporated in game-based learning factories to increase interactivity between user and platform, thus further improving the quality of learning and teaching. In a cybersecurity learning factory, machine learning technology can be used to provide real-time and customised feedback to the user by detecting wrong inputs such as a syntax error in a programming language, interpreting that, and providing the most likely set of inputs a user may choose from to

correct their input (Loftus & Narman, 2023). Personalised feedback has been proven to enhance learning, therefore, incorporating machine learning in a cybersecurity learning factory can ease the complexity of cybersecurity training according to individuals' varying capabilities (Loftus & Narman, 2023)

Simulation technology involves the use of computer software to replicate real-world scenarios and processes in a virtual environment. In the context of learning factories, simulation has emerged as an effective tool for providing participants with a safe and controlled environment to experiment with various manufacturing processes. Simulation-based learning enables participants to gain hands-on experience in a virtual setting and obtain immediate feedback on their performance. This feedback mechanism can help participants identify errors and gaps in their knowledge and provide an opportunity for participants to correct and improve their performance in a timely manner. As a result, simulation-based learning has become an increasingly popular approach for enhancing learning outcomes and skills development in learning factories.

Virtual reality is an emerging technology that leverages software tools to create a computer-generated environment that replicates real-world scenarios. Within the context of learning factories, digital and virtual learning factories have emerged as a means of creating an online learning environment that is accessible from anywhere. In such environments, participants can engage in simulation-based activities, such as layout planning and concurrent engineering, which provide a realistic representation of manufacturing processes in a virtual space (Tvenge et al., 2020). This approach enables participants to experiment with different scenarios and gain valuable hands-on experience, without the constraints of physical space or equipment.

Through virtual reality, participants can receive real-time feedback on their performance, enabling them to identify and correct errors quickly. The virtual environment also allows for the creation of multiple scenarios to test various skills, thereby facilitating a deeper understanding of the subject matter. Additionally, virtual reality-based learning can increase participant engagement and motivation, as participants are immersed in an interactive, gamified experience that fosters a sense of competition and achievement.

The use of dynamic and interactive ICT platforms provides for a richer experience and helps grow the knowledge base of the participants. Due to the innovation offered by digitalisation, users can have a much more personalised and intensive experience and help with knowledge retentions and skills development.

Various software training platforms provide for automatic quizzes, practical's, exercises, videos, badges and rewards. With the use of these animated and interactive offerings, participants are encouraged to achieve certain goals. Such platforms can also offer background training content. In this way, the knowledge required for job related tasks can be encapsulated into smaller modules which makes them more digestible to the users.

5. Conclusion

The innovation in learning factories promotes better knowledge generation, transfer and application. ICT evolves at a rapid pace. So too does cybersecurity. New threats and threat actors emerge continuously. Through cybersecurity learning factories, underlying theory as well as emergent knowledge can be conveyed.

This paper elaborates on the benefits of learning factories which can contribute extensively to knowledge management. The innovation offered by learning factories provides a more practical method for participants to distill knowledge from abstract concepts by offering practical training and exposure to tools and technologies. ICT provides for several digitized offerings that can further support the learning factory objectives. Through hybrid, virtual, gamification and simulation techniques, cybersecurity learning factories offer tremendous potential to help with skills development and knowledge generation.

Future work on this topic will include exploring learning factories within the cyber security domain towards replication to improve the cyber security posture of organisations within the country,

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Organizing Decision Making Processes in Public Administration: The Impact of Knowledge Visualization

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Abstract: The growing complexity of the competitive context imposes on organizations the necessary to make effective decisions in a short time. Consequently, the organization must make decisions on an ever-increasing volume of data and information to increase their competitive advantage. For this reason, the decision- making process must be supported by new tools capable of facilitating and time reduction the knowledge transfer. The public administrations are a particular and very emblematic case. Indeed, public administrations are characterized as bureaucratic organizations with lengthy, often ineffective decision-making processes. The main consequence is a loss of value for the reference community. Hence, improving decision-making in public administrations can have a direct impact on society. On this wise, knowledge visualization by transforming knowledge into different visual tools (e.g., images, tables, graphs, knowledge maps, etc.) can support the decision-making process, speeding up the knowledge transfer process. A growing field of studies is focusing on the knowledge visualization, and on tools to support the decision-making process. The knowledge visualization in complex organizations appears to be a subject that has not yet been fully explored. The objective of this study is to understand the impact that knowledge visualization has on the decision-making process in public administration. In this study the methodological approach implemented has qualitative and exploratory nature. The exploratory nature aims to build the theoretical premises regarding knowledge visualization, the use of knowledge visualization in public administration, and the operational and strategic capacity to support decision- making. The data was collected through the analysis of a case study. This study is part of knowledge management studies, with particular emphasis on knowledge. visualization. The results of this study, based on the observation of a case study, offer theoretical reflections on the impact of knowledge visualization in the decision-making processes of public administration. The managerial implications of this study offer an overview of the knowledge visualization tools used in public administration and the impact of knowledge visualization in the decision- making process.

Keyword: Knowledge visualisation, Decision-making, Public administration, Case study

1. Introduction

In recent years, several scholars have highlighted the importance of using diagrams, graphs, schemes, mind maps and social graphs captured in real-time (Berinato, 2016; Miah et al., 2017). The decision-maker can use KV formats (images, maps, etc.) to transform data and information into accessible forms of representations to extract new knowledge and information. Visual representations of information and knowledge have been indicated as a dimension of modern knowledge management to support decision-making process (Miah et al., 2017). Knowledge Visualisation (KV) knowledge visualization is a research area that focuses on the valorisation of knowledge, represented in a visual form. KV can be used at all levels of organizational analysis such us personal, interpersonal, group, organisational and inter-organisational. Public administrations are organizations that have a direct impact on society and on the well-being of the citizen/user. For this reason, they must respond quickly to changes and the growing needs of the citizen/user. The knowledge visualization in complex organizations like public administration appears to be a subject that has not yet been fully explored. The objective of this study is to understand the impact that knowledge visualization has on the decision-making process in public administration. On these premises, this research starts with an analysis of the literature about KV and its formats. It then focuses on the empirical analysis of a case study to offer theoretical reflections on the impact of knowledge visualization in the decision-making processes of public administration. This study investigates KV—through a qualitative and exploratory approach—with the help of two research questions.

RQ1: How does KV support decision-making and knowledge management in public administration?

The remainder of this paper is structured as follows. Section 2 provides a theoretical framework on KV. Section 3 proposes a detailed description of the methodology used to answer the RQ. Section 4 presents the findings and conclusions that are then discussed in section 5, in which the study's limitations and recommended future research are also identified. Finally, section 6 provides managerial and social implications.

2. Theoretical Framework

2.1 Knowledge Visualisation Perspective and Format

The field of Knowledge Visualisation focuses on creating and transferring knowledge through visualisation (Eppler and Burkhard, 2004; Meyer, 2010; Yan et.al., 2011). These authors (Eppler and Burkhard, 2004) presented a widely accepted definition of KV, stating that it "*is defined as a field that examines the use of visual representations to improve the creation and transfer of knowledge between at least two people. Knowledge visualization thus designates all graphic means that can be used to construct and convey complex insights* ". KV has a right impact on the time to make decisions in the knowledge-intensive organizations that need rapid communication. Eppler and and Burkhard (2007, p. 18) proposed a revised definition of KV as "*the subject that studies how to improve complex knowledge creation and transmission between two or more applying visual representation*". The primary goal of KV is to support knowledge creation and sharing processes. Burkhard (2005) compared Knowledge Management (KM) and KV and concluded that both disciplines are intertwined in efforts towards knowledge creation and sharing. KV is classified as a component of KM, mainly because knowledge transfer is a key process in knowledge-intensive organisations (Burkhard, 2005). Burkhard (2005) proposed a Knowledge Visualisation Model based on the intuition that knowledge cannot be directly transferred from one person to another. The recipients of the transferred knowledge must integrate it into their knowledge according to their backgrounds and experiences. The model is divided into three components. The first component is the "sender" mental model in which the "sender" wishes to transfer a certain part of their knowledge to the "receiver". Therefore, they externalise their knowledge into visualisations, which are the source for re-creating the "receiver" who tries to internalise the knowledge. In the case of questions or misunderstandings, they can create a feedback loop for the "sender", who must modify their existing views or create new ones to meet the "receiver's" needs. In the second phase, an external visual representation of knowledge must be built to make the recipient aware of the importance of the knowledge. In the last phase concerning the recipient's mental model, the "recipient" focuses on their interests while presenting the details. Finally, regarding the model, it is necessary to answer the following five questions: What is the purpose and effect of externalising visual representations? What is relevant, and should it be displayed? Which audience should be targeted? What are the recipient's interests? What is the most efficient way to visualise knowledge? (Burkhard, 2005, p. 245).

The KV framework includes all graphic means that can be used to build and convey complex insights. The transfer of visual knowledge is complex and challenging as the recipient's background cannot be distinguished. Visual formats need to be specific, but above all, they need to be consistent so that they can go beyond the details of any individual or group. To become knowledge, information must be processed, meaningful and integrated into the user's mental knowledge structure. In academic literature, KV assume different formats.

KV formats may include a sketch, diagram, map, images, physical model and interactive visualisation (Meyer, 2010). Starting with early symbols, visualisation formats have been designed to improve and enhance knowledge sharing and overcome limitations of time and space (Katuscakova et al., 2019).

For the actual creation and transfer of knowledge through visualisation, Burkhard (2005) stated that at least five perspectives should be considered (Figure 1).

TYPE WHAT?	FUNCTION WHY?	TARGET GROUP FOR WHOM?	SITUATION WHEN?	VISUALIZATION FORMAT HOW?
know-what	Creating	For oneself	In a paper report	Structured text\tables
know-how	Codifying	For another person	In face to face dialogues	Mental image\ stories
know-why	Transferring	For a team	In a speech	Heuristic sketch
know-who	Identifying	Community of practice	In a Mngmt - workshop	Conceptual diagram
know-where	Applying\learning	For all employees	In a expert system	Image\visual metaphor
know-what- it	Measuring\assessing	Specific stakeholders	On the inter\intranet	Knowledge Map
normative k.\value	Signalling	For the public	In a virtual environment	Interactive Visualization

Source: Burkhard, 2005 p. 251; Eppler and Burkhard, 2007 p.113

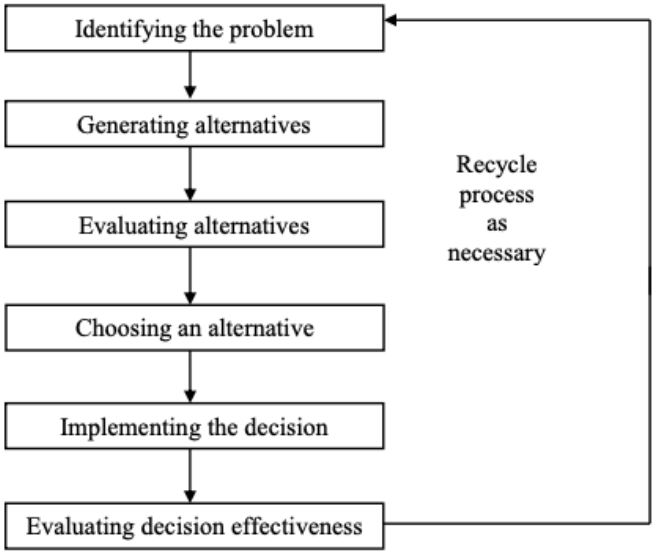
Figure 1: The Knowledge Visualisation Framework

The framework distinguishes six types of knowledge: declarative knowledge (knowing what), procedural knowledge (knowing how), experiential knowledge (knowing why), knowledge about people (knowing who), location-based knowledge (knowing where) and knowledge based on legislation or values (know-what-if). With the help of the function, it is possible to differentiate between different aims for the use of KV, including knowledge sharing through visual means, knowledge creation, learning from visual representations, visual coding of experiences in the past for future users or knowledge mapping (Eppler and Burkhard, 2004; Elouni et al., 2016). The target group perspective, on the other hand, underlines the fact that knowledge visualisation must satisfy the preferences of primary and potential target groups. Their background needs to be taken into consideration, in addition to their expectations when choosing a display format. The situation perspective view emphasises that the use of visualisation depends on the physical or virtual environment and the number of people interacting to manage knowledge.

Finally, the format perspective view outlines the view formats into seven main groups that use media prerequisites as a ranking criterion.

2.2 Knowledge Visualisation in the Decision-Making Process

In an organization the decision-making process is one of the most important activities. It is a process involving choices, and this process generally consists of several steps: identifying problems, generating alternatives, evaluating alternatives, choosing an alternative, implementing the decision, and evaluating decision effectiveness (Schoenfeld, 2011). Two major approaches to decision-making have been identified (Bazerman and Moore, 2013). The rational model characterises decision-makers as completely rational—searching through perfect information to make optimal decisions.



Source: Schoenfeld, 2011

Figure 2: The Decision-Making Process

If a decision-maker were completely rational, they would have perfect information: know all alternatives, determine every consequence and establish a complete preference scale. Moreover, the steps in the decision-making process would consistently lead to selecting the alternative that maximises the solution to each decision problem. Frequently, decision-makers in public administration are not aware that problems exist. Even when they are, they do not systematically search for all possible alternative solutions. They are limited by time constraints, cost and the ability to process information. As a result, they generate a partial list of alternative solutions to the problem based on their experience, intuition, advice from others and perhaps even some creative thought. Therefore, rationality is limited. Herbert Simon (1997, 2009) coined the term 'bounded rationality' to describe the decision-maker who would like to make the best decisions but normally settles for less than the best.

Furthermore, the decision problem may involve relevant problem situations, including physical surroundings, time, requirements and social and technological contexts. During, the decision-making process, decision-makers encounter a variety of challenges, for example, how to gather relevant information in a timely and accurate

manner, how to store, organise and manage the information efficiently so that the resources can be accessed and shared and how to reuse knowledge or experience to facilitate current decision-making (Zhang et al., 2012). The KV formats help decision-makers to see patterns in data that are more difficult to detect through rational methods, improving decisions (Lurie and Mason, 2007). According to Lurie and Mason (2007), the use of KV formats in decision-making shows higher performance, in terms of speed, appropriateness, accuracy and completeness. KV formats that shape and present information more effectively facilitates better communication and supports sense-making (Al-Kassab, 2014). Visualisation can help to support decision-making processes, but it is important to understand its role in terms of knowledge. Visualisation formats can be interpreted as knowledge enablers and could influence knowledge processes such as sharing, integrating and translating (Canonico et al., 2021).

Using appropriate visual representations allows us to present knowledge at a given moment and link it to previous knowledge, facilitating knowledge dissemination for decision-makers and problem-solving. Diagrams, tables and maps are useful for representing precise and indexical information, both quantitatively and qualitatively, supporting decision-making by constraining the set of alternatives that one must consider during a decision-making activity and specifying paths and commonalities among different problem states within an information space (Parsons and Sedig, 2014). Decision-makers need to be aware that KV can enhance knowledge processes and bias them by constraining the attention to a limited set of alternatives, focusing the attention on the wrong variables or encouraging inaccurate comparisons (Al-Kassab, 2014).

KV investigates the use of visualisation techniques to facilitate communication in knowledge-intense processes and support the creation of new knowledge by using visual techniques. It also explicates, shares or develops knowledge and supports the creation of visualisations for contents that constantly change, such as a process or complex project (Burkhard, 2006).

The emerging field of KV examines the use of visual representations to improve knowledge management on all levels (personal, interpersonal, team, organisational, inter-organisational and societal). It designates all graphic means that can be used to construct, assess, measure, convey or apply knowledge (i.e., complex insights, experiences, methods, etc.). The decision-makers who employ KV aim to create, assess, reference or transfer insights, experiences, attitudes, values, expectations, perspectives, opinions and predictions, and they do this in a way that enables someone else to re-construct, remember, find or apply these insights correctly (Eppler, 2008). This factor is relevant because the visualisations may reduce the cognitive load and enhance the processing abilities by visualising abstract relationships.

3. Methodology

In this study, a qualitative and exploratory methodological approach has been implemented. There are limited studies in the academic literature on the topic of KV and even fewer studies that explain and define KV practices within public administration. The qualitative research approach is appropriate for obtaining a greater description of the phenomenon by the complex nature of the organisations under observation. In fact, knowledge, due to its immaterial nature (Moustaghfir and Schiuma, 2013; Vesperi, et al., 2019), is difficult to capture and observe with different methodologies.

For this reason, the qualitative approach appears more coherent for collecting data or information relative to the indescribable nature of people's understandings, interpretations, feelings or thoughts (Patton, 2002; Ritchie et.al, 2003), participants' perspectives and discovering and conveying the delicacy of their responses (Nunes, et al., 2017). The exploratory nature aims to build the theoretical premises regarding KV, the use of KV in public administration and the support decision-making. With these premises, the methodology is based on the analysis of case study. Research based on the empirical observation of a case study allows for a better understanding of a wide variety of aspects of the phenomenon investigated (Gerring, 2007; Vennesson, 2008). The case study structure is useful for fully understanding an organisation in its context (Crowe et al., 2011, Hyett et al., 2014).

The Italian judicial systems are a complex system of a public nature made up of numerous courts, based on civil law. Courts have different specializations. In fact, according to the specialization we can have Ordinary civil and criminal law, Administrative, Accounting, Military and Taxation courts. Analyzing the Italian judicial systems appears very interesting, due to the direct repercussions on the quality of life of the citizen/user. The Italian judicial systems present several critical issues.

Preliminary, the Italian court assume the characteristics of bureaucratic configuration, with numerous hierarchical levels, centralization and pressure on resource management.

Second, the outcome of the judges' decision-making process (judgments) is slow, often hampered by incorrect documents and procedures. For this reason, our analysis focused on understanding the support and use of KV during the judge's decision-making process. A court with jurisdiction in civil and ordinary criminal matters will be examined. The observed case is that of an Italian court. In particular, the study focuses on the decision-making process that the judge applies, within the court, to deliberate a decision (sentence).

Three data collection techniques were used: desk analysis, participant observation and semi-structured interviews (Schiele and Krummaker, 2011). The documentary analysis made it possible to understand and identify the organisational characteristics of the decision-making process. To increase the quality of the material and identify significant consistencies with the aim of the research, a thematic analysis is carried out (Patton, 2002). During the interviews with the decision-makers, experiences, opinions and all the elements for the investigation of the phenomenon were collected. At the end of each interview, the researchers who conducted the interview shared and discussed the interviews' results with the interviewees, based on the approach described by Ricoeur (1986; Kahkonen, 2014; Canonico et al., 2021).

Finally, participant observation was done by the researchers who carried out the field work by accessing the Italian court premises and verifying the KV tools present. This allowed us to acquire relative familiarity with the implementation of their KV tools (Khan et al., 2019).

4. Findings and Conclusions

To understand the implementation of KV within the observed case, the results of this study were collected based on the framework for KV proposed by Burkhard and the model by Eppler (2005, 2007). In fact, using this theoretical framework it was possible to identify and understand the use of KV in the context of an Italian court, explaining the interactions of the decision-maker. KV must be understood as a crucial component of Knowledge Management (KM), with which decision makers can obtain information and thus manage and share knowledge. The results highlighted the use of formats for KV, in different stages of the decision-making process. The first result that emerged from the observation of the case study is that the KV allows to guarantee clarity of data and information, determining greater speed in the transfer of knowledge. Despite this, the KV assumes a marginal "weight". In fact, regulatory impositions lead to a greater implementation of some forms of KV than others. This causes the use of KV tools considered more "suitable" and commonly used.

The complexity of the decision-making process in public administrations, with timing and phases strongly influenced by legislation and the context such as in the courts, characterized by different sources of data and information of different nature.

The decision-making process that determines a sentence is a multi-step process, consequently the use of knowledge visualization allows knowledge to be made accessible, discussed and shared. The reason visual archetypes, containing representations of the real world, are used is because humans could rapidly process images and relate them to prior knowledge already associated with a known image. When you see an image, you know what it represents even if you don't remember the name/concept. It is important that the decision maker is aware of the type of recipient that identifies the target group and the context of the recipient, which can be an individual, a team, an entire organisation or a network of people.

From the observation of the case study, it emerges that the implementation of the KV is strongly influenced by the context and the cognitive background of the recipient to find the right method of displaying the KV. KV offers a systematic approach to the creation, coding, transfer and identification of knowledge at various levels: between individuals, from individuals to groups, between groups and from individuals and groups to the whole organization. To do this, the knowledge must be recreated in the mind of the recipient (El Sawy et al., 1997). This depends on the recipient's cognitive ability to process incoming stimuli (Vance and Eynon, 1998). Once the knowledge is visualized, the decision maker captures feedback from the target audience. Therefore, the responsible person must also convey it in the right context and in a way that it can be used and remembered. The decision-maker, with the help of his own skills and experience, will start a new decision-making process which will lead to the construction of a new view. In this new phase, the decision maker will be able to refine or add more KV formats until knowledge creation, encoding, transfer, identification, etc. is successful. The use of knowledge visualization by all the organizational actors involved in the judge's decision-making process confirms the characteristics of speed and information transfer and the visualization of emerging notions. The use of KV tools emerges from the analysis of the documentation, from the observation of the process and from the interviews carried out, to improve the understanding of particularly complex information and data. In fact, in

the presence of technical data and information, there is a tendency to use KV tools to improve understanding and the risk of information loss.

Some KV tools are preferred over others. The most used tools are diagrams, sketches and images. These KV tools are used to support the transfer of technical knowledge from one organizational actor to another. The main KV tool used are diagrams that allow you to synthesize large quantities of words, making it easier to understand the text. This tool is used to report historical data or future projections. Using different colors, the diagrams make complex information visual and intuitive.

The sketches facilitate the transfer of cross-functional knowledge between different individuals with different professional backgrounds. As we discovered during an interview, the use of sketches encourages reflection and debate between different subjects. Above all it supports the communication process, making explicit and questionable the knowledge in progress, which is generally used to highlight their problem-solving potential.

Finally, images are considered as a "safe and seeking source" of knowledge, as they leave no room for subjective interpretation.

The other knowledge visualization tools (objects, knowledge maps, concept maps and interactive visualization) are not used.

By deepening the analysis on the implementation of visualization in KM it is possible to identify the type of knowledge transferred. The results show that KV allows to transfer knowledge deriving from different sources in a simple and pictographic way. Specifically, KV promotes more effective and faster work and improves teamwork. Better capture staff attention and make knowledge-related work and contributions more effective. However, KV takes longer to prepare, which is rewarded by reduced decision time. In the application of KV, one can explore large and time-varying datasets and allows them to see the behavior of individual data items in the global context of the entire dataset.

The implementation of the visual format has improved the decision-making process as it has allowed the acquisition of cognitive information supported by visual elements.

Knowledge visualizations have been used to explain and answer questions about why, what, who, when and how. The diversity of the target audience underlined that KV has to be adapted to the preferences of the target audience (teaching staff, administrative staff, students, etc.), which then have to be implemented in the different types of KV. Formats can improve the creation, identification and transfer of knowledge.

5. Discussion

The results of this study have provided important food for thought. Visual representations of information and knowledge are the modern dimension of KM (Miah, et al., 2017).

From a theoretical point of view, the results of this study can contribute to the growing debate in knowledge management studies on decision-making problems. In particular, the results of this study highlight the role of visualization to transfer and share knowledge in a new and rapid way, supporting decision-making processes through visual representations. Empirical observation from a court highlighted the complex decision-making process and the role of KV in supporting decision makers. The data collected through interviews with decision makers, analysis of internal documents and participatory observations show that the use of KV has had an overall positive impact, which leads to better communication and better understanding of information and data.

The results highlight the flexibility and adaptability of KV formats in organizations. The different KV formats adapt to the characteristics of the organizations, allowing them to accelerate their decision-making process. KV formats have helped decision makers see patterns in data that are more difficult to detect through rational methods, improving decision making (Lurie and Mason, 2007). Visual representations can expand problem-solving capabilities by allowing more data to be processed without overloading the decision maker (Lurie and Mason, 2007, p. 2).

6. Managerial and Social Implications

This study offers some preliminary reflections on the implementation of knowledge visualisation within the public administration, with particular focus on Italian court. Starting from the assumption that the improvement of the justice system has a direct impact on the quality of life and the well-being of the citizen\user, this study has highlighted the complex decision-making process that characterizes the Italian courts. In particular, the results offer managerial and social implications on the Italian legal system and on the functioning of the judge's

decision-making process. The academic debate within knowledge management studies appears very broad and with numerous fields of application and empirical observation. Nonetheless, the implementation and support of knowledge visualization appears to be an area of strong growth. Above all, there are very few observations from public administrations. Improving and supporting the judge's decision-making process can lead to improvements in the quality of life of the citizen/user.

The preliminary results of this study show that knowledge visualization tools are used by judges to make their decision (sentence). However, some other considerations are necessary. In particular, the complex decision-making process divided into numerous phases, highly formalized and influenced by legislation, limits the true understanding and application of KV. At the same time, the choice and implementation of KV tools can guarantee the speed and certainty of the information and data acquired.

The results of this preliminary study contribute to the academic debate by offering reflections to start future research on public administrations and to understand its real impacts on the implementation of the KV.

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Advancing the Intellectual Capital Theory: Some Ways Forward

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Abstract: The development of intellectual capital theory has been guided by the ideas and thoughts of a handful of influential practitioners, including Sveiby (1997), Kaplan (Kaplan and Norton, 1992), and Edvinsson (Edvinson and Malone, 1997). These pioneers established the basis of the "intellectual capital standard theory". More recently, other authors have advanced some contributions integrating an ecosystem approach in line with sustainability concerns. The present paper discusses the assumptions and principles that support the standard theory (the prevailing paradigm). The paper then introduces other models and methodologies as alternatives to the standard theory—such as the "Value Explorer" (Andriessen and Tissen, 2000) and the "Intellectual Capital Benchmarking System (ICBS)" (Viedma and Cabrita, 2012)—and examines the foundations and principles on which the alternative new theory (the 'new paradigm') is based. Finally, the paper attempts to synthesize both theoretical approaches with other new views and contributions and rises discussion avenues on the topic.

Keywords: Intellectual capital, Knowledge management, Strategic management, Models, Paradigms, Theory

1. Introduction

Intellectual capital (IC) issues have undergone extraordinary development since the beginning of the 1990s. The increasing difference between company market value and company book value has prompted academics and practitioners to consider the concept of "intellectual capital" as a key determinant of the process of value creation for shareholders, managers, and society. In this paper, we define IC as the knowledge and other intangibles that produce or create value in the present and other intangibles that will produce value in the future. It's true in any dimension (micro, macro, meso). In such a context, it is vital to identify what is value creation and the ingredients to drive the value creation process. This paper intends to contribute to this field.

The development of IC theory has primarily been guided by the ideas and thoughts of a handful of influential practitioners, including Sveiby and Edvinsson. These pioneers established the foundations of the way in which intangible factors determine the success of companies. In the words of Andriessen (2001), the pioneers established the basis of the "intellectual capital standard theory". Their respective models - "Intangible Assets Monitor" (IAM) (Sveiby, 1997) and "Skandia Navigator" (Edvinsson and Malone, 1997) - are representative of the assumptions, principles, and foundations of the IC standard theory. Nevertheless, the academic contributions to the IC theory came later, mainly due to the pioneering efforts of Nick Bontis (2002), who promoted the first "World Congress on Intellectual Capital and Innovation" in 1996 and contributed to the creation of the "Journal of Intellectual Capital". Later contributions from other academics and practitioners have developed and refined the standard theory. Among many, some authors (Dumay, 2009; Dumay and Garanina, 2013; Dumay *et al*., 2020; Paoloni, *et al*, 2023) have contributed to the field of IC theory consciousness, examining IC methods and applications, and critically analyzing how evolving approaches have been explored and contributing to additional understanding of IC. In the 2020s, IC research has advanced beyond its original strategic focus on identifying, measuring, managing, and reporting. Today, this theory is the pre-eminent guide to the management of intangible assets and has facilitated success through sustainable competitive advantage for leading companies and organizations. While acknowledging all the contributions in the sense of a more comprehensive theory of IC, this work focuses on the assumptions and foundations of a new IC paradigm, discussing the limitations of the IC prevailing concept.

The paper is structured as follows. Following this Introduction, Section 2 presents the representative models and methodologies from the standard theory (or "prevailing paradigm")—the IAM, the "Balanced Scorecard", the "Skandia Navigator" and the InCaS "Intellectual Capital Statement, Made in Europe", exploring the assumptions and principles that support the standard theory (or prevailing paradigm). In Section 3, other models, and methodologies as alternatives to the standard theory are introduced. These include the "Value Explorer" (Andriessen, 2001), and the "Intellectual Capital Benchmarking System" (Viedma, 2001). These two

models share similar goals and taken together, propose some new approaches, opening avenues for discussion on the topic. Section 3 also examines the foundations and principles on which the new approach is based. In Section 4, the paper attempts to synthesize both theoretical approaches with other new views and contributions. Finally, in Section 5, some of the most relevant conclusions are presented.

2. Representative Models and Principles Underlying the Standard Theory (or Prevailing Paradigm)

2.1 Classification of Intangible Assets

Intangible assets (IAs) have been extensively analyzed in the economic literature, however, there seems to exist little agreement on issues such as their economic nature, definition, and classification, the way in which they affect the value of companies or the criteria that should be adopted for their recognition, measurement, and depreciation. Although IAs are assets without physical substance, many do not meeting traditional accounting standards' recognition criteria, but they contribute significantly to the market value (Balzer *et al*., 2020). Many attempts have been made to develop theoretically consistent classifications of IAs. One such simple classification is given by Sveiby (1997), including its Intangible Assets Monitor (IAM). This tool aims to guide managers on the use of intangible assets and is focused on three types of IAs: external structure assets, internal structure assets, and competence of assets used.

2.2 Representative Models of the Prevailing Paradigm

Because IC is the key source of wealth creation, it is logical that firms pay close attention to the effective management of such capital. Therefore, the ability to identify, audit, measure, renew, increase, report, and communicate these intellectual assets is a key factor for the success of companies in the modern environment. In this regard, significant effort has gone into the search for methodologies/models to improve the management of IC—although, it must be said, with mixed success. The main reason for this is the nature of these assets and the fact that each business has its own business model, knowledge mix, specific objectives, and market environment. The literature provides different intangible asset evaluation approaches and levels of detail, which change according to the purposes of each proposed approach. Three authors have been of special significance in this search for useful models of IC: i) Sveiby (1997), author of the first intellectual capital model—the "Intangible Assets Monitor" (IAM); ii) Kaplan and Norton (1992) who devised the Balanced Scorecard methodology (especially with respect to effective strategy implementation); and iii) Edvinsson and Malone (1997), architects of the "Skandia Navigator".

A more recent collective effort synthesizes contributions of the European project called InCaS (Intellectual Capital Statement. Made in Europe, (2006).

2.3 Assumptions and Principles of the Prevailing Paradigm

The main assumptions and principles that support the standard theory (or the prevailing paradigm) can be summarised in seven points:

- *The accounting view;
- *The strategy implementation view;
- *Breakdown of intellectual capital;
- *Cause-and-effect relationships;
- *Relatively static approach to value-creation processes;
- *Limitation of the concept of IC;
- *Use of the same models and methodologies to manage and produce reports; and
- *Attempts to treat intangible assets as if they were tangible.

Each of these is discussed briefly below.

The accounting view

Among representative models of the standard theory, there are some that try to explain the causes of the difference between the company market value and the company book value. The aim is to establish an IAs accounts plan that allows the identification of the relevant IAs and their later valuation. This is an accounting approach to IC.

The Strategy implementation view

Most of the representative models corresponding to the standard theory follow a strategy implementation approach. It is assumed that in the company where the IC model will be applied, there is a strategy already formulated in implicit or explicit terms.

Breakdown of intellectual capital

This is a common denominator of all models. Despite the different terminology that they each use, the four models previously mentioned all breakdown IC into its distinct elements. These elements can be summarised as human capital, structural capital, and relational capital. For each of these elements, the company establishes a set of indicators that are used to consider each specific type of capital.

The daily firm's operations show that this division is artificial because, in the value-creation processes, all three types of IC act together, and such a division never arises. Furthermore, physical, and financial assets act together with the intangible assets in the value-creation processes.

Cause-and-effect relationships

The models of the prevailing paradigm examine cause-and-effect relationships between each of the three types of capital (human, structural, and relational) and each of the objectives (strategic and financial). These are extremely difficult to establish—due mainly to the artificial division of the model's intangible assets. In the value-creation processes, the human assets act together with the structural and relational assets, making it difficult to determine such cause-and-effect relationships.

Relatively static approach to value-creation processes

The artificial categorization of IC lacked consideration of how firms deploy their resources through their organizational core activities. Because of this, the above-mentioned models fall short of explaining how firms effectively compete.

Although Sullivan (2000) deemed the IAM and the "Skandia Navigator" models to be oriented toward value creation, it should be emphasized that they lack the dynamism and flexibility required in the turbulence of the modern environment. By focusing on existing IAs (human, structural, and relational intellectual capital), these models become prisoners of a dangerous reductionism. Indeed, the most common reason for failure in firms today is deficient strategy implementation—which demands paying close attention to what the firm does (rather than what it has). In short, the prevailing paradigm lacks an activity-based view (ABV).

Limitation of the concept of intellectual capital

Existing models limit discussion of IC to ideas of means of production, and do not take proper account of other non-intellectual intangibles—such as values, organizational culture, and so on. The models described above consider IAs as being mainly intellectual assets or knowledge assets—that is, those that psychologists ascribe to the left side of the brain. However, other IAs (such as values, organizational culture, talent, motivation, and employee commitment) also exist.

Use of the same models and methodologies to manage intangibles and produce external reports

The above-mentioned models are too often identified with the reports of IAs that they generate, which supplement the balance sheets of the company's tangible assets. Usually, the same models and methodologies that are used to prepare such external reports of IAs are also used to manage the same intangibles—even though the requirements of management are quite different from those of preparing an external report. One exception is the "Balanced Scorecard", which was specially conceived as a management tool. Moreover, the end users of intangibles reports are shareholders, suppliers, financial, institutions—that is, external stakeholders in general. In contrast, the end users of management models and methodologies are the organization's internal managers.

Attempts to treat intangible assets as if they were tangible

The use of the term "intangible assets" is dangerous—in that it induces people to think of "intangibles" as assets that can be entered into the books as if they were tangibles, using the extended accounting system of double entry.

Several efforts have been made to assimilate IAs with tangible assets. Some models attempted to apply to IAs similar procedures to those that have been universally applied to tangible assets—with the aim of generating balance sheets and earnings statements that could be used to make comparisons among any type of company,

no matter its nature. Caddy (2000) followed a similar approach in his attempt to discover and assess not only IAs but also intangible liabilities.

3. Representative Models and Principles Underlying the New Theory (or New Paradigm)

3.1 Representative Models of a New Paradigm

In the late 1990s, the problems encountered (particularly by small and medium-sized enterprises) when trying to put into practice the prevailing IC models and methodologies led to the development of new methodologies and an alternative theoretical paradigm. Among these new methodologies are the "Value Explorer" (Andriessen, 2001), and the "Intellectual Capital Benchmarking System" (Viedma, 2001, 2003a, 2003b), explored below in a little detail because it represents an introductory methodology to the new theory of IC.

"Intellectual Capital Benchmarking System" (ICBS)

The "Intellectual Capital Benchmarking System" (ICBS) has a strategic view—as does the "Value Explorer". Nevertheless, there is a substantial difference between ICBS and the rest of the IC models. ICBS focuses mainly on strategy formulation whereas the other IC models essentially consider strategy implementation.

In the following paragraphs, we describe the fundamentals of ICBS.

In today's knowledge economy, the Resource-Based View (RBV) and the Activity-Based View (ABV) are the fundamental cornerstones that determine company competitiveness. The RBV (Barney, 1991, 1999; Grant 1991, 1998; Teece *et al*., 1997) stresses that, in turbulent times and in times of rapid change in technology and in customer and industry needs, sustainable competitive advantages are mainly due to the intangible resources of a company or, more specifically, to core competencies (which are, in practice, equivalent to core knowledge). But resources *per se* do not create value, and because the RBV focuses only on what the firm *has*, this view does not, in isolation, adequately explain *how* to deploy scarce resources to create superior value. To that end, the ABV (Porter and Rivkin, 1998) is a necessary complementary perspective that focuses on what the firm *does* and considers that value creation results from the activities to which the resources are applied. If core knowledge is the key strategic asset, improving existing core knowledge and building new core knowledge are fundamental tasks. Building and improving core knowledge requires organizational learning capabilities, including the appropriate learning structures and information systems. World-wide industry hyper-competition has ensured that strategic competitive benchmarking has become an essential learning tool. In fact, companies and organizations are now competing based on core knowledge and core competencies. Opportunities and threats come mainly from competitors who offer the best in the same industry segment.

As a result of the above discussion, the SWOT analysis framework moves from that shown in Figure 1 to that shown in Figure 2. In effect, there is a change from a simple SWOT analysis to an extended SWOT analysis.

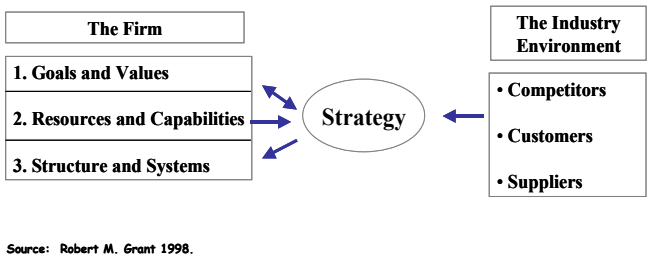


Figure 1: SWOT Analysis

The extended SWOT analysis gives us the main factors to consider when seeking strategies that lead to entrepreneurial excellence. The main factors of the extended SWOT analysis also determine the information system required to measure and manage those factors. In other words, the main factors produce the strategic benchmarking of the intellectual capital system (ICBS) that we have defined as a knowledge-based strategic management methodology and information system framework. Nevertheless, strategy formulation in dynamic environments has different features when dealing with the innovation process than when dealing with the operations process. Core capabilities can be very different in the two processes.

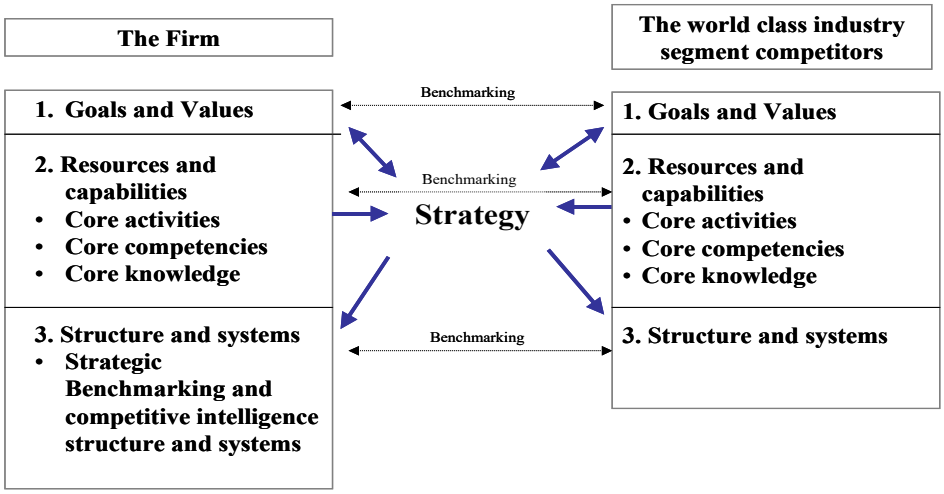


Figure 2: Extended SWOT Analysis

The innovation process points to new products and services through the innovation value chain in which innovation capabilities are basic and fundamental. ICBS has a specific system for the innovation process—the innovation intellectual capital benchmarking system (IICBS) (Viedma, 2002).

The operations process, which produces ordinary products and services through the systematic and repetitive operations value chain, also requires core competencies and core capabilities to be competitive. However, these competencies and capabilities will probably be of a different nature from the ones mentioned above in the discussion of the innovation process. ICBS also has a specific process for the operations value chain—the operations intellectual capital benchmarking system (OICBS). Figure 3 illustrates the business process broken down into its two constituent parts, and the specific methodologies and information systems that correspond to each of the constituent parts.

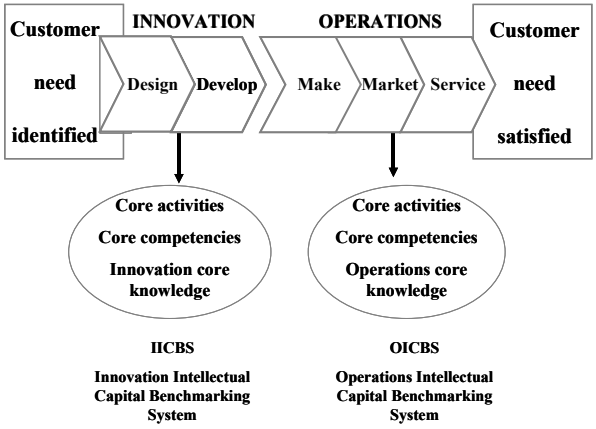


Figure 3: Business Process Value Chain

In summary, the general model of the ICBS can be divided into two partial models. The IICBS, refers to innovation core activities and core knowledge, whereas the OICBS, refers to operations core activities and core knowledge.

The two models have a similar structure but there is a fundamental difference. The IICBS model refers to the core activities and core knowledge of the different projects that make up the innovation process. In contrast, the OICBS model refers to the core activities and core knowledge of the different business units that make up the operations process.

Detailed information on the ICBS systems can be found in Viedma, (2003a, 2003b), Viedma (2001), and Viedma and Cabrita, (2012).

3.2 Assumptions and Principles of the New Paradigm

The main assumptions and principles that support the new intellectual capital theory (or the new paradigm) can be summarised in seven points:

- *The complete strategic view (strategy formulation as well as strategy implementation);
- *Not breaking down IC into its constituent parts;
- *Core competencies as the only IAs to manage;
- *Reality and dynamism in the value-creation processes;
- *Breaking down core competencies into their constituent intangible assets;
- *Core competencies linked with core capabilities of professionals who work independently or in teams;
- *Evaluation and assessment of the value-creation potential of future core competencies.

The complete strategic view

The models of this new paradigm support decision-making, not only in the process of strategy implementation but also in the key process of strategy formulation. According to this approach, it is not important to determine and appraise every intangible asset—because only a few are relevant to a firm's strategy formulation and implementation. These few relevant IAs are usually grouped according to the firm's core competencies or core capabilities—which are the true IC and then, the key variables to manage.

The theoretical background to the significance of core competencies is grounded in resources and capabilities theory (Barney, 1991, 1999; Grant, 1991, 1998; Teece et al., 1997). In short, this view focuses on the fact that, in turbulent and changing environments, competitive sustainable advantages are due mainly to resources and capabilities—in particular, the core competencies or capabilities that Andriessen (2001) describes in terms of a "coordinated bundle" of IAs that constitute the roots of the firm's competitive sustainable advantage.

Not breaking down intellectual capital into its constituent parts

The new theory focuses on a strategic view in achieving the firm's mission and objectives and in surpassing its "best in class" competitors. Thus, the artificial division of IC into human, structural, and relational capital is of little use because the products and services that result from a specific strategy have no relationship at all with these three types of capital considered independently. Rather, these products and services are associated with an integrated bundle of such assets as reflected in core competencies and capabilities.

Core competencies as the only intangible assets to manage

From the above discussion, it can be concluded that, for each business unit in the operations value chain, and for each project in the innovation value chain, the only assets to manage are those grouped in the core competencies, which are not usually very numerous (Del Giudice et al., 2021).

Reality and dynamism in the value-creation processes

One of the main questions that have always been at the core of the strategy theory is: 'How do firms create and exploit value?'. This leads to an examination of what is deemed to be the essence of entrepreneurial success—good strategy formulation and implementation. Seeking answers to these sorts of questions leads back to both the RBV and the ABV (because implementation is mainly about activities) to try to explain how firms deploy resources to create sustainable competitive advantages and achieve superior performance.

From a knowledge perspective, this is possible only if the models pertain to the new emerging paradigm of IC—the ICBS and the Value Explorer. The focus of these new models on a firm's core competencies allows considerations not only of which intangible resources are crucial to achieving success, but also of which core activities must be acted upon (if it is accepted that value creation and exploitation are both intrinsically resource-oriented and activity-oriented). It is not only what the firm has, but what the firm does, that matters in value creation (Haanes and Fjeldstad, 2000).

Breaking down core competencies into their constituent intangible assets

Once the principle that core competencies constitute the firm's authentic IC has been accepted, the improvement, strengthening, and enrichment of the intangibles' "bundle" is enhanced if they are broken down into their constituent parts. This should be undertaken in a broader sense, including not only intangibles that are intellectually based but also intangibles that are effective in origin.

Core competencies linked with core capabilities of professionals who work independently or in teams.

Core competencies are the result of aggregating IAs of different types. But each asset is made up of knowledge and skills, and skills are always generated by human beings—working either independently or in teams. Thus, core competencies management is essentially dependent upon the effective management of the core competencies of professionals who work either individually or in coordinated teams.

Evaluation and assessment of the value-creation potential of future core competencies

Finally, the strong relationship between future products and services and the competencies that support them allows an assessment of the future potential of each core competency or core capability. The "Value Explorer" appraises the strength of each core competency by means of the following four criteria: (i) value-added to customers; (ii) future potential; (iii) sustainability; and (iv) robustness.

4. A Comprehensive Theory of Intellectual Capital

4.1 Other new Views and Contributions

Following the above discussion, the present paper attempts to synthesize both of these theoretical approaches with other new views and contributions. The new views and contributions considered in this context are:

- *The essential role of commitment and action;
- *IC as the difference between intangible assets and intangible liabilities;
- *IC as a dynamic concept;
- *IC identified with the concept of a 'business recipe' in action;
- *Benchmarking as a strategic tool.

Each of these is discussed below.

The essential role of commitment and action

Commitment and action have an essential role in the process of wealth or IC creation. Firm competencies are the ultimate creators of IC. As such, they are a necessary but not sufficient condition for wealth creation. However, firm competencies must be established with the incorporation of certain personality characteristics and attitudes that reflect a strong commitment to convert competencies into competitive and profitable products and services. This positive emotionality embedded in the concept of commitment, together with an appropriate bundle of competencies, is what ultimately accounts for differences in human and organizational behavior (Fait et al., 2021). Commitment is the 'copper wire' that leads human competencies through to superior organizational performance. It is the element that enables these competencies, purposefully aligned with the firm's strategy and objectives, to find their way to market considerations.

Furthermore, commitment accounts for the sustainability of the firm's competitive advantages. The demands for innovation that the knowledge economy has exerted on firms have, in turn, emphasized talent as the main value driver of capital creation. Given that talent is acknowledged as a key source of competitive advantage, the ability of a firm to manage this intangible also becomes a core competence that adds to the firm's value. In such an environment, commitment needs to be managed as well as competencies (Mayo, 2001; Criado-Gomis et al., 2017).

It is therefore apparent that IC theory needs to develop new ways of systematically including commitment in its appraisals. It has long been recognized by theorists in organizational behavior that commitment is a basic driver of a firm's performance, and its explicative power has been clearly demonstrated in entrepreneurship research (Fichter and Tiemann, 2018).

Intellectual capital as the difference between intangible assets and intangible liabilities

Practically all models (both those of the prevailing theory and of the new paradigm) refer only to IAs. Caddy (2000) was the first to consider the existence of both intangible assets and liabilities in organizations. Whereas IAs are oriented toward wealth creation, intangible liabilities are oriented toward its destruction.

It is apparent that IC should be defined as the difference between intangible assets and intangible liabilities, such that positive and negative drivers of value creation are both considered—thus allowing effective intellectual capital management. Given that managing IAs is a difficult task, identifying and measuring intangible

liabilities would appear to be an even more difficult task. However, IC theory is mature enough to undertake this exercise.

Intellectual capital as a dynamic concept

Most models approach IC only in terms of a static concept, without reference to how intangible categories create and destroy wealth. They fail to consider wealth creation and destruction as taking place through virtuous circles and vicious circles.

A virtuous circle can be said to be in place when there is a good alignment of the personal and professional objectives of key people with those of the organization, thus leading to an environment of creativity and positivity. In contrast, vicious circles reflect a malalignment of the objectives of employees and those of the organization. It is possible to identify and manage these circles only through a dynamic approach to intellectual capital assets and liabilities. This identification of virtuous circles and vicious circles must be combined with the identification of intellectual assets and liabilities (as noted above).

All of this emphasizes the need to include ABVs within the new general theory of IC.

Intellectual capital identified with the concept of 'business recipe' in action

Core knowledge and core competencies are brought to bear in creating value through a successful 'business recipe' (BR). The difference between a successful business formula and a successful business recipe is the same as that between a successfully formulated strategy and a successfully implemented strategy. Superior performance that ends in value creation is a natural consequence of a firm's success in bringing a superior business formula into the market. This emphasis on implementation is thus significant for any new general theory of intellectual capital—especially in view of the comments already made (above) about the importance of activity-based views in identifying intellectual liabilities and vicious circles.

Benchmarking as a strategic tool

Recognizing the importance of benchmarking as a strategic tool allows early identification of virtuous and vicious circles and facilitates the management of IC in accordance with the new views and contributions outlined thus far. The only IC measurement tools that introduce benchmarking techniques in their appraisals are those of the Innovation Intellectual Capital Benchmarking System (IICBS) (Viedma 2003a) and the Operations Intellectual Capital Benchmarking System (OICBS) (Viedma 2003b). The objective of both -IICBS and OICBS - is to determine whether the firm possesses superior core competencies in relation to the world's best competitor. This can be used to account for sustainable competitive advantages that might lead to superior performance.

In terms of assessing world competitiveness, IICBS and OICBS benchmark a firm's business recipe against that of its world's best competitor. A firm will be able to create value in the long run if its BR has proven to be superior to the world's best. A detailed and thorough process of benchmarking will enable the identification of superiority (or inferiority)—signaling the presence of virtuous (or vicious) circles that will have to be subsequently managed.

However, a firm's intellectual assets and liabilities, together with its virtuous and vicious circles, remain a matter for the firm's internal management.

4.2 The Formulation of a Comprehensive Theory of Intellectual Capital

The discussion above stresses the main ideas of a general theory of intellectual capital, depicted in Figure 4. This new theory rests on the following principles:

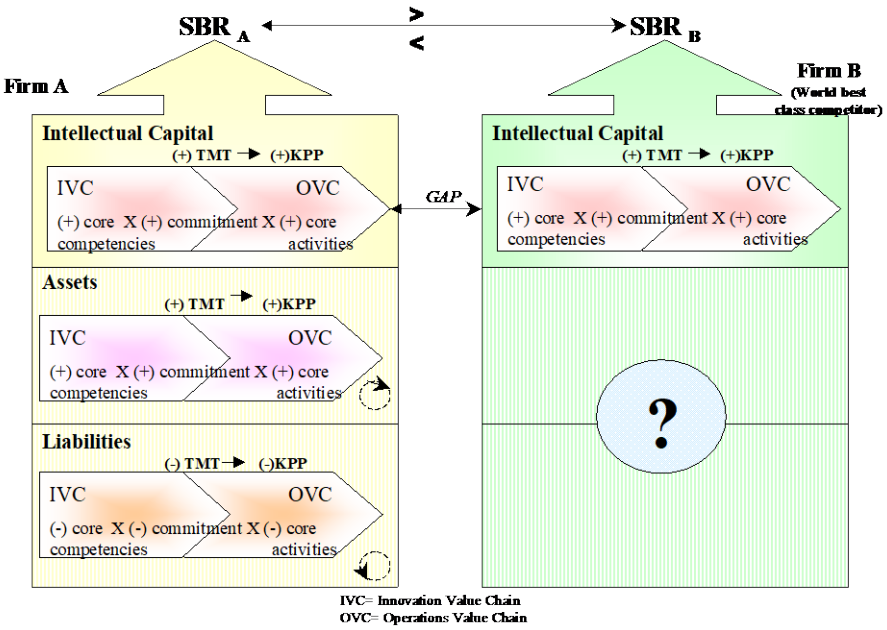


Figure 4: A Comprehensive Theory of Intellectual Capital (Main Concepts)

- *A firm's success is always the result of both well-formulated and well-implemented strategies (Grant, 1998).
- *Successful strategy formulation and execution crystallizes in a successful business recipe (SBR) that offers customers competitive and good-quality products and services. Ultimately, an SBR is the market's validation of the firm's competitive quality offer.
- *Strategy formulation and execution is always a human task. It is in the hands of the top management team (TMT) and the firm's most important technicians and managers—its key professional people (KPP).
- *The TMT and the KPP start from a business formula (that is, a formulated strategy), work through the innovations and operations value chains, and finally accomplish an SBR (as an implemented strategy). Those activities can be performed in a superior way due to the core knowledge and core competencies of the KPP.
- *Apart from the core knowledge and competencies of the TMT and KPP, the process also requires commitment from the TMT and KPP to convert the business formula into an SBR, and thus carry the firm to success. Such a commitment fosters a climate of positivity and trust that is essential for knowledge sharing, organizational learning, and value creation.
- *A firm's BR can only be judged as being successful (that is, an SBR) when it has been proven to be clearly superior to those of the best international competitors as a consequence of a complete and detailed process of benchmarking.
- *For analytical purposes, core knowledge and core competencies can be broken down into their constituent parts of human assets, structural assets, and relational assets.
- *The engine of the process leading to an SBR are the core knowledge, core competencies, and strong commitment of the TMT and KPP who strategically manage value-chain activities in a motivating and knowledge-sharing environment. This is the dynamics of IC creation through virtuous circles. An effective SBR must constantly transform itself to fit the demands of an ever-changing environment.
- *It should not be assumed that the TMT always develops certain activities and actions that are perfectly aligned with the firm's strategy and objectives. Frequently these top managers coexist with others whose professional and personal strategies are not aligned with those of the organization—thus producing vicious circles.
- *The engine of the process leading to wealth destruction (BR deterioration) starts in the TMT—in those managers whose personal objectives prevail against the organization's strategic objectives. These managers put their core knowledge, core competencies, and commitment into effect in a way that does not produce value creation.
- *The above description of virtuous and vicious circles represents two extremes in a continuum of typologies. For a given firm, it is to be expected that several circles of both types might coexist, each

of them more or less important, thus placing the firm in an intermediary position between the two extremes of 'virtuous' and 'vicious'. These configurations evolve through time. They change, expand, and contract—depending on the firm's ability to manage them effectively. It is worth noting that the negative effects of the vicious circle are generally more pervasive than the positive effects of virtuous circles—causing a given firm's performance to shift to the left (thus invading the virtuous positive zone). Figure 5 depicts these ideas.

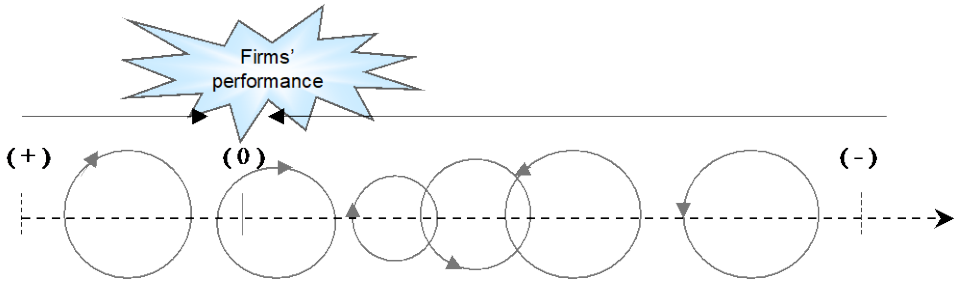


Figure 5: The Coexistence of Virtuous And Vicious Circles

5. Conclusions

An analysis of representative models of the prevailing theory, together with those of the alternative new theory, followed by a synthesis of the two and the integration of new views and contributions, has enabled the present paper to open promising avenues of discussion towards a comprehensive theory of intellectual capital. By conceptualizing IC as the difference between intellectual assets and liabilities, this new general theory attempts to unravel and tackle the fundamentals of the value-creation process in firms. At the inner core of such an analysis is the concept of the management of virtuous and vicious circles, and the importance of the personal objectives of top management and key personnel being aligned with the objective of the organization in a spirit of strong commitment. The general theory of IC introduces a new concept of superior business recipe (SBR) to emphasize the importance of successful implementation in a context of a dynamic understanding of IC.

Finally, in the search for new methodologies to manage IC in accordance with the principles of the new general theory, the OICBS and IICBS methodologies have been emphasized in the belief that strategic benchmarking is the best available tool to keep track of the innovations and value-creation processes of competitors.

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Linking Adult Learning to Knowledge Management in a Multigenerational Workforce

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Abstract: The last years have born witness to immense shifts in the workplace environment; the way people work, their work expectations and work engagement have been modified by both internal and external factors. Distant or hybrid work is no longer a novelty. With increasing remote work becoming a norm, the need for knowledge management (KM) is more evident than ever before. In an era of digitalisation, information technology, social networking and artificial intelligence (AI) software, where the active workforce and knowledge capital of an organization is comprised by four different generations (Baby Boomers, Generation X, Millennials and Generation Z) the organizational memory and intellectual capacity have to be readdressed. Sustaining a long-term, competitive advantage entails, after all, knowledge management efficacy. How KM processes (knowledge creation, sharing/transfer, acquisition, storage/retrieval and application) are administered and organised is important. For the above reasons, the aim of this paper is to rejuvenate the concept of KM by integrating adult learning theories in the organizational learning culture, and addressing the four different age cohorts of employees. Collection of information and assessment of strategies, tactics and practices is conducted via a systematic review of the literature. The main contribution of this paper involves the way in which adult learning principles can smooth transitions, enrich skills and capabilities, and encourage the development of a collaborative multigenerational knowledge pool that can facilitate overall management. Furthermore, practical and theoretical implications are discussed, limitations are communicated, and opportunities are located that can further enhance knowledge management in the future.

Keywords: Knowledge management generations, Adult learning theories, Age-diversified workforce, Cross-generational and intergenerational learning

1. Introduction

Knowledge is difficult to be replicated or substituted. Acknowledging its importance, organizations have put great emphasis on Knowledge Management (KM) and KM systems with a view to retaining this knowledge, especially from older employees, and harnessing it. Knowledge management (KM), an established principle since 1991 (Nonaka, 1991), is the process of identifying, creating, organizing, storing and disseminating information within an organization which leads to better organizational efficiency (Singh, Thomas and Numbudiri, 2021). Decision-making processes and business outcomes become quicker when efficient KM strategies are followed, since collaboration and intergenerational learning directly facilitate and effectuate the flow and direction. Streamlining training and on-boarding also leads to higher employee satisfaction and retention (Belias et al., 2022; Belias and Trihas, 2022a).

Parallelly, the pace of demographic transformations has brought upon the creation of four existing generations working side by side in the workplace; namely the Baby Boomers, Generation X, Millennials and Generation Z. Research indicates that organizations appreciate generational diversity because it can increase competitiveness and performance, but it also creates challenges for knowledge acquisition and transfer (Becker, Richards, and Stollings, 2020; Belias and Trihas, 2022b). The current workplace is characterised by increased utilisation of technology and intel(ligence). Prerequisites and requirements to operate optimally in such an environment is a fact for all four cohorts; thus, facilitating KM processes within an age-diversified workplace via adult education principles is essential for the sustainability and competitiveness of companies and organisations.

This study identifies a research gap in methods that promote cross- and inter-generational knowledge acquisition, reflection, interactivity, and transfer within an age-dynamic workforce by utilizing the principles of adult education (AE) learning theories, and aims to provide insight and guidelines into this matter by developing a conceptual framework. This paper contributes to the growing fields of KM and AE, especially in an era of artificial intelligence and cognitive computing where demands and challenges are increasing for all working generational cohorts. The methodology used entails examination of scientific authored work drawn

from online academic bibliographic databases via an in-depth literature review and elaboration, where research questions are formed. Its structure onwards presents a retrospective and future view on KM, AE and multigenerational groups in the workplace. The research questions are answered involving the generations of KM so as to show the evolution of the field and its current demands. Next, we analyse how adult education theories can aid KM processes and suggest adult learning methodology that can be effectively applicable within and across generations, endeavouring that future research implements them. We conclude with the closing remarks, referring to the respective limitations and implications.

2. Methodology

The methodology employed concerns critical literature review reflection and analysis based on accredited scientific studies, papers, articles, and books drawn from databases of digital libraries, journals, conference proceedings and scientific websites, mainly including Google Scholar, Science Direct, Web of Sciences, Elsevier Scopus, Emerald insight, The Chartered Association of Business Schools (ABS) list, Scimago Journal Rank. For the implementation of the research, the authors used a combination of keywords that directly addressed and were associated with the subject of the research such as "Adult Learning Theories", "Knowledge Management", Knowledge Management Processes and Eras", "Multigenerational workforce", "Knowledge-intensive marketplace", "Intergenerational Relationships", "Baby Boomers", "Generation X", "Generation Y", "Generation Z", "Adult Learning and Age Cohorts". Every source used was coherent with these keywords and concepts. Our selection criteria involved a) topic or terms relevant to current piece of work, b) a time span of six years concerning research and findings (foundation principles were excluded from the time limitations), and c) cohesion and coherence of the paper, provision of useful insights and solid theoretical framework and/or practical-empirical researches.

This study identifies a research gap in methods that promote cross- and inter-generational knowledge acquisition, reflection, interactivity, and transfer within an age-dynamic workforce by utilizing the principles of adult education (AE) learning theories and aims to provide insight and guidelines into this matter by developing a conceptual framework. This paper contributes to the growing fields of KM and AE, especially in an era of artificial intelligence and cognitive computing where demands and challenges are increasing for all working generational cohorts.

As aforementioned, the aim of this paper is to investigate methods that facilitate knowledge management processes in an age-diversified workforce via adult learning theories, thus, the current paper seeks to answer certain research questions through literature review and critical analysis with the aim to shed some light on the complicated topic of multigenerational knowledge management in the workplace via AE principles and methodology. Thus, the research questions are formulated as follows:

RQ^1. How can we facilitate KM Processes via adult education principles?

RQ^2. How critical are Knowledge Management generations?

RQ^3. What kind of adult education methods can aid cross and intergenerational learning?

3. Literature Review

3.1 Knowledge Management

Knowledge management (KM) as a multidisciplinary approach cannot remain constant or stable over time, but changes along the external environment transitions and the nature of the human resources' needs. KM is responsible for achieving organizational objectives by utilising knowledge effectively. There are four basic types of knowledge an organization can produce or have: *tacit*, which is gained through personal experience and comprehended intuitively; *implicit*, which involves learned skills applicable in certain situations; *explicit* that represents structured knowledge, such as data-based applicable information (King, 2009); and *embedded*, which lies within the organization's processes and policies (culture), rules, ethics and conduct (Lönnqvis, 2017). Data put in context present us with information (Deng et al., 2022). When information is understood, exploited, utilized and linked to a purpose or an idea, it becomes knowledge.

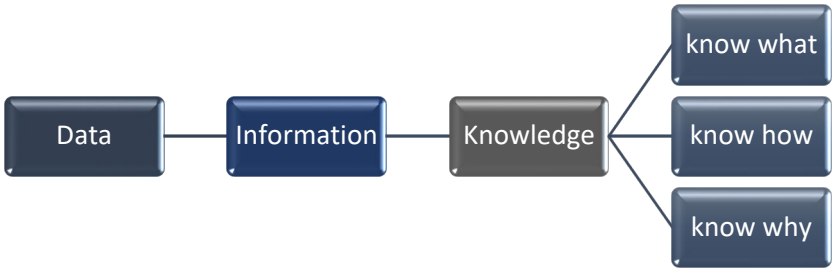


Figure 1: Rough Conversion of Data to Knowledge (modified from King 2009; Deng et al., 2022)

According to Erceg and Zoranović (2022), scientific literature refers to four main phases of KMPs, namely:

1. Collecting/Creation/Acquisition/Organizing,
2. Storage/Extracting/Presentation/Organizing
3. Distribution/Sharing/Usage/Transfer,
4. Application/Usage/Transfer/Analysis. They themselves categorised it as: knowledge collection; conversion; application and protection. A further classification of knowledge management systems (KMSs) is based on the knowledge lifecycle phases developed by King (2009) as outlined below:

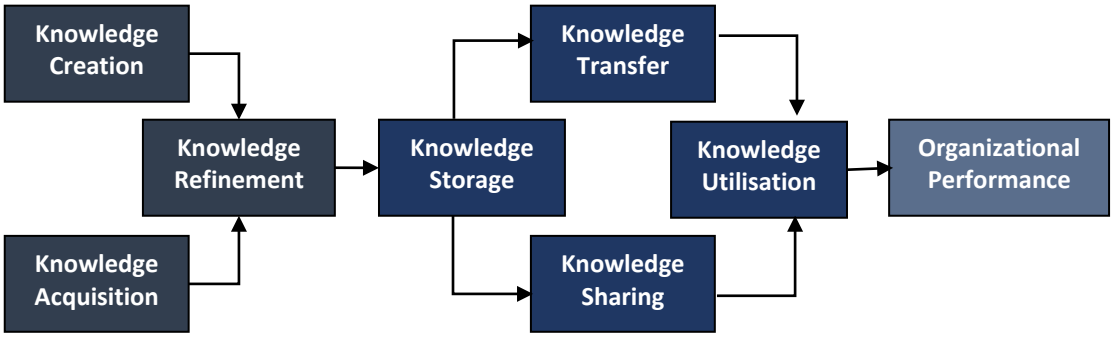


Figure 2: KM Process Model (King, 2009)

According to this process model the initiation of KM cycle involves either the *creation* or the *acquisition* of knowledge by an organization; the former entails either the development of new knowledge or new content within existing knowledge, whereas the latter refers to quest for, realization and assimilation of potentially valuable knowledge. *Knowledge refinement* involves filtering and improving selected knowledge so as to facilitate its entrance into the organization's memory, enhance its impact and long-term reusability. *Knowledge storage* concerns repositories, physical or electronic, that are retained and embedded in the organization's processes. Once stored, knowledge has to be transferred or shared. *Transfer* refers to sending meaningful and distinctive items of knowledge to potential, known recipients, whereas *sharing* refers to a more open, undefined dissemination of knowledge to a broader pool of candidates. *Knowledge utilisation* phase materialises the exploitation, "elaboration (different interpretations), infusion (underlying issues) and thoroughness (multiple understandings" (King, 2009, p. 8) of knowledge to enhance performance. Knowledge represents 'lessons learned', where a repository of cognition, skills, capabilities,expertise, wisdom, intuition and savoir faire is formed and serves as a unique competitive advantage difficult or even impossible to replicate. That is why scouting for new knowledge sources and resources so as to optimise the end-result in being meaningful, up-to-date and to-the-point is important.

3.2 Adult Learning Theories

Learning is always "being" and" becoming"

(Jarvis, 2009, p. 25)

Adult learning theories have expanded to include a spectrum of principles and approaches since the 1960's, when the educator and 'father of adult learning', Malcolm Knowles (1968), introduced the concept of Andragogy and popularised Adult Education. Adult education (AE) is a practice in which adults engage in systematic and sustained self-educating activities with a view to gaining new forms of knowledge, skills,

capabilities, attitudes, or values (Merriam and Brockett, 2007). It encompasses notions that can lead not only to basic literacy, but also to personal fulfilment and self-actualization of the learner (Viterouli et al., 2022). Adult learning is self and life-centred; self-centred in the sense that adults view learning as a means to enhance themselves and cope with bottlenecks and challenges; life-centred in the sense that it promotes life quality and facilitates life roles. AE theories involve principles such as self-direction, transformation, experience, mentorship, mental orientation, motivation, inclusion, and readiness to learn (Gupta and Misra, 2023; Viterouli et al., 2021) as displayed below:

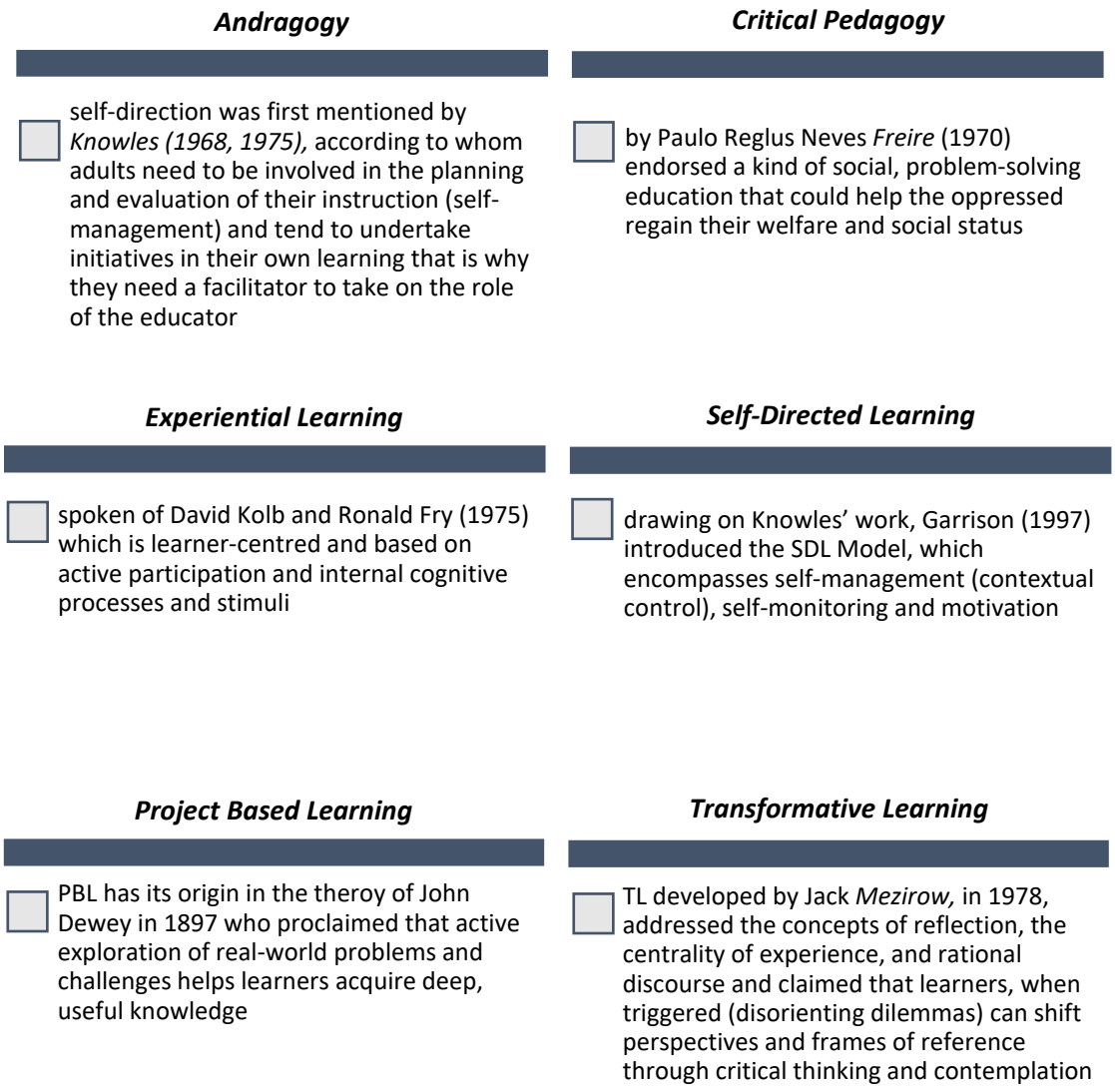


Figure 3: Main Adult Education Theories

All adult learning theories have the learner at their core. They posit that all learners use different assumptions, expectations, and beliefs to make sense of the world around them and are confronted with different obstacles, biases and experiences that might hold them back or even prohibit them from advancing or even moving further (Fedeli and Bierema, 2019). Forming an environment that promotes collaboration and intergenerational learning can aid the transferral and dissemination of knowledge (Gerpott, Lehmann-Willenbrock and Voelpel, 2017) and alongside long-term organizational sustainability (Simic, 2019). Knowledge management, especially after the era of Covid-19 pandemic, is critical for the business-status, resilience and sustainability (Belias and Trihas, 2022c). Remote work or hybrid work, for instance, has catapulted KM to overcome barriers. Especially when confronted with phenomena such as the Great Resignation (Serenko, 2022) that took place in 2021, a lot of companies and organizations were drained of their intellectual capital and pool of experience, not being able to substitute the knowledge 'lost'; hence, onboarding new recruits was

another challenge, as well as reskilling or upskilling the remaining personnel. That is why the field of adult learning is increasingly intersecting with knowledge management, and information and communications technology (ICT).

3.3 Key Attributes of the Contemporary Age-Diversified Workforce

Demographic, social, political and economic factors, especially in Western societies, have helped shape different generational groups in the workplace working simultaneously and contemporaneously (Jones, Murray, and Tapp, 2018). At the time being, four different cohorts co-exist in the workplace, namely, Baby Boomers, Generations X, Y and Z. Since age-related factors affect knowledge accumulation and utilisation along with organizational success, it is imperative for businesses and organizations to have a clear understanding of their employees' characteristics; differences or similarities (Triana et al., 2021) in extrinsic or intrinsic motivators, work and life values and attitudes, or professional engagement and commitment. For this reason, we have proceeded in formulating the basic traits and characteristics of each generation (tables 1 & 2) drawn from scientific literature research (Kirchmayer and Fratričová, 2020; Triana et al., 2021; Singh, Verma and Chaurasia, 2021).

Table 1: First and Second Age Group

	Baby Boomers (1946–1964)	**Generation X (1965 to early 1980s)**
1	live to work; challenge authority; value ambition, collaboration, personal growth	work to live; work wisely; unimpressed with authority; strong sense of entitlement
2	driven; strong work ethic; loyalty; workaholism	loyalty according to intakes; change job if necessary; listening to inner feelings
3	multi-taskers; team players; mission-oriented	flexible; adaptable; end-result focused; a mentality of 'let me have a life, it's just a job'
4	consensual leadership; democratic; humane "flat" organizational hierarchy	authority-sceptical; informal; functional; positive hierarchical equality; open access to leadership
5	instructions; traditional lectures and interactive team- and relationship-building communication; structured learning	seminars and training courses via blended learning methods; prefer learning independently/informally, not micromanaged
6	in person; a lot of body language; phones; 'call me anytime'	in person; emails; cell phones; laptops; 'call me only at work'
7	work comes first; self-worth and identity related to position	balance is necessary for their well-being
8	need to "shine"/"be a star"; work is a career demanding long hours; need experts	need reason and cause of gain for task/job; cutting edge systems/tech; forward thinking and flexible company; need leaders/mentors
9	skills just as important as work ethic and interpersonal relationships for success; mainly promoted based on seniority.	a means to an end; input evaluated on merit, not seniority; amassed skills more important than work ethic in versatility.
10	adapted make-do; not really good at it	assimilated competency
11	money; awards/praise; title recognition	rewards; freedom; benefits; coaching; hands-off supervision; fair remuneration; fun atmosphere

Codified as: 1. Work Values and Viewpoints, 2. Company loyalty & Work ethics, 3. Working style, 4. Leadership style, 5. Learning style, 6. Communication Style, 7. Work-life balance, 8. Job Expectations, 9. Educational expectations, 10. Work and Technology, 11. Motivation

Table 2: Third and Forth Age Group

	Generation Y (early 1980s to mid '90s)	**Generation Z (mid '90s to early '00s)**
1	"me first "attitude in work life; living comes before working; multi-taskers; innovative; work much by having fun	individualistic; entrepreneurial and progressive; want to prove themselves and their worth; risk-averse; technoholics

	Generation Y **(early 1980s to mid '90s)**	**Generation Z** **(mid '90s to early '00s)**
2	job transitions are unavoidable; eager to please others; net-centric team players	flexibility, respect, recognition; good salary; progression; vocal at resisting authority
3	adaptable; short-term and flexible	healthy competition; recognition of hard work
4	collaborative (harmony/unity); flexible; achievement-oriented; feedback	transparent; feedback on changes; fun; flexible; continuous feedback
5	technology-based learning from multiple, easily accessible sources and concise content; prefer team learning	self-directed and active learning styles with visual and kinaesthetic methodology; adaptive, engaging and interactive learning environments
6	quick and advanced technology-based communication; lack in interpersonal communication	tablets and cell phones usage over computers; prefer distant, to-the-point communication via applications; latest tools and technologies
7	work-life, plus community involvement and self-development balance	not only wish for it, but do what it takes to make it happen
8	flex time, job sharing, and time off on request; look for challenges, need strong, ethical and friendly guides	authenticity, career development; personalized, tailored approaches to overcome arising challenges; need mentors; job-shadow
9	new skills/knowledge, via high-priced spending, ease stressful situations	personalized, tailored approaches to overcome arising challenges
10	integral to work; tech-savvy, digital generation, spherical and complete utilisation of technology	digital natives, information technology (it) and artificial intelligence (AI) environment is second-nature
11	constant feedback and communication; meaningful and flexible work; rewards; acknowledgement; new learning opportunities	trust, support and care, technology usage, flexibility, control over their work inclusivity, diversity, and respect appreciating and acknowledging their efforts

Codified as: in table 1

Types of behaviour, expectations, styles and values underpin each group and form commonalities or differences with one another. These patterns and structure can help pinpoint ways of KM processes and behaviour (KMB) via effective learning methods (Razi & Habibullah, 2017).

4. Research on Knowledge Management Generations

In an era where we are experiencing massive technological advancements, a long line of innovations and inventions, and multiple kinds of networking, some speak of three transitive KM generations so far (Nonaka and Takeuchi, 1995; Liebowitz and Paliszkiewicz, 2019), while many contemporaries refer to six KM generations (Bencsik, 2021; Gaviria-Marina, Merigob, and Baier-Fuentesc, 2019; Cummings, Regeer, and Zweekhorst, 2013) of critical phases and trends, since the 1960's, as depicted below:

Table 3: Generations of Knowledge Management - Evolution

KM 1.0	**ICT-based**: Focus on technology of knowledge creation and formation to explore, integrate and transfer hard-to-find dimensions of tacit knowledge. (databases portals and clearinghouses)	
Personal knowledge Creating Company		**Knowledge as a tool**
KM 2.0	**Organisation-based**: Focus on differentiation between knowledge-based and experiential, problem-solving knowledge; Creation of an atmosphere and culture that supports both explicit and tacit knowledge collection codification, conversion, distribution via intra-corporate knowledge communities. (benchmark, KM audits)	
Knowledge Workers processes		***Knowledge as an organizational asset***
KM 3.0	**Knowledge sharing-based**: Focus on establishing strong knowledge communities and systematic improvement of the organisation's ability to mobilise knowledge in order to increase performance. (peer assist, case studies, best practices)	

Building collaborative knowledge	**Knowledge as a social network**
KM 4.0	**Practice-based**: Focus on the integration of knowledge in the organizational processes, as a capital factor and social contributor, and on its quantification. (social media, people-centric)
Knowledge integration	**Knowledge as an embedded process**
KM 5.0	**Innovation-based**: Focus on the relationship between company competitiveness and endogenous innovation; development of knowledge systems ecology. (radical, conceptual advances and inventions, information technology prevalence, multiple kinds of knowledge, multi-stakeholder processes)
Cross-domain knowledge co-creation	**Knowledge as a competitive advantage**
KM 6.0	**AI-based**: Focus on the potential of artificial intelligence solutions and cognitive computing. (analytics, generative tools, automated programs)
Multi and trans-disciplinary process	Knowledge as a power & control manipulator

Formed from: Gaviria-Marina, Merigob, and Baier-Fuentesc (2019); Bencsik, A. (2021); Cummings, Regeer, and Zweekhorst (2013); Zamir, 2019;

No matter the number of distinctions, categories or generations, a fact prevails, that of advancement. We are experiencing unprecedented phenomena; the onset of artificial intelligence and its applications have presented us with countless possibilities and opportunities. Digital workplaces, digital transformation, cognitive computing, analytics and business intelligence, enterprise social networks (ESNs) are only a few examples. One can claim that KM and AI could be in fact the two sides of a single coin. Haenlein and Kaplan (2019) propose that KM allows for complete understanding and utilisation of knowledge, while AI offers potential to expand this knowledge, refine and recreate it on a completely new basis and on grounds beyond aspirations.

5. Facilitating KM Processes via Adult Education Principles

Stimulating learning should be way easier than ever before, given that we have all the assets and tools at our disposal. However, processes, tactics and methods are the link between the inputs and the outputs of learning, and respectively knowledge management. Adult education principles via its effective teaching methods involve interactive and participatory learning. There are many teaching techniques, some teacher- and others learner-centred (Gravani, 2019; Jarvis, 1995; Fedeli and Bierema, 2019); teacher-centred, informational, approaches commonly include: lecture-based learning; directed discussion and direct instruction. Nevertheless, outcomes have shown that in both children and adult education they are not optimally effective, since the attention span is minimized, and knowledge creation/acquisition is only short-term. Thus, learner-centred methods, as outlined below, have flourished.

Putting into practice these methods could encourage learning for either homogeneous or heterogeneous groups of employees via online, face-to-face or blended learning, synchronous or asynchronous. Intra-corporate or extra-corporate learning can adapt any of the aforementioned adult education (AE) learner-centred methods. For this reason, educators in AE are regarded mediators and/or facilitators, rather than experts in and of their own field, which guide learners through the whole learning process and aid them to reach their goal (Merriam and Brockett, 2007).

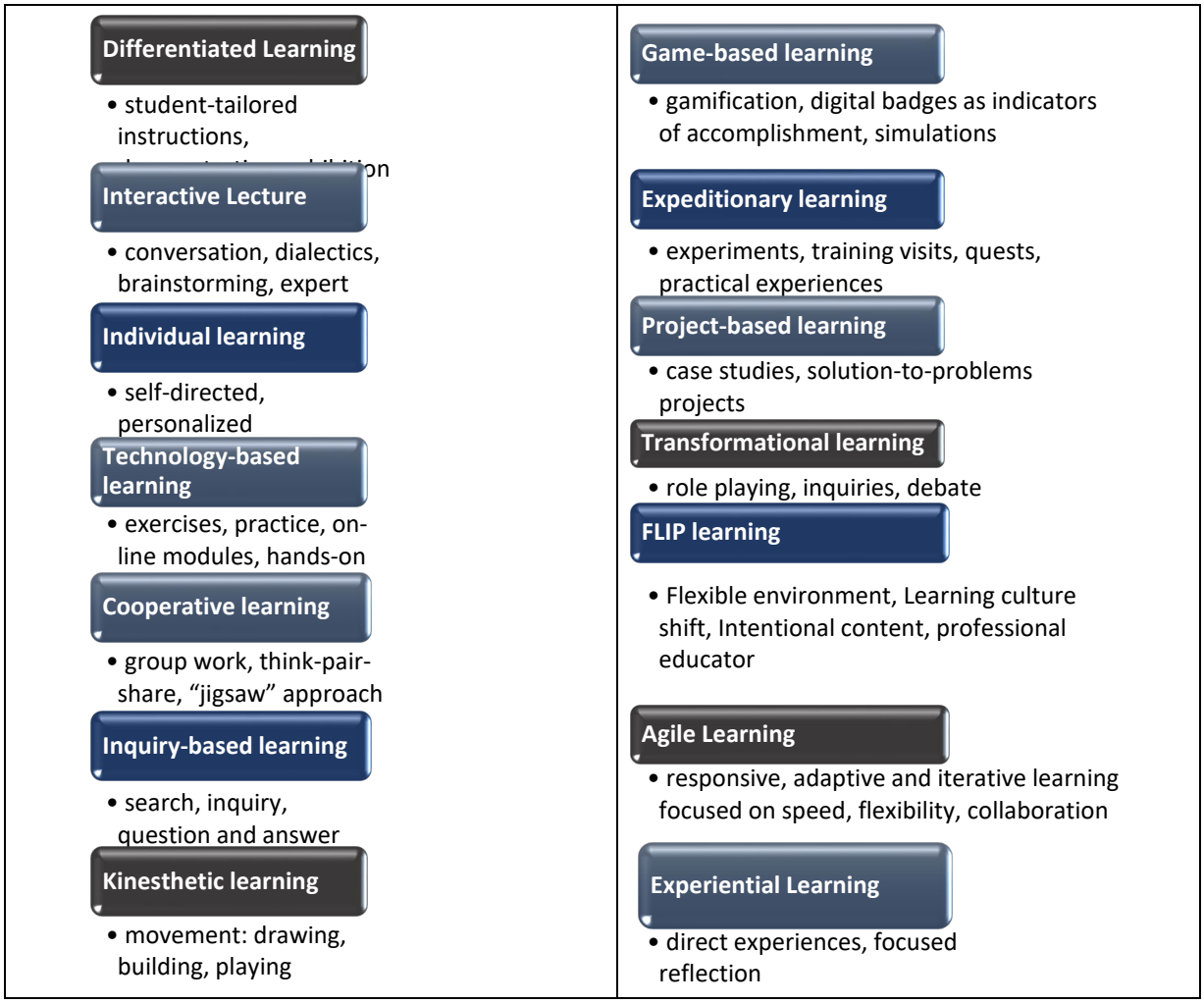


Figure 3: Adult education learner-centred methods (Viterouli, 2022; Gravani, 2019; Merriam and Brockett, 2007; Fedeli and Bierema, 2019; Bremner; Sakata and Cameron, 2022)

6. Designing Methodologies for Cross and Intergenerational Learning

Managing a workforce spanning multiple generations involves not only understanding differences or commonalities, but also overcoming barriers of ageism, bias and pre-conceptions or misconceptions. Building a culture of continuous, lifelong learning helps shutter these barriers, fortify knowledge management, boost morale, reinforce cooperation and inclusion, and improve engagement and performance. Each generation's key attributes along with the power the adult learning theories exert on different types of learners and the ways they facilitate KM processes have led us to the following conclusions about each cohort's respective and efficient methodologies application with regard to Knowledge Management generations and transitions. The findings show that learner-centred learning tactics and methods can address age cohorts, either separately or collectively, as suggested by Deng, et al. (2022), Gupta and Misra (2023), Erceg and Zoranović (2022), Fedeli and Bierema (2019), Kirchmayer and Fratričová (2020), Viterouli, Belias and Koustelios (2021), Gerpott, Lehmann-Willenbrock, and Voelpel (2017), Gravani, (2019) to achieve desired results. Methodologies, i.e. policies, rules, techniques, and procedures, prescribe how learning is to be conducted and provide proven ways to do it repeatedly and successfully:

Baby boomers – traditional with a touch of modernism learning

Since this age group is characterized as loyal team players and multi-taskers, who appreciate democratic procedures and policies seeking for a friendly expert, differentiated learning and active face-to-face lectures could match their needs according to their learning style. Baby boomers have learned to tolerate lecture formats, abide by the rules and look interested; hence, lectures, worksheets, and other traditional learning activities in a traditional classroom environment with a teacher-led curriculum could be sufficient. However, any kind of method that entails collaboration and relationship building via structured-learning, such as

cooperative learning and project-based learning, could prove more stimulating and energizing. Open discussions, interactive social learning methods, experiences sharing, disorienting dilemmas, as in transformative and experiential learning, can foster active engagement, memory retention and shifts in frames of reference. On the other hand, when given the chance, since they have the benefit of hindsight, they can become great mentors in intergenerational learning, keep it culturally concise and time-efficient, and help younger generations assimilate new knowledge or expand their understanding.

Generation X– tailored, individual learning

They, without a doubt, share some commonalities with Baby Boomers such as the preference of an in-person learning session, yet their desire for lifelong quality learning (strictly relevant to their needs) and their inclination towards active and participatory methodology is prerequisite and non-debatable. They have come to understand technology's reason of existence and utilisation, and became quite proficient at it, therefore technology-based methods and online teaching have become convenient and ordinary for them, since they allow for space, means and time management and flexibility; especially in asynchronous online learning. They do not comply with long-term lectures and detest being micro-managed, seeking for guides rather than experts, thus self-directed, agile or experiential learning that is focused on the information/knowledge they seek, and involves more practice than theory, could be what they are looking for. Moreover, Xers can either take on leadership roles to develop their own skills and promote work-life-learning integration, or can serve as mentors that have the capacity to bridge proceeding and succeeding generations (conservatives and progressives).

Generation Y - interactive and spirited learning

The Millennials represent a digitally competent and highly connected generation, which is why they embrace technology-based learning from multiple sources. To satisfy their interrogative nature, inquiry-based and FLIP learning can prove efficient in providing for their need for evidence-based sources and resources, conducted either online or in hybrid ways. Millennials also appreciate opportunities to get feedback and learn from their peers, so collaborative learning on up-to-date trends and technologies can prove intriguing. On-demand access to learning is important to them and testifies flexibility and efficacy for advancement, since they are achievement-oriented. However, they do not only want to learn, but also connect with each other and have fun, so game-based and project-based learning arises their curiosity and interests for involvement, especially when it involves informal learning. This age group can be great reverse mentors for Baby Boomers and Xers, connect them to unrestricted global networks and leverage the digital world to the organization's advantage.

Generation Z - engaging, real-time learning

The post-Millennials, as the most technologically savvy of all, aspire for any means and methods that are technology-integrated, especially interactive technology. Due to their direct absorption in all phases and kinds of technology and its negative or positive stimuli, this generation lacks in in-person communication skills, is mostly unable to read from a hard copy and has short attention span. This fact alone, leads them to pursue, other than technology-based learning, kinds of learning that fosters and boosts commitment to a cause, such as game-based and collaborative learning. Real-time communication and social learning environments can constructively engage them. Games, digital infographics, videos can help improve their spatial and intrapersonal intelligence, and offer the freedom and flexibility they need to learn at their own pace. Moreover, since iGen can be computer-addicts, kinds of learning that might be world-shaking for them, such as transformative to make them reconsider their own beliefs, or expeditionary learning to make them create new experiences, might be inspiring. Gen Zers look for mentors and role models in the workplace and often turn into job-shadowers, so as to feel supported and confident to thrive. However, they, in turn, can become great teachers for all previous generations on how to navigate analytics, AI and technological changes.

7. Discussion

Linking adult learning (AL) to knowledge management in a multigenerational workforce is demanding of its own accord. The notion that every person learns differently, has a unique way of thinking and poses certain traits is undeniable. However, using this to one's advantage and exploiting cross and intergenerational learning to boost own and peers' knowledge and performance is perhaps the most efficient way to achieve results. Knowledge should be accessible, disseminated and imparted in the most convenient manner. Finding beneficial ways and methodologies to aid these processes and procedures can accomplish desired outcomes and integrate AL principles via 'prescribed' policies.

8. Limitations and Implications

Through the passage of time, it is certain that demands change as do needs. Knowledge management has to evolve and adapt more quickly than any other field, since it is the driving force of the organizations and businesses. The above methodologies and approaches were drawn via literature review, thus, it would advisable that qualitative and quantitative researches be conducted and verify or reject research questions. Moreover, they were drawn for this time period and era and are liable to change in the future, according to the needs that will arise at that time. Nevertheless, one should always contemplate that adult learning theories have had and will always have positive practical and theoretical implications on the knowledge capital of the enterprises and must always be in line and up-to-date with the personnel's training so as to facilitate processes and systems, and accordingly boost knowledge transfer, engagement and performance.

9. Conclusion

Catering to and for every generation's unique needs, preferences and demands might be a tall order due to their extra-rational, sociocultural, cognitive nature. However, adopting new learning methods and knowledge development strategies is imperative so as to engage and motivate all workforce generations. Using interactive, blended methods in adult learning can prove effective in addressing all cohorts simultaneously or subsequently. There is no optimum way to teach diversified groups and there is always room for improvement with a view to creating benchmarks. Further empirical research is needed in the interconnected fields of KM and AE in light of the multigenerational workplace. After all, each generational cohort has a lot to learn and a lot to offer via synergies. Leveraging one's knowledge to aid and advance others' is crucial for KM and performance so as to improve knowledge-related practices as well as organizational behaviours and decisions, and navigate each era efficiently.

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Preparing for Work-Life Through Work-Like Situated Learning: A Case Study

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Abstract: In this paper we investigate how it is to have supervision during a course when the students are to learn to write and compose music during a 12-hour music camps. It is a study that is close to practice as the part of the programme is about the students are to experience how it is to work on producing and developing music in a work life. The connection to work life require that the students establish an understanding of the purpose of the music camps and why they are organized the way they are. We will analyse this approach in the light of the communication principles of Habermas. The role of the supervisor does in a Norwegian setting require equality and symmetry in the relation between the supervisor and student, something that contributes to a psychological safety in the situation. This in turn contribute towards the students being able to forward their own points of views. The supervisors seek to make the students reach an awareness regarding what they will encounter in a work life. Hence, they encounter the concrete situations that occur and either steer or support the students based on their level of maturity and competency level. This can be regarded as an ongoing interaction regarding tacit and explicit knowledge. These are processes that not only support individual learning, but development of new knowledge which can be incorporated in the further development of the music camps. We have developed a conceptual model that has guided us in our analysis which is based on the qualitative investigations we have undertaken. Our conclusion is that the lecturers experience and skills, and work-like approach to the education strongly contribute towards facilitating a way of communicating that imply a sense of equality and symmetry in the communication between the student and lecturers, something they report contribute to a psychological safety that enables the learning not only of theory and skills, but also prepare them for a work-life.

Keywords: Knowledge development, Work-Like learning, Situated Learning, Supervision, Communication, Psychological safety

1. Introduction

Educating people for the Music Business require an approach that meet not only these creative students' needs, but also the needs of the trade. Some students will be educated for the administrative and business within organizations working with developing and producing music, and others aim to be the singer/songwriters/producers for the music business. The music business is a part of the entertainment industry which embraces a lot of other sub-industries (such as the gaming industry, the gambling industry and the movie industry, to mention a few) (Hull, Hutchison and Strasser, 2011).

Technological developments have changed a lot in the music business. For example, the digitalization and the internet has enabled not only a swifter production, but also the possibilities of copying without permission, which has offered some challenges within the music business industry. It has also enabled quicker dissemination and promoted internationalization (Hull, Hutchison and Strasser, 2011).

At the Inland Norway University of Applied Sciences, Rena, Norway, the students in the Bachelor program of Music Business and Production, are exposed to both the creative and the economic/administrative sides of the music business in order to gain insights and understanding of the different aspects of it. The idea is that this will strengthen their candidacy for a job in the music business. Also, whatever the students should choose, or be offered, they are prepared for a variety of work tasks within any organization in the music business.

In this paper we focus on features developed to enhance their skills and understanding for the music business industry. Already in the first year they are exposed to how to develop and produce songs in a way that they will be exposed to in the "real life" within the industry. The course consists of ordinary weekly lectures of three hours and six seminars of 10-12 hours, three in the autumn semester and three in the spring semester. During these seminars they are to write and produce a song over a theme decided by the teachers. We will have a particular focus on the supervision during the seminars as this need to not only promote developing their skills, but also be a part of what prepares them for a work-life in the music business.

Supervising students not only require skills within the particular trade (here writing lyrics, developing sound tracks and producing the songs), but also require an understanding of time management, how to motivate and how to communicate in order for the students to learn, develop, feel personal mastery and develop skills. This also implies to establish an environment that induces psychological safety which, in turn, facilitates the students' need to obtain the feeling of personal mastery and thus develop the necessary skills. The students, on the other hand, need to understand that the supervision will bring them forward regarding internalizing the curriculum and developing skills, and the supervisors need to understand how to communicate to motivate the students learn and develop. Thus, we have investigated this in the light of Habermas' theory on communicative rationality (Habermas, 1985a) as this is based on a linguistic communication supporting the idea of aiding the students to understand and internalize the knowledge and skills, based on a mutual understanding between the students and the supervisors.

Hence, our research question is:

How to facilitate work-like supervision in a higher educational setting?

In order to investigate this we have also formulated sub-questions:

What do the supervisors base their feedback on?

How do the supervisors use their professional background when providing feedback?

What is the impact of the supervision on the students' psychological safety?

The case

We have followed two sets of first year students over a total of three semesters (from spring 2022 till end of spring 2023). The students must register for mandatory seminars (music camps). The purpose of registering is for the supervisors/lecturers to be able to divide the students into groups. The groups consist of a producer, one or more lyric writers and one or more song writers. When the students register, they need to list what they believe they can contribute with to the group (for example if they believe they are good at writing lyrics or producing). On the day of the seminars, the groups are presented, and it is different groups for each seminar. The assignment, which is defined by lecturers, is presented at the start of the seminars. Generally, it is about pop music from around the world (J-pop (Japanese pop music), K-pop (Korean pop music), Nordic pop music) and they are introduced with the assignment accompanied by examples of what the students may use as inspiration for their work. They are provided with a rough schedule of the seminar describing approximately when they need to be finished with the different tasks. This schedule is approximate, but by experience the idea should be ready after an hour or two, then the start of the lyrics and the main theme should be in place by the next few hours, so that the producer will be able to make a start on the song in the computer tool. The total production needs to finish one hour before the listening session in order for the lecturers to organize for the session. In the session, the students are to present their idea to the audience, and receive feedback from their fellow students, but only a few comments from their supervisor/lecturer, as they will have had most of their supervision during the seminar.

There are rules for how the group members are to communicate how they like or dislike ideas and the basic rule is that if you do not have a better idea yourself you are not to discard, nor speak negatively about the idea from a fellow student.

In the following we will present the theory that has enlighten our study and how we have collected the data we later present and discuss before we conclude.

2. Theoretical Foundation

In order to support the students in their learning process, as well as making it a work like environment, in addition to paying attention to the closeness the outcome has to the real world business, we need to look at how the students and supervisors/lecturers can draw on theory from not only learning through communicating but also on work-life situations that support development processes.

Habermas (1985a) theory of communicative rationality rely on mutual understanding and build on other theorists such as Ludwig Wittgenstein, John Searle and J.L. Austin. Wittgenstein's contribution to Habermas was about his way of looking at language (Wittgenstein, 2010). When language is stripped from contextual clues, there may be problems with understanding. Hence, a context and metaphysical environment is needed to avoid misunderstandings. He also presents an idea of language games where words may have different meaning

according to context and how it is used (Wittgenstein, 2010; Baker and Hacker, 2014). John Searle, heavily influenced by John L. Austin, present in his book Speech Acts (Searle, 1969) different sets of semantical rules where the same words will produce different meanings according to how it has been presented. He had his own interpretation of Austin's "illocutionary acts" (Searle, 1968, 1975; Austin, 1975) which is about saying something (locution) with the purpose of obtaining an answer, expecting something to be executed, asserting something, or ordering someone to do something.

Habermas was also inspired by George H. Mead who was concerned with pragmatism and social behaviourism. The pragmatism was based on the idea that the reality is socially constructed, that social and physical items encountered are defined by their usage of them, that people alter meaning about things that does not function the way they are used to anymore, and that actors must be understood by peoples' behaviour. To Mead, it was also important to promote that consciousness is an integral part of action and interaction between people. In his "Mind, Self and Society" (Mead, 1934), he presents the idea of the mind and self, the self, emerging from communication as a social process, and mind descending from communication as a social action, a socially mediated act.

Jean Piaget has not only inspired Habermas, but also for example Lev Vygotskij. Most notably has Habermas incorporated Piaget's thoughts in The Theory of Communicative Action (Habermas, 1985a, 1985b). Somewhat unlike the behaviourists, Piaget claimed that knowledge needs to be constructed within each human being, but as a result of an interaction with the surroundings. The tough processes are organized in schemes that embraces experiences, thoughts and knowledge. If a new experience fits a scheme it will be expanded by assimilation and if a new scheme has to be construed it is an accommodation (Lyngsnes and Rismark, 2014).

In a Norwegian context the supervision in an educational institution need a high degree of equality and symmetry in the communication and relation between supervisor and student. This contributes towards preparing the grounds for psychological safety during the supervision, which in turn contributes towards allowing the students to promote their views. We are thus not only inspired by the social construction amongst the students and between supervisors and students, but also by Buber (1992) regarding establishing a relation that is characterized by equality and symmetry. Edmondson refer to a term called *psychological safety* (Edmondson, 2018, p. xiv) which in her research has proved to be a necessity for maximized organizational performance. In fact, psychological safety is underpinning other factors (like "setting clear goals and reinforcing mutual accountability" (Edmondson, 2018, p. xviii)) regarding successful teamwork. Psychological safety is thus important for driving innovation and development in organizations as it is important that people speak up if they have a good idea or discover something that should be corrected (Frazier *et al.*, 2017). Akan, Jack and Mehta (2020) claim that: "When team members feel psychologically safe, they engage more in exploratory and exploitative learning and are more creative and motivated, and in turn, more productive" (Akan, Jack and Mehta, 2020, p. 30). Too many do not dear speaking up because they want to avoid being thought less of something that again may lead to dissatisfaction and underperformance (Edmondson, 2018). To gain psychological safety one needs to establish trust and respect. Edmondson define psychological safety as "the belief that the work environment is safe for interpersonal risk taking" (Edmondson, 2018, p. 8), and further states: "Psychological safety is present when colleagues trust and respect each other and feel able – even obligated - to be candid" (p.8). Edmondson also refer to Kahn (1990) who has also investigated psychological safety and how this support and develop engagement amongst employees. Kahn (1990) also refer to personal engagement which he defines as "the harnessing of organization members' selves to their work roles; in engagement people employ and express themselves physically, cognitively , and emotionally during role performances" and disengagement as "the uncoupling of selves from work roles; in disengagement, people withdraw and defend themselves physically, cognitively, or emotionally during role performances" (Kahn, 1990, p. 694). Kahn also present his own research projects and refer to an instructor that shared his personal philosophy on a related topic as well as showing a "pure personal engagement" was able to empathize with his students and thus psychologically connecting with the students (Kahn, 1990, pp. 700, 701). According to Kahn, the four factors that influences psychological safety are: "interpersonal relationships, group and intergroup dynamics, management style and process, and organizational norms" (Kahn, 1990, p. 708). Akan, Jack and Mehta (2020) refer to a "concrescent conversation environment" which is defined as "disclosing, questioning, and steering verbal behaviour that constructs the team environment and contributes to task completion" (Akan, Jack and Mehta, 2020, p. 30) and builds on Searle's (1969) ideas and thoughts about language. Disclosing is about sharing information, including personal information in order to induce trust, questioning is about information-seeking and include five behaviours: posing relevant questions, being friendly (avoiding friction), being spontaneous, willingness to

answer questions, and appreciate the shared information, and steering which is defined as "describable verbal behaviour that guides or directs tasks efforts" (Akan, Jack and Mehta, 2020, p. 32).

Frazier et al. (2017) also tie psychological safety to two of the "Big Five personality constructs"; emotionally stability and openness to experience (Frazier *et al.*, 2017, pp. 118, 148). The emotionally stable are generally calm and relaxed and the openness is tied to risk taking which is again a sign of psychological safety.

Work-like learning can be called situated learning (Lave and Wenger, 1991). Situated learning is a theory that explains how an individual learns skills and how they are to take part in a community of practice by legitimate peripheral participation in a work environment. It is according to Lave and Wenger about changing behaviour as "learning implies becoming a different person with respect to the possibilities enabled by these systems of relations" (Lave and Wenger, 1991, p. 53), where the "systems of relations" refer to the learners relations to the communities and how they relate to a given problem that is to be solved based on their competencies. More experienced workers will have lesser peripheral distance than a newcomer. Hence, the learning is of a social kind that comes through participation and evolves and is renewed based on the relations with the community, the actions and ultimately; the world. According to Cooper, Orrell and Bowden (2010) this is about merging formal learning and work (theory and practice) and is in HEIs often executed like internships, fieldwork, service learning or similar.

Work-based learning are generally learning programmes initiated by a work-place but which takes place in for example a HEI. It is the often a cooperation between a HEI and the industry organizations (Cooper, Orrell and Bowden, 2010).

3. Methodological Approach

The data presented is from a qualitative case study following a number of songwriter camps throughout terms of spring and fall of 2022/2023. In this study we have mainly used observations, group interviews and single interviews. We have used a semi-structured interview form (Saunders, 2007; Johannessen, Tufte and Christoffersen, 2010; Dalen, 2011; Jacobsen, 2015). This has allowed us to discuss the different data and to observe the supervision in action and provided us with a thicker description (Geertz, 1973). The aim has been was to investigate how the songwriter camps were organized, the teaching methods, and make enquiries about the students' experiences. A total of four researchers have been taking part in the data collection. During the camps we have conducted an open observation, as present observers. In addition to observation, we were doing both formal and informal interviews with teachers and students, e.g., sitting in at the introduction from the start, following the students doing studio practice during the day and listening in at the presentations of music products in the evening. During and after observations, we took fieldnotes. In addition, some students were interviewed individually, and we also have conducted group interviews using a semi-structured interview-guide, and the conversations were recorded and transcribed verbatim. A total of 18 students has given written reflections upon their experienced outcome learning of the songwriter- camps. The use of several different data collection methods has provided us with an insight into the processes of the songwriter camps, as well as the meanings, feelings and reflections of the various participants. This is what can be called thick descriptions (Geertz, 1973).

Table 1: Overview of Data Collection, Timetable and Informants

Songwriter camp	Observation by researchers in classroom and studio (fieldnotes)	Informal group conver-sations with students (fieldnotes)	Informal conver-sations with teachers (field-notes)	Individual interviews students (rec)	Group interview students (rec)	Group interview teachers (rec)
18thFeb 2022	Researcher1	x	Teachers1 &2	Informants A and B		
4thMarch 2022	Researcher2	x	Teachers1 & 3			
6th April 2022	Researchers1 and 3	x	Teachers1 & 2	Informant C	Four informants	Teachers1& 2

Songwriter camp	Observation by researchers in classroom and studio (fieldnotes)	Informal group conver-sations with students (fieldnotes)	Informal conver-sations with teachers (field-notes)	Individual interviews students (rec)	Group interview students (rec)	Group interview teachers (rec)
18th Nov 2022	Researchers 1, 2,	x	Teachers 1,2			
3rd March 2023	Researchers 2,3,4	x	Teacher 2			
14th April 2023	Researchers 1,3,4	x	Teacher			

The data analysis have been carried out by reading the transcripts to identify themes and issues relevant to the research questions. In this way the material was coded by marking sentences representing a central meaning to the research themes, thus developing descriptive codes close to the experience. Secondly, the categories were further interpreted into theoretical codes. Our interpretation of the data has also been qualitative and rather than trying to generalize (Yin, 2014), we have sought to find the nuances in the data from each semester in order to better interpret the subtleties of the supervising process to prepare the students for a work-life in the music business industry. The findings are presented and discussed against the theories presented above.

The conceptual model

What we are setting out to investigate is if and how the lecturers' production focus and their facilitation of psychological safety for the students through their way of communicating can contribute towards the students' perception of a work-like setting within the frames of their education. The lectures then utilize their communication skills acquired from their own work-life setting.

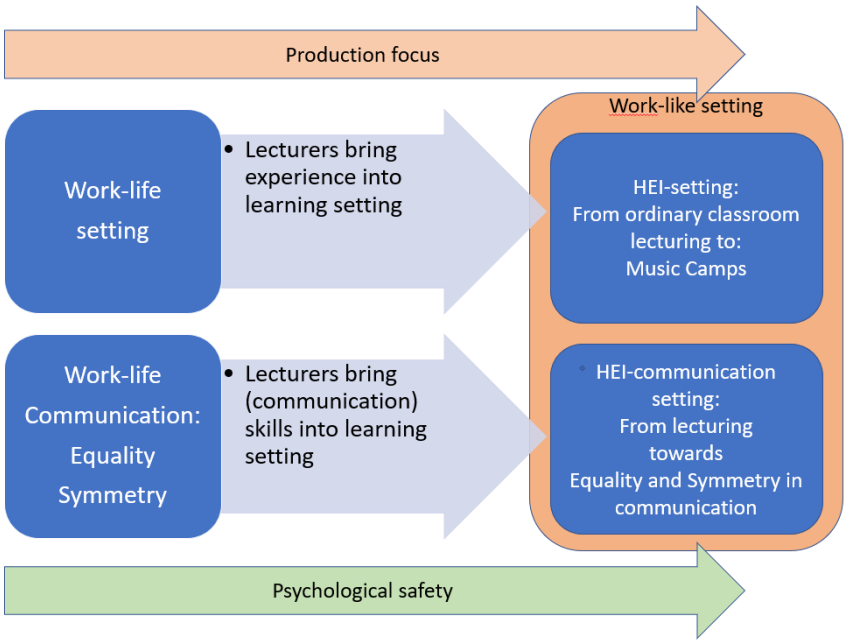


Figure 1: Our Conceptual Model for the Investigations

4. Findings

The students in this case study have all reported on relatively good communication. As the students had ordinary lectures where they learned about the different digital tools and also theory on how to build lyrics and melodies, they were able to follow the lectures introduction to the different assignments. The context was thus established

and not disconnected from the messages from the lectures, hence, there was a perceived *communicative rationality* (Habermas, 1985a). The purpose of the presentation of the assignments was to make the students understand the task at hand and avoid what Searle (1969) suggest may alter meaning if the semantic rules were not in place. The lecturers were also perceived to be clear about the expectations, hence, "illocutionary act" (Searle, 1968; Austin, 1975) was to make the students produce a song with lyrics and melody either freely or within a genre. Even if some of the student groups found it hard to execute the assignment, no groups reported on not understanding the assignments.

The student groups, however, in every session made different songs but within the frames of the assignments. The "negotiations" were both between the group members (students) and the group and the lecturers/supervisors. This "negotiation" we interpret to be similar to the pragmatist social construction of a reality (Mead, 1934). However, this does not come without a context. The lecturers/supervisors had asked the students to register for the seminars with their desire of role in the groups. Some like to produce and work with the digital tools to produce the songs adding different sound effects, etc. Some like to write lyrics and some like to play instruments and develop the melodies. All of them are needed in the group in order to finish producing a song, hence, the lecturers/supervisors divided the groups in such a way that the different roles were distributed evenly in the groups making sure they had someone to produce, someone(s) to write lyrics, and someone(s) to develop the melody. Which students who were assigned which roles was also made clear in the introductory process. As the students have communicated their desired roles and the lecturers assign the roles, much based on the students own input, this form of "negotiation" resemble a social act of communication and a "socially mediated act" according to Mead (1934), underpinning a possibility of the different group members to have a "self" and "mind" within the group and within the social realm of the educational setting in the seminar. When the group starts to work, this is also allows the knowledge to be constructed within each of the group members (Piaget, 1976). During the seminars the supervision and own experimentation, as well as feedback from the group members and supervisors, they will gain and develop knowledge within their role and within the group. As the seminars progresses, we may assume that the students develop "schemes" which again are developed as they attend more and more seminars (Piaget, 1976; Lyngsnes and Rismark, 2014). Comments like "I learn more about the tools and how to use different tools every time" and "I thought I knew how to make music, but I had to rethink that when I started here" are examples of how students alter their schemes as they attend the seminars. They also express that they appreciate learning the digital tools that they use in the industry and that they can "play around" with it in order to master them as they recognize the value of this when entering the work-life in the music industry.

However, one of the most noticeable features about the seminars are the way the lecturers/supervisors facilitate for a *psychologically safe* environment for the students. This is done by establishing, communicating, and executing, rules for communication within the groups, and between the groups and supervisors. This is a part of how the lecturers/supervisors establish trust and respect, according to Edmondson (2019). The students' feedback on this is unanimously positive. Statements like "It was hard at first not to be negative if I did not like it, but after a while I understood how we could develop it to something that we (the group) liked" and "It took a while before I dared to present my idea, but when I did, I was so happy that it was not met with negative feedback, which made me feel comfortable in the group" confirm the positive outcome of these rules. There are also examples of where the students were less happy with the results: "I did not like the idea that came up, but I had no better idea myself, so I did not say anything. I was not too happy with the result, but it was ok, and I did learn a lot from the process" and "I did not agree with the structure of the song, but I did not know how to make it better. It was when the supervisor came up with a new suggestion, that we all understood what to do to make it a better product". Here the supervisors have intervened in the process and come up with a better suggestion.

Also, the lecturers'/supervisors' ability to take part in the groups is commented on. They are perceived as knowledgeable, positive, engaging and personal. They are also perceived as emotionally and cognitively engaged in the students' work. Statements like: "[the supervisor] started to sing our song which made us understand better how to modify it and record our vocals again" and "He really pushed us and made us stick to the time schedule and told us about his own experiences when writing songs, explaining the steps in the process as he has done it himself", and "They really seem to care if we are able to make the product", show how the lecturers/supervisors share from their own experiences and show their personal engagement in the groups. This resembles what Kahn refers to as "pure personal engagement" (Kahn, 1990).

Upon interviewing the lecturers/supervisors, they also claim to learn from each camp/seminar. They are alert to different situations and by experience they claim to have realized for example that there needs to be a "timetable" for when different "jobs" needs to have been executed for the groups to be able to deliver on time.

They have also learned to look at different personalities in the group members and have incorporated their knowledge about the different students into their work prior to the camps regarding dividing the students into groups.

5. Conclusion

The camps or seminars and the way they are conducted seems to have had the desired effect; be effective learning arenas as well as provide a work-like environment in order to secure both the development of knowledge and skills, but also to provide the students with insights in the music production industry. By communicating with the individual group members on roles and expectations, as well as facilitating the assignments in such a way that they are able to understand the rules and norms to be followed, the lecturers/supervisors are able to establish a work-like environment within the higher education setting. Establishing trust and respect in order to secure psychological safety to promote innovativeness, engagement and a good learning environment is important and is done through being clear in their communication, making sure that the semantics cohere with the assignments, and supporting the role understanding and behaviour in the groups allowing for the social construction of the knowledge as well as the personal development with each student. Their ability to be personal and sharing own experiences and expertise support what Kahn suggest are the important grounds for psychological safety. This is by securing "interpersonal relationships, group and intergroup dynamics, management style and process, and organizational norms" (Kahn, 1990, p. 708). The interpersonal relationships, the group and intergroup dynamics, and organizational norms are dealt with through the rules presented, the management is partly done by the group themselves and partly by the supervisors/lectures that make sure they make the different "deadlines" during the course of the seminar.

5.1 Further Research

The students in the first year of our study have continued working in camps even if the camps are no longer organized (for the second-year students) from the educational institution. It would be interesting to investigate why they organize them, how close these camps are in conduction and performance to the ones organized by the faculty staff, and what learning outcome they experience. Also, it would be interesting to see if they maintain the strict rules of communication constituted by the lectures/supervisors in their first year.

What we as researchers also noticed there were multiple learning processes at play. The students learned about how to develop and produce songs, but the teachers also had a learning outcome. As this was more about group processes and how to approach supervising each student as well as the different student groups, we noticed also a difference in the approach as this study program has a closeness to the business. The subtleties of the differences between supervising groups in an "ordinary" educational setting and this more "work-like" adaption to groupwork, would be interesting to investigate further as it would be interesting to establish what exactly constitutes the differences.

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Inter-Hospital Knowledge Sharing: Insights From Case Studies on Infrastructure Issues During COVID-19

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Abstract: This paper presents findings on knowledge sharing (KS) behaviours among Estates and Facilities Management (EFM) staff in the English National Health Service (NHS). EFM departments play a crucial role in ensuring the safe delivery of healthcare services while facing the impacts of disasters, climate change hazards, and continuous organisational change. Effective KS among hospitals is required to efficiently manage these constantly changing conditions and emerging challenges. While previous research has largely focused on evidence-based clinical knowledge dissemination among clinical professionals, scant research has been conducted to investigate KS processes among EFM departments. The research draws on primary case study data from semi-structured interviews with 34 EFM professionals conducted in seven NHS hospitals across England. Using qualitative analysis and the persona technique, we identify variations in KS behaviour among managerial levels and explore the associated barriers to KS. The findings reveal that KS is more prevalent among strategic-level managers, who engage in regular peer discussions and focus on the sharing of knowledge and best practices. In contrast, operational-level managers face barriers to KS due to a lack of personal networks and time constraints. The study also highlights the effects of frequent organisational changes in the NHS, which has resulted in a lack of technical in-house expertise and slow central coordination. The study concludes that a centralised coordination function is necessary to facilitate effective KS, with a focus on the organisation of peer collaboration, enhancing the centralised online repository for best practice and academic research, and the use of a national skills register. The study extends the current literature by identifying variations in KS behaviour among managerial levels and providing insights into the barriers to KS in the NHS EFM workforce. The findings have implications for NHS managers and policymakers seeking to improve KS in the EFM workforce, particularly in addressing the barriers faced by operational-level managers and the need for a centralised coordination to facilitate effective KS.

Keywords: Knowledge sharing, National Health Service, Estates and facilities management, Managerial levels

1. Introduction

The current change towards integrated care systems (ICSs) in the UK's National Health System (NHS) is another major restructuring designed to integrate NHS and local government services. However, as highlighted by The House of Commons Public Accounts Committee, the reorganisation cannot be successful if the systemic problems in the NHS, such as expanding patient waiting lists, workforce recruitment and retention issues, and an ever-increasing backlog maintenance for the NHS Estate, are not addressed (Iacobucci, 2023). Moreover, inflationary pressures resulting from rising energy costs due to the Ukraine war and the ambitious net-zero carbon target by 2040 complicate the task (Jennings and Rao, 2020). The COVID-19 pandemic exposed these vulnerabilities by revealing bed capacity limits and staff shortages (Coyle, 2022).

NHS Estates and Facilities Management (EFM) departments – responsible for maintaining safety-critical infrastructure and essential support services – currently face the challenge of maintaining an ageing Estate while enduring various external stressors and internal change initiatives. To achieve this, the NHS needs to be able to effectively share knowledge, such as lessons learned and best practices across the NHS (AHSN Network, 2019). However, there is currently only fragmented KS among few NHS Trusts (HSIB, 2021), and most EFM departments have to resort to using their own resources to find guidance and innovative solutions to their safety-critical infrastructure issues. Moreover, previous research has shown that KS behaviours with peers from other Trusts differ among managerial levels within EFM (von Behr et al., 2022). Therefore, this paper aims to analyse KS behaviours and perspective on different managerial levels within EFM departments to enable the creation of KS channels customised to the needs of the employees.

The paper is structured as follows. Firstly, we summarise the existing literature on managerial levels and KS. Then, we review the methods that were used to collect, analyse, and present data for the research. Finally, we present and discuss the collected data and conclude by outlining academic and practical contributions, acknowledging the limitations of this study and highlighting further research opportunities.

2. Literature Review

2.1 Knowledge Sharing (KS) Behaviours in NHS EFM

To ensure patient safety, policies in many NHS Trusts require EFM services to operate based on national best practices (PH NHS Trust, 2019). Therefore, EFM staff must be able to access knowledge and experience of peers in other Trusts, necessitating effective KS across organisational boundaries. However, several studies have highlighted limited KS among NHS Trusts (Barlow et al., 2009; Kothari et al., 2011; Nutt, 2000), with poor attempts to address the issue (Pathirage et al., 2008).

According to Davenport and Prusak (1998), knowledge comprises a dynamic blend of structured experience, values, contextual data, and expert judgment. This knowledge is often ingrained not only in documents or databases but also in organisational routines, procedures, practices, and standards. Various categorisations of knowledge exist, including explicit and tacit types of knowledge (Nonaka, 1994; Polanyi, 1966). Explicit knowledge is the type of knowledge that can be embodied in a code or language and can be verbalised, communicated, processed, transmitted, and stored relatively easily. Tacit knowledge is based on personal experiences and is difficult to articulate or transfer to another individual because the possessor is unaware of its existence and how it could be beneficial to others (Nonaka, 1994).

A recent study (von Behr and Minshall, 2022) reviews the KS literature and identifies three overarching KS strategies for EFM departments: For documented knowledge, codification strategies such as guidance documents and library services provide effective storage tools, while newsletters, bulletins or blog posts provide effective ways by which to disseminate topical knowledge (Adeyemi and Olla, 2020). Undocumented knowledge can be shared via informal social networks or alternatively using personalisation mechanisms, such as communities of practices and action learning. These channels enable individuals to share undocumented knowledge of value in the same or different EFM disciplines (Kothari et al., 2011).

Similarly, several barriers to KS have been identified in the literature which can be categorised into four key areas: source-recipient relationship, knowledge transferred, organisational context, and flow mechanisms. Barriers in the source-recipient relationship include the lack adequate knowledge among EFM managers (Baaki et al., 2016), and the need for leadership programs for collaborative behaviour (Hope Hailey et al., 2017). For operational staff, several factors hinder effective KS, including lack of awareness of tacit knowledge (Pathirage et al., 2008), lack of expertise and insufficient professional development in the NHS (Naylor, 2017; von Behr and Minshall, 2022), and reliance on technical manuals (Wetherill et al., 2007). Additionally, some staff may be unopen to KS (Adeyemi and Olla, 2020; Kothari et al., 2011) or lack critical thinking skills (Kothari et al., 2011). Furthermore, there are various challenges related to the knowledge to be shared. For example, information overload (Kothari et al., 2011) can complicate KS. Moreover, some knowledge types – especially related to context-dependent factors – are difficult to share with external peer groups (Pathirage et al., 2008). The organisational context is another important factor that affects KS. In particular, in- and outsourcing of services (Yousefli et al., 2017), the PFI ownership model (Barlow et al., 2009; May, 2018), benchmarking/competitive pressures (Agostini et al., 2020), no or unsuitable reward systems (Kaushal and Nyoni, 2022; von Behr et al., 2022), and a lack of an overarching Estates strategy (Naylor, 2017) can all impact KS. Finally, issues around existing KS channels, such as reliance on top-down communication (Kothari et al., 2011), bureaucratic procedures (Adeyemi and Olla, 2020), and lack of formalised collaboration (Adeyemi and Olla, 2020) can hinder effective KS.

2.2 Managerial Levels Within NHS EFM

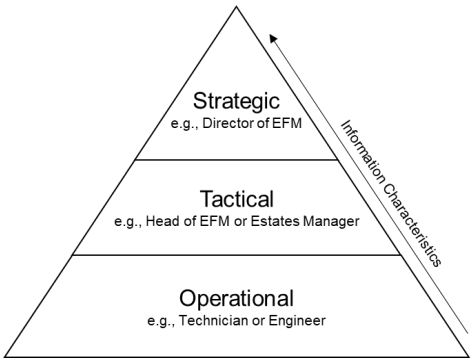
Secondary care hospitals in the NHS are run by so-called NHS Trusts that have varying organisational structures and degrees of autonomy to respond to local needs based (Auschra, 2018). Within NHS Trusts, EFM departments play a crucial role in ensuring that the physical infrastructure of hospitals and healthcare facilities is properly managed and maintained to support the delivery of high-quality patient care. EFM incorporates multi-disciplinary activities within hospitals' built environment, managing their impact on people and the workplace (Alexander, 1996). These activities ensure that hospital buildings, systems, and services align with the core clinical operations, thereby contributing to the organisation's strategic objectives. Therefore, EFM encompasses strategic, tactical, and operational considerations, and consists of a variety of disciplines that can be classified into Estates (building and infrastructure-related) and Facilities (support services) management.

The organisation of EFM departments within the UK NHS involves a complex structure of roles and responsibilities that must be considered when studying KS behaviours. This includes the management of specialised high-risk-impact services, such as high voltage electricity, medical gas pipeline systems (MGPS), and

water safety and quality. The NHS Trust board appoints a Designated Person (DP) – usually the Director of Estates and Facilities – to carry the responsibility for the services. The DP nominates technically qualified engineers as Authorised Persons (AP) who have the key operational responsibility for the specialised service and appoint Competent Persons (CPs) to carry out installation or maintenance works in accordance with the standard operating procedures. Additionally, Authorising Engineers (AEs) act as independent professional advisers to a portfolio of NHS Trusts (HSIB, 2021). These complex structures of actors with specific operational, tactical, or strategic roles within EFM departments must be considered when studying KS behaviours among NHS Trusts.

2.3 Research gap and Question

Effective EFM services require access to different types of information on strategic, tactical, and operational management levels. At the strategic NHS EFM level, Directors of EFM (DoEs) must consider new ways of thinking about healthcare buildings and create visions and translate these into policies to guide the organisation into the future. At the tactical level, Heads of EFM (HoEs) must implement those policies and monitor the performance to meet policy requirements. At the operational management level, APs and CPs are responsible for executing the policy interventions and reporting the progress on their implementation. As visible in Figure 1, the management literature associates different concepts with the different management levels: On strategic level, topics are centred around effectiveness, organisational alignment, governance, and competitive advantage, while on tactical level, the literature discusses the dilemmas between effectiveness vs. efficiency, outcomes vs. outputs, and system design vs. process design. For operational management, efficiency and business processes are key elements (Nechkoska et al., 2015).



Characteristic	Strategic	→ Operational
Time period	Forecast	→ Historical
Timeliness	Delayed	→ Immediately available
Objectivity	Subjective	→ Objective
Quantifiability	Qualitative	→ Quantitative
Accuracy	Approximate	→ Accurate
Certainty	Uncertain	→ Certain
Completeness	Partial	→ Complete
Breadth	Broad	→ Specific
Detail	Little detail	→ Highly detailed

Figure 1: STO Framework Illustrating Management Levels and Required Information Types (Adapted From Anthony, 1965)

Despite the recognition of the importance of KS for organisational success, there is a lack of understanding on the variations in KS practices among managerial hierarchies within the NHS EFM workforce. Cresswell et al. (2021) argue that policy interventions should aim to reduce barriers and promote informal KS. Pfeffer (1981) emphasises the role of power differentials in shaping communication patterns and decision-making processes within organisations, suggesting that hierarchical structures can affect the ability of workers at different levels to share knowledge and influence decision-making. To address this gap, we formulated the following research question: *What are the variations in knowledge sharing practices among managerial levels within the NHS Estates and Facilities Management workforce?*

3. Research Design and Methodology

To address the proposed research question, a multiple retrospective case study methodology was selected to investigate KS behaviours of EFM staff responsible for medical oxygen infrastructure systems during the COVID-19 pandemic. The case sampling process was guided by a maximum variation rationale focussing on hospital site characteristics, including geographical region, size and type of hospital, and organisational structure. This rationale aimed to document unique or diverse variations that have emerged in adapting to different conditions (Patton, 2014).

After the identification of potential cases, the research departments of the Trusts were contacted and asked for participation in the study. Once the Trust and the EFM department confirmed capacity and capability to deliver the research activities, a “Non-Commercial Participant Identification Centre Agreement” was signed. In total, seven NHS Trusts, one in every region of England, agreed to participate. Interview guides were refined and validated during a pilot case study. Upon successful completion of these steps, the first interview was

conducted with the EFM employee that was nominated by the Trust's research department. During this interview, a snowball sampling strategy was used to identify other potential interviewees – both trust-internal and external (e.g., AEs) who were involved in the flow of knowledge related to the Trust's MGPS. In each case, we conducted 3 to 6 semi-structured interviews with stakeholders on strategic, tactical, and operational levels as well as external Authorising Engineers (AEs), each lasting 45-60 minutes. Table 1 summarises the conducted interviews and shows the differences in organisational and tenure type across the seven cases.

Table 1: Overview of Case Studies and Interviewed Stakeholders

Case studies	Code	Job title	Hierarchical level	Internal (I)/ External (E)	Interview date
Large Teaching Hospital Trust A (Part-site PFI)	1.1	Deputy Director of Estates and Facilities	Strategic (DoE)	I	26.05.2022
	1.2	Senior Mechanical Engineer	Operational (AP)	I	12.06.2022
	1.3	Head of Estates	Tactical (HoE)	I	14.06.2022
	1.4	Hospital Engineer	Operational (AP)	I	21.06.2022
	1.5	Authorising Engineer	External (AE)	E	21.06.2022
	1.6	Director of Capital, Estates and Facilities	Strategic (DoE)	I	20.10.2022
Multi-Service Trust A (Part-site PFI)	2.1	Director of Estates and Facilities	Strategic (DoE)	I	24.01.2023
	2.2	Head of Medical Technology	Operational (AP)	I	07.11.2022
	2.3	Head of Estates and Facilities	Tactical (HoE)	I	23.01.2023
	2.4	Authorising Engineer	External (AE)	E	05.12.2022
	2.5	Mechanical Technician	Operational (CP)	I	19.01.2023
Large Acute Hospital Trust A (Part-site PFI)	3.1	Head of Estates and Facilities	Tactical (HoE)	I	11.07.2022
	3.2	Authorising Engineer	External (AE)	E	20.07.2022
	3.3	Estates Manager	Operational (AP)	E	22.07.2022
	3.4	Project Engineer	Operational (CP)	E	19.07.2022
	3.5	Director of Finance	Strategic (DoE)	I	03.11.2022
Large Teaching Hospital Trust B (Freehold)	4.1	Director of Estates	Strategic (DoE)	I	25.08.2022
	4.2	Senior Operational Manager, Site A	Tactical (HoE)	I	17.11.2022
	4.3	Deputy Operations Manager, Site A	Operational (AP)	I	22.11.2022
	4.4	Estates Manager, Site B	Operational (AP)	I	22.11.2022
	4.5	Authorising Engineer	External (AE)	E	24.11.2022
Multi-Service Trust B (Freehold)	5.1	Interim Operational Estates Manager	Tactical (HoE)	I	20.10.2022
	5.2	Estates Officer	Operational (AP)	I	16.01.2023
	5.3	Authorising Engineer	External (AE)	E	24.01.2023
Large Acute Hospital Trust B (Whole-site PFI)	6.1	Director of Estates and Facilities	Strategic (DoE)	I	09.11.2022
	6.2	Senior Estates Manager	Tactical (HoE)	I	09.11.2022
	6.3	Mechanical Estates Officer	Operational (AP)	I	25.11.2022
	6.4	Estates Manager	Operational (AP)	E	21.11.2022
	6.5	Apprentice	Operational (CP)	E	30.11.2022
	6.6	Apprentice	Operational (CP)	E	30.11.2022
Medium Acute Hospital Trust (Part-site PFI)	7.1	Associate Director of Estates and Facilities	Strategic (DoE)	I	13.10.2022
	7.2	Estates Manager	Operational (AP)	E	25.10.2022
	7.3	Authorising Engineer	External (AE)	E	17.10.2022
	7.4	Senior Hard FM Manager	Tactical (HoE)	I	23.22.2022

All interviews were held remotely using Microsoft Teams due the uncertainty concerning the COVID-19 pandemic and its impact on in-person interactions in hospital environments. This arrangement allowed more scheduling flexibility and reduced research travel costs, facilitating access to NHS Trusts from different regions. The interviews were recorded through the respective platform and transcribed by the lead researcher. Subsequently, transcripts were pseudonymised with a unique code.

The data analysis involved three steps: (i) a two-step process of structural and axial coding to identify themes in the collected data, supported through the qualitative data management tool NVivo 12, (ii) the creation of personas for every interviewee, following Pruitt and Adlin's persona lifecycle process (2010), and (iii) the summarisation of KS behaviours by managerial level.

4. Findings and Discussion

This section examines the collected and analysed data as summarised in Table 2. Any direct quotes from the interviews will be in *italics* accompanied by the corresponding interviewee code. It is important to note that due to the restricted scope of this paper, the discussion is limited to managerial levels. However, to illustrate

the effect of organisational differences across the seven cases, additional information considering hospital and tenure type can be found in **Tables 3** and **4** in the appendix.

Table 2: KS Behaviours by Managerial Level (Most Frequently Mentioned Aspect per Managerial Level Bolded)

	Level/ perspective	Strategic *Director (n=7) (%)*	Tactical *Head (n=7) (%)*	Operational *AP (n=10) (%)*	Operational *CP (n=4) (%)*	Overall *excl. AEs (n=28) (%)*
Origin	**Preferred sources of information**					
Trust int.	Internal collaboration (e.g., team members, colleagues within Trust, Committee meetings)	71	57	70	**100**	**69**
	Learning through practical experience	0	14	30	25	**17**
NHS-wide	Guidance, Standards, Regulations (e.g., HTM, ISO, BSI)	0	71	**100**	75	**62**
	NHS England Collaboration Hub	43	43	10	0	**24**
	CAS Alerts	14	43	10	0	**17**
	Benchmarking (e.g., ERIC, Model Hospital)	43	29	0	0	**17**
	Government & NHSE stakeholders	14	43	0	0	**14**
External	Personal development (e.g., training & CPD)	57	**86**	**100**	**100**	**83**
	Personal network (e.g., ex-colleagues)	**100**	57	50	50	**62**
	Authorising Engineer	14	43	**100**	25	**52**
	Professional bodies and institutes (e.g., IHEEM, HefmA, CIBSE, IET, IEng, NAFO)	86	57	40	0	**48**
	3rd parties (e.g., manufacturers, universities, consultants, contractors)	29	29	80	50	**48**
	Peer collaboration via informal networks (e.g., peer groups, regional hubs, LinkedIn)	71	43	50	0	**45**
	Research (e.g., internet, journals, other industries)	43	29	10	0	**21**
Origin	**Perceived barriers to sharing knowledge**					
Trust internal	Time and resource constraints	43	**86**	30	0	**41**
	Communication issues (e.g., silo-working within Trusts, lack of meeting rooms, no feedback after escalation)	29	57	**50**	0	**38**
	Management/ leadership issues (e.g., ineffective knowledge retention, governance, board representation)	29	29	**50**	0	**31**
	Organisational culture issues (competition, power dynamics, commercial conflicts)	14	14	10	25	**14**
NHS-wide	Inadequate links among Trusts (no access to peers)	43	43	**50**	**100**	**52**
	Ineffective/slow central coordination/ facilitation (e.g., lack of feedback & central coordination)	29	57	**50**	25	**41**
	Insufficient training (e.g., inadequate training courses, lack of expertise, financial constraints on training)	**71**	29	30	0	**34**
	Varying contexts (e.g., different protocols and procedures among Trusts)	57	0	20	25	**24**
External	Challenges of remote meetings (e.g., distractions, lack of trust, anxiety)	29	43	40	25	**34**
	Difficulty to access trusted & reliable sources of information (e.g., standards, policy documents)	29	14	20	0	**17**
	Ideal future of knowledge sharing with peers from other Trusts					
Channel	Regular peer discussion forums	**71**	**71**	**70**	**75**	**69**
	Online repository with best practice & research (e.g., extending functionality of Collaboration Hub)	14	29	30	50	**28**
	Email newsletter	0	0	20	0	**7**
Facili-tation	KS facilitation through NHSE team (e.g., central moderation of dialogue, linking similar Trusts)	14	57	0	0	**17**
	Systems approach (e.g., ICS, cross-disciplinary)	29	14	0	0	**10**
	National skills register	0	0	0	0	**0**

4.1 KS Behaviours by Managerial Level

The dominant channels for strategic level EFM staff to acquire information include inter-disciplinary internal collaboration, seeking advice and comparing performance with people in the same role through personal networks, professional bodies, and informal peer networks. For example, interviewee 2.1 mentioned, that multiple team members are part of different professional bodies so the Trust is *"quite attached to those networks"*, while another DoE stated that the EFM team relied *"heavily on IHEEM and HefmA" (4.1)*. Beyond professional bodies, informal peer networks are used to connect with peers and discuss best practices and strategies. Multiple DoEs mentioned being part of 'EFM Square' – *"a group of like-minded Directors of the Estates and Facilities" (1.6)*. This network includes DoEs from *"the big teaching hospitals, […] to try and influence policy and have a collective effort" (1.6).* DoEs also use the Collaboration Hub - an NHS EFM internal

online forum – and benchmarking tools to stay up-to-date with industry standards. The Collaboration Hub *"gives quite good information on new developments" (4.1)*, while NHS benchmarking tools *"get the teams to understand how we compare with our peers" (4.1).* Moreover, personal development and industry research also play a crucial role in staying up-to-date with industry standards, as *"often questions come up which aren't answered in black and white in the [guidance documents], but often by talking to people and by using the internet, you can find lots of information." (1.1)*

At the tactical level, understanding the local operations and performance is crucial, hence, HoEs must *"be familiar with the HTMs, the guidance"* (4.3). They also rely on inter-disciplinary internal collaboration, seeking advice from colleagues in the senior management team who have more experience, and who can provide insights into their roles. Interviewee 1.3 noted, *"there are people within the senior management team that I would go to for advice […] due their experience, having done it themselves for longer".* In addition to personal networks and informal peer networks, many HoEs join professional bodies to share experiences and compare performance with peers in a similar role. To understand trends and risks, they rely on patient-safety alerts via the Central Alerting System (CAS) and stakeholders from NHS England (NHSE), who are responsible for "supporting service improvement and transformation across systems and within providers" (NHS, 2022), and the Collaboration Hub. Overall, HoEs use the widest range of information sources to understand how operational, often very technical activities align with the overarching strategic objectives.

Operational managers rely on various sources of information to understand their own operations and performance. Following guidance and standards documents is crucial, as one interviewee stated: *"we use the HTM which […] is basically the guiding Bible" (3.4)*. Beyond the guidance, they collaborate within their teams to ensure that they have a comprehensive understanding of the local operations, such as *"APs passing any knowledge or anything they pick up down" (2.5)* to CPs. When encountering technical issues, AEs are the *"first point of call*" (6.3), as *"they are the cream of the crop when it comes to your information" (6.3).* Operational managers rely heavily on the advice and expertise of the AEs, as they have experiences from different hospitals and can share this knowledge with their clients. AEs also benefit from extensive networking with other AEs to share information and identify potential issues. As one AE explained, *"I just pick the phone up and ring other AEs. If we do some training or something on a site that's not one of mine and I see something that's wrong, I'll normally ring the other AEs and say, you need to have a look at this, there's a problem" (2.4).* During COVID, NHSE stakeholders set up a regular call for MGPS AEs. Another source of information for operational staff are third-party contractors who work in different hospitals and share information about best practices. As one interviewee noted, *"if they see something good at another site, they'll come to us and say, have you thought about doing this?" (4.3).*

4.2 Barriers to Sharing Knowledge With Peers

At the strategic level, one of the main challenges is the lack of central coordination, highlighted by an interviewee stating that *"NHSE is not close enough to the operational stuff [so] they don't understand the pressures that we're dealing with on a day-to-day basis" (2.1).* The lack of capacity and technical in-house expertise of NHSE was confirmed by AEs. As one AE revealed the Department of Health has long considered *"engineering and building issues as non-core activity" (7.3)*, which has led to a lack of attention by policymakers and budget cuts for the central coordination of NHS EFM activities. This resulted in the abandonment of the arms-length body NHS Estates in 2004 which was frequently criticised by AEs due to the bodies' central role in disseminating knowledge and fostering collaboration among NHS Trusts. The responsibility for coordination now lies with NHSE. However, NHS Estates "*had 80-90 staff at their disposal",* compared to "*a department of about six people" (7.3)* within NHSE so they *"don't have an inhouse team to do it as they used to" (3.2)* and are *"understaffed to look after all the Trusts" (4.5).* Therefore, when NHSE does share information, it is often not timely enough, supported by a DoE stating that *"a faster process from the centre" (5.1)* is needed*.* This view was echoed by an AE noting that *"if you raise a hazard report, it could be literally […] two years before it comes out, by which time things have been put" (2.4).* In addition, varying contexts of Trusts hinder effective KS since *"all the systems are actually very different [so] you need the knowledge of your system to relate your system to the information" (1.1)* from other Trusts (for further insights, see Table 3 in the appendix). As a result, DoEs prefer networking with peers from similar organisational and building contexts, such as the Shelford Group, a network of the largest Teaching Hospital Trusts, or EFM-Squared. However, these are *"not open to everybody, it's invitation-only"* (4.1), restricting wider collaboration across the NHS system.

At the tactical level, HoEs perceive time and resource constraints as major barriers to KS with peers. Managing the oversight and responsibility for multiple EFM disciplines means that *"everybody is massively busy and understaffed" (4.2)* so it *"takes your time away to perhaps visit other places to broaden horizons" (6.2)*. As a result, communication issues such as silo working arise. Furthermore, interviewees criticised that training courses for APs are insufficient to equip them for their responsibilities as *"there seems to be a misunderstanding across the whole NHS that because you go on an AP course, that then makes you an expert in that field, which is not the case." (7.4)*

Operational managers highlighted inadequate links to peers. The majority of APs and CPs are early in their career, and therefore do not have similar personal networks as staff on tactical and strategic levels, as highlighted by an AE who said KS among operational staff occurs only when an employee *"knows somebody at another hospital, but a lot of times they don't" (7.3).* Time constraints are also a challenge, with many APs covering multiple responsibilities, leading to a high demand on their time and expertise. As one Director emphasised, *"certainly for APs and CPs, one of the big challenges is that the demand on their time and expertise is so big"* (2.1), which was reflected in the statement of an AP: *"I'm thinking of 55 things that I still need to do before I leave for home today" (6.3).*

4.3 Envisaged KS in the Future

For the majority of interviewees, regular peer discussion forums would be ideal way to share best practice and learning. One interviewee emphasised the importance of having all NHS EFM join groups with *"a focus around standard topics or issues" (2.2)*. Additionally, interviewees highlighted the importance of having Trusts of similar size and context in such groups, as interviewees stated that they *"do find […] quite a difference" (2.5)* with most neighbouring Trusts. While quarterly forums, either virtual or in-person, were suggested as an effective way to effectively share knowledge, one interviewee expressed doubts about the feasibility of organising such gatherings: *"I don't think we'd be able to get that type of gathering in place." (4.4)*

Regarding the responsibility for the required facilitation of KS across the NHS, interviewees stressed that this *"needs to come out of NHSE" (6.2)* so *"NHSE […] need to gear up and get the correct staff capacity to be able to do that" (7.3).* It was also remarked that NHSE should have the ability to quickly review and distribute information such as best practice, as one interviewee explained, *"it definitely needs to be a centralised organisation that can review the information quickly, look at it, and then go out with best guidance" (4.5*). Overall, a majority of EFM staff on tactical level believe that a centralised organisation within the NHS is necessary to facilitate effective KS.

In addition to central coordination by NHSE, some interviewees suggested utilising existing systems and approaches to facilitate KS. One interviewee stated, *"there's an opportunity at ICB level to start to drive that collaborative thinking" (4.1)*. Furthermore, the use of a national skills register was suggested as an effective way of identifying the right people for the KS groups. In such a register, every NHS employee would have their qualifications and completed trainings in certain disciplines recorded so *"any updates or safety alerts would be sent" (1.5)* to the interested and affected sub-groups with the NHS EFM domain.

Beyond the organisation of networking events, interviewees also suggested enhancing the existing Collaboration Hub. The goal should be to have *"an NHS knowledge hub where people can post things from one Trust and other Trusts look at it" (1.4).* Additionally, email newsletters were suggested as "*that would be probably the easiest way to share information across Trusts" (4.4).* Considering that the Collaboration Hub currently serves as the primary medium for NHSE to disseminate information, it is imperative to evaluate its efficacy in light of the fact that fewer than one-third of interviewees perceive it as an optimal channel for future use.

5. Conclusion

This paper has sought to answer the research question: What are the variations in knowledge sharing practices among managerial levels within the NHS Estates and Facilities Management workforce? As summarised in Figure 2, we have identified varying KS behaviours and barriers to KS for the different managerial levels of NHS EFM. The findings of the study enhance the understanding of KS processes in the NHS and extend the current literature by revealing the variations among managerial levels.

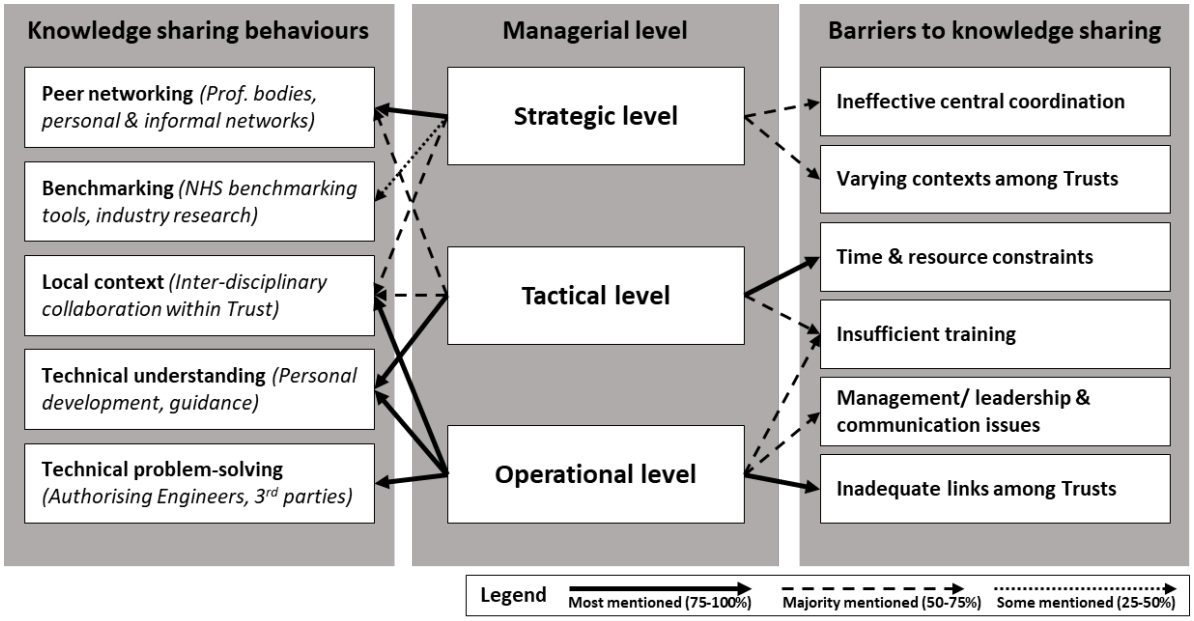


Figure 2: Summary of Knowledge Sharing Behaviours and Barriers to KS by Managerial Level

5.1 Contribution and Limitations

The findings can inform policymakers and decision-makers in creating customised KS channels for different managerial levels. The insights can also be used to develop targeted training curricula that cater to the specific needs of each managerial level. This targeted approach would enable NHS policymakers to address the unique challenges and requirements associated with KS at different managerial levels, ultimately leading to more effective collaboration across NHS Trusts. Additionally, the application of the findings of this research helps create an awareness of "who knows what" (Cross et al., 2003) within the NHS, enabling better knowledge flow, identifying and addressing knowledge gaps, and fostering a collaborative culture.

This research has some limitations. First, the sample size of seven NHS Trusts might not reflect the complexity and diversity of the entire NHS hospital landscape. The findings may not be generalisable to other NHS trusts, especially those with different sizes or specialties. Second, the case studies only focused on one discipline within EFM, namely MGPS, which is not representative of the multi-disciplinary nature of EFM. Therefore, the findings may not apply to other EFM areas or other healthcare systems. Third, due to the uncertainty caused by the COVID-19 pandemic, hospital site visits were not possible, and we were unable to conduct face-to-face interviews or on-site observations, which may have limited the depth and richness of the data collected. However, the engagement of AEs – who have vast portfolios of NHS Trusts as clients – allowed the researchers to capture highly experienced perspectives and gain a better understanding of the dysfunctions of the current system.

5.2 Further Research

This qualitative study analysed KS behaviours and barriers to KS across managerial levels of EFM, providing insights into the complex healthcare system environment. Future research could explore how organisational, cultural, and individual factors that impede or facilitate the flow of knowledge across organisational boundaries affect the management of challenges. Additionally, further investigation could examine best practice KS channels from other industries that could be adapted to meet the identified knowledge needs of the EFM workforce.

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Appendix 1: Tables 3 and 4

Table 3: Preliminary Insights from Table 4 (TH = Staff in Teaching Hospitals, AT = Staff in Acute Trusts, ST = Staff in Multi-Service Trusts, FH = Staff in Freehold Trusts, PSP = Staff in Part-site PFI, WSP = Staff in Whole-site PFI)

Dimension	Preferred source of information	Perceived barriers to KS	Ideal future of KS with peers from other Trusts
Trust type	- TH and AT focus on personal development of workforce and relationships within personal networks - MST seek knowledge external views from professional bodies/ institutes, and authorising engineers	- TH perceive lacking links to other Trusts (hence reliance on personal networks) and insufficient training opportunities (prohibiting upskilling the workforce) as major barriers - AT perceive Trust-internal communication issues - Majority of MST mentioned that ineffective/slow central coordination hampers KS	- All Trust types view regular peer discussion forums as ideal channel for KS with peers from other Trusts - 50% of MST also view an online repository, such as an upgraded Collaboration Hub, with best practice and research as useful KS channel
Tenure type	- PSP and WSP value personal development and personal networks. - FH engage more in peer collaboration via professional bodies and institutes	- WSP highlight communication issues (due to more complex organisational structures of PFIs) - Most FH perceive a lack of access to peers in other Trusts - PSP regard time and resource constraints and insufficient training as most important barriers	- All Tenure types view regular peer discussion forums as ideal channel for KS with peers from other Trusts
External	- AEs have strong focus on guidance, standards, and regulations as they need to be able to advise within regulatory guidance	- AEs perceive ineffective/slow central coordination as major barrier to KS among Trusts	- AEs also envision regular peer discussion forums to be beneficial for KS among Trusts, however, large majority see need for facilitation of such collaboration with central NHSE team

Table 4: KS behaviours by Trust and Tenure Type (most frequently mentioned aspect per type bolded)

		Trust Type			Tenure Type			External	Overall
	Level/ perspective	Teaching Hospitals *(n=9)* *(%)*	Acute Trusts *(n=13)* *(%)*	Multi-Service Trusts *(n=6)* *(%)*	Freehold *(n=6)* *(%)*	Part-site PFI *(n=16)* *(%)*	Whole-site PFI *(n=6)* *(%)*	Authorising Engineers *(n=6)* *(%)*	*incl. AEs (n=34)* *(%)*
Origin	**Preferred sources of information**								
Trust int.	Internal collaboration (e.g., team members, colleagues within Trust, Committee meetings)	67	77	67	67	63	**100**	83	**76**
	Learning through practical experience	33	8	17	33	13	17	33	**21**
NHS-wide	Guidance, Standards, Regulations (e.g., HTM, ISO, BSI)	56	77	50	67	56	83	**100**	**70**
	NHS England Collaboration Hub	33	15	33	17	31	17	0	**21**
	CAS Alerts	33	8	17	50	13	0	67	**27**
	Benchmarking (e.g., ERIC, Model Hospital)	22	15	17	33	19	0	0	**15**
	Government & NHSE stakeholders	0	15	33	17	13	17	67	**24**
External	Personal development (e.g., training & CPD)	**89**	**92**	67	67	**88**	**100**	50	**79**
	Personal network (e.g., ex-colleagues)	**89**	62	33	50	69	67	50	**61**
	Authorising Engineer	56	38	**83**	67	56	33	0	**42**
	Professional bodies and institutes (e.g., IHEEM, HefmA, CIBSE, IET, IEng, NAFO)	67	23	**83**	**83**	44	33	67	**55**
	3rd parties (e.g., manufacturers, universities, consultants, contractors)	67	46	33	67	44	50	50	**48**
	Peer collaboration via informal networks (e.g., peer groups, regional hubs, LinkedIn)	78	23	50	50	56	17	17	**42**
	Research (e.g., internet, journals, other industries)	44	15	0	0	38	0	50	**24**
Origin	**Perceived barriers to sharing knowledge**								
Trust internal	Time and resource constraints	56	38	33	50	**50**	17	33	**42**
	Communication issues (e.g., silo-working within Trusts, lack of meeting rooms, no feedback after escalation)	33	**54**	17	17	38	**67**	50	**39**
	Management/ leadership issues (e.g., ineffective knowledge retention, governance, board representation)	44	23	33	33	25	50	17	**30**
	Organisational culture issues (competition, power dynamics, commercial conflicts)	0	23	17	0	25	0	50	**21**
NHS-wide	Inadequate links among Trusts (no access to peers)	**67**	38	**67**	**83**	44	50	67	**58**
	Ineffective/slow central coordination/ facilitation (e.g., lack of feedback & central coordination)	44	15	**67**	67	38	0	**83**	**39**
	Insufficient training (e.g., inadequate training courses, lack of expertise, financial constraints on training)	**67**	31	33	33	**50**	33	33	**45**
	Varying contexts (e.g., different protocols and procedures among Trusts)	22	23	33	33	25	17	50	**30**
External	Challenges of remote meetings (e.g., distractions, lack of trust, anxiety)	44	31	33	33	38	33	0	**30**
	Difficulty to access trusted & reliable sources of information (e.g., standards, policy documents)	33	15	0	0	25	17	50	**24**
	Ideal future of knowledge sharing with peers from other Trusts								
Channel	Regular peer discussion forums	**67**	**62**	**100**	**67**	**69**	**83**	**83**	**73**
	Online repository with best practice & research (e.g., extending functionality of Collaboration Hub)	33	15	50	33	31	17	0	**24**
	Email newsletter	22	0	0	33	0	0	17	**9**
Facilitation	KS facilitation through NHSE team (e.g., central moderation of dialogue, linking similar Trusts)	22	23	0	17	19	17	**83**	**27**
	Systems approach (e.g., ICS, cross-disciplinary)	11	15	0	17	13	0	0	**9**
	National skills register	0	0	0	0	0	0	17	**3**

Knowledge Management Dynamics in Offshore Wind Farms in the Netherlands

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Abstract: Offshore wind farm development is a is a highly complex process. The societal and political pressure to implement is high while environmental responses and future developments in the global energy network are uncertain. Moreover, many interests in maritime space are at stake. The dependency on knowledge for decision-making is high, but the capacity to use knowledge is limited. In this paper we investigate the role of ecosystem knowledge in offshore wind farm planning and management. We have identified 4 types of research arenas: (1) government driven (e.g., monitoring programs) (2) subsidized research (national or EU), (3) industrial or PPS (Public-private partnerships), and (4) research by universities. This study considers the way in which knowledge from different arenas is or could be taken up and used in policy. We identify that particularly government-driven research (monitoring) is used in policymaking. The analysis of policy documents, in-depth expert interviews and focus groups reveals that the distance between knowledge developers and knowledge users may differentiate from purely transactional relations to co-production-relations. However, co-production is rare beyond the monitoring programs directly initiated by the government agencies.

Keywords: Research arenas, Impact pathways, Science-policy interactions

1. Introduction

Most North Sea countries are heavily investing in offshore wind farms (OWF) to comply with the Paris Climate Agreement and energy-security goals (WindEurope, 2021). The process of planning, installation, operation and decommissioning of offshore wind farms is highly complex. Many interests are at stake, including fisheries, sandmining and nature protection, and there is limited knowledge about the North-Sea's Biophysical system leading to uncertainties concerning environmental responses and future developments in the global energy network (Ansong *et al.,* 2021). To support the OWF decision-making process in the Netherlands, the so-called North-Sea Agreement has recently been developed (OFL, 2020). The agreement specifically states that knowledge from the knowledge programs must be considered in the decision-making process and that these programs and other monitoring operations are to be cooperated with to make smart combinations and prevent double work (OFL, 2020). The knowledge programs encompass (i) a monitoring programme called WOZEP in which ecological knowledge concerning the development of OWFs is gathered, (ii) a program called KEC considering the cumulative effects of wind farms (Noordzeeloket, 2016; Noordzeeloket, 2020) and (iii) a program called MONS, in which a more integral perspective is taken by including other activities besides OWF development and operation (OFL, 2021).

Next to WOZEP and MONS, many other research projects are in progress, initiated by authorities, universities or the industry. Together, the studies cover a broad range of knowledge development relevant for decision-making concerning OWFs, including ecology, abiotic dynamics and hydrodynamics, technology and engineering, and economics and law. Yet, within these fields and beyond, not everything can be studied and a limited capacity of authorities to consider the broad array of newly produced knowledge, most knowledge is not formally and explicitly coupled to governance processes (Keijser et al. 2020; Paez et al. 2020).

This paper aims to shed light on the ways in which newly developed knowledge from different arenas is taken up and used in the governance of OWF planning and operation, and how this can be improved. We aim to develop understanding of knowledge development dynamics and knowledge use in decision-making and governance by studying the systems of knowledge users and developers and in particular their interactions. Moreover, we discuss relevant impact pathways and interactions that could support, structure, and formalize knowledge-uptake.

2. Producers and Users of Knowledge

Knowledge is a free-flowing commodity, differing from physical objects in its dependence on a knower and their subjective interpretations. It can be seen as information, context, skills, values, insight, experiences, a social construct, a tool of influence or a combination of these concepts (Nagel, 2014). In understanding the dynamics around knowledge use in decision-making for OWFs, we use a producer-user perspective, based on

the sender-receiver model by Tromp (2019), and Tromp et al. (2022) (Figure 1). This model builds on the idea that there are research arenas and policy arenas within which separate endeavours operate at geographically dispersed locations (Wiewiora et al. 2009). Their primary task is either knowledge development or policy/decision making, both having different goals and incentives, and operating in different networks. The research arena consists mainly of universities and research institutes, engaged with scientific development, discussing with peers in conferences and scientific journals (Spaapen and van Drooge, 2011). The policy arena mainly consists of ministries and authorities dealing with policymaking, implementing said policy, maintaining and controlling public services, and regulating the conduct of other parties (Liefferink, 2006). These organisations and people involved meet at the interface, for example when performing specifically requested studies or when jointly doing projects, but the emergence of a gap is inevitable (Bradshaw & Borchers, 2000). This so so-called science- policy gap needs to be bridged.

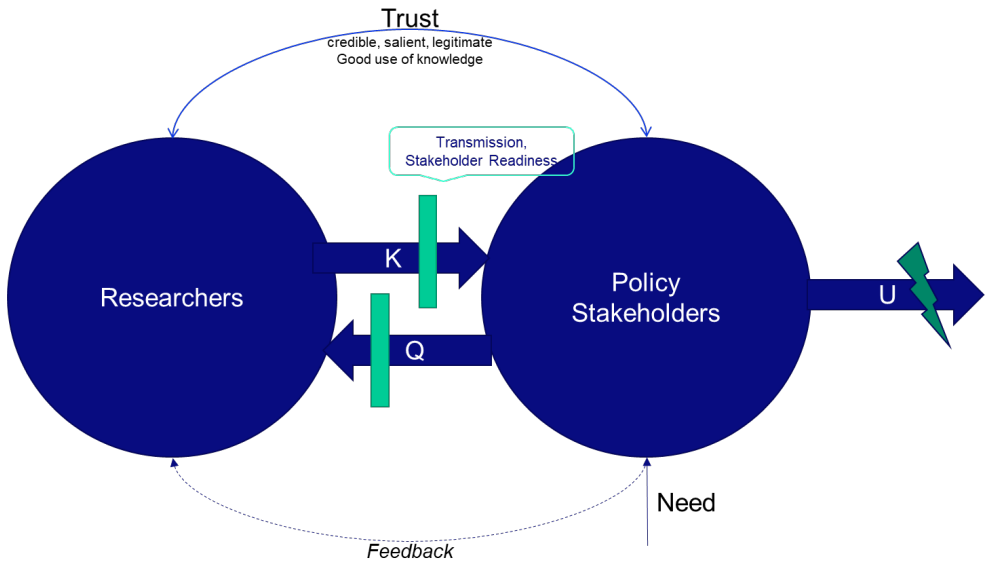


Figure 1: A Knowledge Developer-User Model (Adapted from Tromp et al. 2022). K=Knowledge, Q=Questions, U=Utilization

3. Productive Interactions and Knowledge Impact Pathways

For the co-production and transfer of knowledge between disciplines and across actors, there is a need for close and continuous interaction (Janssen *et al.,* 2014). Spaapen and Van Drooge (2011) defined productive interactions as: 'exchanges between researchers and stakeholders in which knowledge is produced and valued that is both scientifically robust and socially relevant'. The interaction is productive when it leads to efforts by stakeholders to somehow use or apply research results, practical information or experiences in practice. Based on Spaapen and Van Drooge (2011), Muhonen et al. (2020) have identified mechanisms through which impact of research is generated. They identify 12 pathways based on (1) dissemination, (2) co-creation, (3) reacting to societal change and (4) driving societal change. The concepts of productive interaction and impact pathways constitute a comprehensive framework for assessing the manner and effectiveness of knowledge transfer between different parties in the OWF domain.

4. Methods

The research is designed around the distinction of a governance arena, several knowledge arenas, and the interactions between them. To understand the governance system, we have reviewed policy documents that are available on official websites of the Dutch ministries of Economic Affairs (EZK), Agriculture, Nature, and Food quality (LNV), Infrastructure and Water management (IenW). Secondly, we interviewed 4 policy makers from these ministries involved in the planning, decision making and operational management of OWFs. Additionally, we interviewed 10 scientists involved in 6 knowledge development programs and projects about the impact of OWFs on biophysical systems, notably 1) WOZEP, 2) Dutch national scientific agenda (NWO/NWA) "effects of windfarms at sea and implications for governance", 3) Joint Industry Project HASPRO, 4) Joint Industry Project Road2SID, as well as offshore wind energy research at 5) Delft University of Technology and 6) the University of Groningen. Lastly, we organized an interactive session during the NWO

thematic day May 3rd 2022 in Scheveningen, the Netherlands and a workshop with researchers and policy makers (June 28th, 2022) to discuss the results, outcomes, and dynamics.

5. Knowledge Production and Policy Making Landscape in Offshore Wind Farms

Considering the science-policy interface we distinguish between knowledge producers (universities, research institutes and consultancies) and knowledge users (ministries, government agencies and industry). They may use knowledge in different phases of OWF: planning, construction, operation and decommissioning. Four types of knowledge production arenas can be identified: (1) government funded research, primarily related to monitoring (e.g. WOZEP and MONS), (2) Research subsidy funded, with a wider focus on diverse drivers, longer-term and larger-scale cumulative ecological impacts (e.g. NWO/NWA, EU Horizon), (3) Industry/PPS funded, primarily focusing on direct industry needs, often to meet tender requirements and (4) university funded research with a focus on more fundamental knowledge, technological innovation and governance (Figure 2).

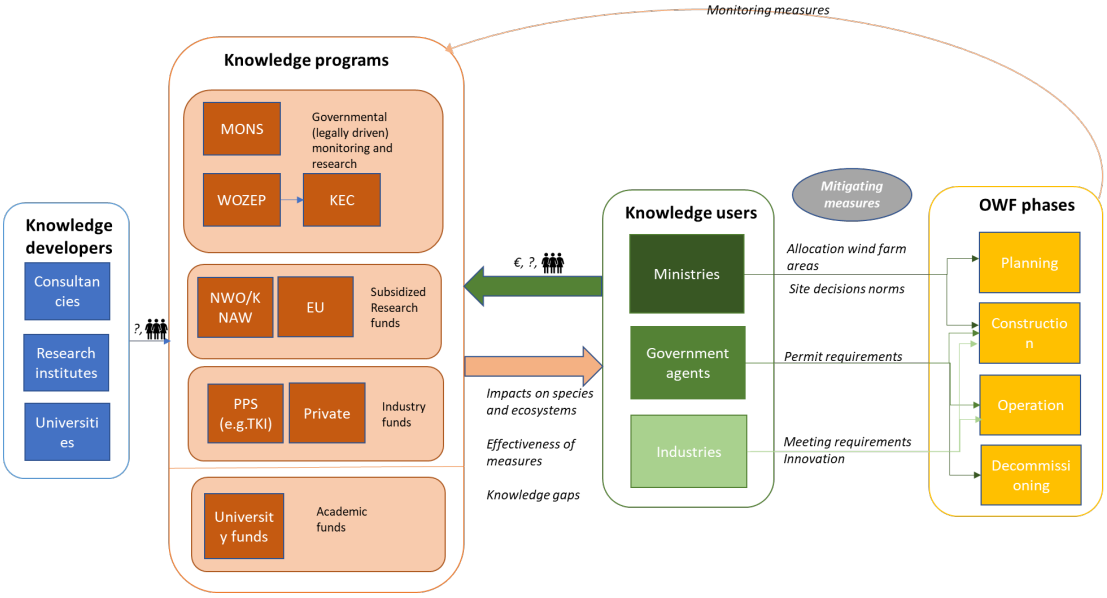


Figure 2: Knowledge Production and Policy Making Landscape of Offshore Wind Farms in the Netherlands

The four different knowledge arenas all have different objectives, research foci, primary methods and origin of the question. The government driven programs aim to support policy and management, focus on ecosystem knowledge relevant for legislation like protected species. Examples are birds and bat collision and a digital twin. The main method used is monitoring and the origin of the question is either a legal requirement or derived from the North Sea stakeholder group NZO. The subsidized research more generally aims to support OWF development and understanding of the North Sea, so the focus is on more fundamental knowledge concerning the physical-ecological interactions of OWFs and governance. Industry-based research intends to increase the competitiveness of the industry, by increasing efficiency and meeting tender requirements. The research focus is usually of a technical nature such as on construction techniques or more nature-based solutions. Research is done by modelling or testing in the field or laboratories. Lastly, university funds have the broadest perspective. Their objectives are first to deepen system understanding, to innovate beyond wind farms, for example on multi-energy generation, but also governance issues like Marine Spatial Planning. Universities also aim to include new knowledge in education, influencing the next generation of workers and researchers. Figure 3 gives a more detailed overview of the different research systems.

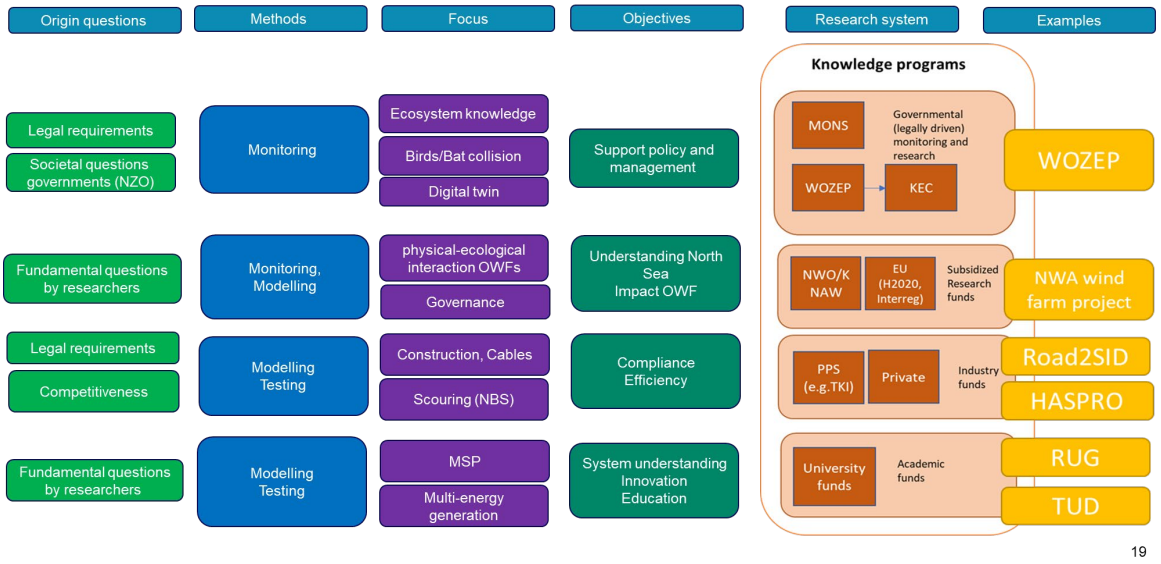


Figure 3. The Objectives, Knowledge Focus, Methods and the Origin of the Questions of the Different Research Arena

6. Science-Policy Interactions

The interactions between the knowledge arenas and the policy arenas (see Table 1)give an indication of the manner of knowledge uptake, and why certain knowledge is better adopted in policy than others. To specify the policy arena further, we follow the four phases relevant to offshore wind farm development. The knowledge arenas are relevant to different phases of decision-making, the nature of decision-making alters as well as the dominance of stakeholders. For example, the ministry of Economic Affairs is mostly dominant in planning, but Rijkswaterstaat is in charge of monitoring during operation. To describe the science-policy interactions we identify the 'intensity' of the relation between the knowledge arenas and the policy arena as well as the most relevant impact pathways. The intensity of the relation is a subjective measure (high-low) of the actors in both arenas, indicated by interviewees during the interviews and workshops. It refers to (i) how often they meet with actors from research or policy respectively during different phases of a research or policy process (i.e. question articulation, modelling/testing, validation, policy formulation), and (ii) nature of interactions (e.g. formal project moments such as advisory board meetings, do they call each other on a regular basis) and (iii) perceived influence on each other (e.g. is research adjusted based on interactions?). The relevant impact pathways (dissemination, co-creation, reacting to societal change and driving societal change) are also based on the interviews and workshops.

Table 1: Interactions between Different Knowledge Arenas and Policy Arenas

Knowledge arena	**Policy arena**				**Intensity of relation**	**Most relevant impact pathways**
	Planning	**Construction**	**Operation**	**Decommissioning**		
Governmental research			x		High	Co-creation Dissemination
Subsidized research	x		x		Low	Dissemination Reacting to societal change

Industry funded research		x	x		High	Co-creation Reacting to societal change Dissemination
University funded research	x				Low	Dissemination Driving societal change Co-creation

The results show that governmental research is primarily used for operational purposes, and because the distance is low, and used impact pathways include co-creation and dissemination, the knowledge uptake is relatively high. Subsidized research takes more place at a distance of policy making, the results could however be beneficial for operation and to a lesser extent for planning (e.g. on area selection taking into account cumulative effects on the sea ecology). The primary impact pathway is dissemination, co-creation is limited and takes primarily place at the level of call development, and in later instances through expertise and mobility pathways. Industry funded research is mostly relevant for construction and operation, to comply with tender requirements. The interaction between users and researchers is high and mobility of researchers is of relevance. University research is mostly relevant for planning, for example on including innovative approaches, or balancing interests. The primary impact pathway is publishing, but on the long term driving societal change is highly relevant.

7. Concluding Remarks

Both knowledge producers and knowledge users are very active in the OWF knowledge arena. However, the productive interactions differentiate across the four knowledge arenas and policy arenas identified in Dutch OWF development. Users are more involved in government driven and industrial research. In subsidized research the users are at a distance, whereas in university driven research the users are mainly reached on the long term, through education and building an epistemic community. So, knowledge use is primarily achieved in the arenas where there is a direct client.

Acknowledgements

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Towards a Deeper Understanding of Intellectual Capital

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Abstract: This paper takes its cue from a paper by Kianto and Cabrilo (2022) presented at ECKM 2022. In their paper they raise concerns both with the theoretic underpinnings of the theory of Intellectual Capital and the more specific need to consider the impacts on new technologies and work structures. In the existing literature it has been proposed that Intellectual Capital is composed of a variety of components which have often been addressed somewhat independently. It is important to both investigate the nature of these sub-components and recognize the extent to which they interact. Some key concerns with Intellectual Capital and its subcomponents are discussed including their valuation, which presents significant challenges to traditional approaches of valuation. Other notable concerns relate to the underlying conceptual structure for Intellectual Capital, which needs further study with respect to its general intelligibility, its explanatory value, and in the light of major technological changes and the phenomenon of digitization.

Keywords: Intellectual capital, Intangible assets, Practical and theoretical challenges, Digitization, Valuation

1. Intellectual Capital (IC) and it's Subcomponents

The first use of the term intellectual capital (IC) is often credited to economist John Kenneth Galbraith in 1969 (e.g., Bontis, 1998; Kalecki, 1975; Martın-de-Castro, Delgado-Verde, Lopez-Saez, Navas-Lopez, 2011) but it was more than a quarter century later, with the rise of the knowledge economy and the popularization of the knowledge-based view of the firm (Grant 1996), that the idea gained significant interest and traction within the business and research communities. Most definitions of IC are broad and inclusive, reflecting the multi-dimensional nature of the concept. However, definitions of IC generally agree on two important principles.

First, that IC includes intangible assets, which, by definition, are nonfinancial and immaterial (i.e., they have no physical existence) (e.g., Bontis, 1998; Brooking, 1997; Bueno et al., 2004; Edvinsson and Malone, 1997; Martín-de-Castro et al, 2011; Stewart, 1997; Sveiby 1997). The terms intellectual capital, intangible assets, and knowledge assets are often used synonymously (Evans, Dalkir, and Bidian, 2014; Stewart, 1991; 1994; Martın-de-Castro et. al., 2011) though, as noted below, this confounds many subtle and not so subtle distinctions. Commonly cited examples of IC may include employee knowledge, competencies/skills, intellectual property, organizational systems, reputations, or relationships with customers. The second principle that scholars generally agree upon is that IC has 'value' to the organization. The IC itself, may be the principal source of value, or the IC may be a means by which the organization gains a competitive advantage (e.g., Bontis, 1996; 1998; Edvinsson and Malone, 1997; Stewart, 1997; Sveiby, 1997). Based on these two general principles, IC will be defined, in this paper, as knowledge and knowing capabilities, which create value for an organization (Bontis, 1998; Nahapiet and Ghoshal, 1998).

A variety of taxonomies or frameworks have been presented for understanding IC. The most ubiquitous framework builds on the work of early IC scholars (e.g., Bontis, 1998; Bontis, Crossan, and Hulland, 2002; Edvinsson and Malone, 1997; Sullivan, 1998) who describe it using three dimensions or components: human capital, structural capital, and social capital. Human capital can best be summarized as the intangible assets that are embedded in the knowledge, skills/abilities/competencies, education/training, innovativeness/creativity/intuition, and the attitudes and beliefs of an organization's employees (Bontis, 1998; 2000; Bontis et al., 2002; Edvinsson and Malone, 1997; Roos, Roos, Edvinsson, and Dragonetti, 1997).

Structural capital is composed of the intangible assets that are embedded in an organization's systems, processes/routines, organizational design, and organizational culture (Bontis, 1998; Brooking, 1997; Edvinsson and Malone, 1997; Martın-de-Castro et al., 2011; Stewart, 1998; Sveiby, 1997). Examples include the organization's intellectual property (e.g., patents, trademarks, trade secrets, etc.), information and communications systems (e.g., databases, technological infrastructure, software), and any other non-human organizational capabilities. Roos, et al., (1997), described these intangible assets as "what remains in the company when employees go home for the night" (p. 42). However, this definition is deceptive. One may cogently argue that the only thing of value left when employees leave are the physical assets. The intangible assets only have value when they are combined with employees and other participants in the organization's

ecosystem. Thus, although structural capital may have some stand-alone value, its real value lies in its ability to provide a conducive environment where human capital and social capital can be leveraged.

Earlier researchers have referred to social capital as the sum of the value created from relationships the organization has developed with key stakeholders (Bontis, 1996; Edvinsson and Malone, 1997, Stewart, 1998).

Distinctions have also been made among cognitive social capital, structural social capital and relational social capital (Claridge, 2018). *Cognitive social* capital refers to the shared values, shared beliefs, shared mental models, etc. of employees and, potentially participants in the organization's ecosystem. *Structural social capital* refers to the networks potentially linking members of the organization's ecosystem, the formal and informal aspects of the organizational structure and ecosystem. Finally, *relational social capital* refers to the actual and potential relationships that have been established between an organization's stakeholders. Social capital is critical because it forms the basis for knowledge sharing, knowledge acquisition, and the development of trust (Coleman, 1988; 1990). It is important to understand that social capital is not owned by any one individual in the organization, or by the organization itself. Instead, it is embedded in the relationships that the organization can leverage for value and will largely depend on everchanging factors associated with those relationships (e.g., interaction frequency, trust, reputations, reciprocity, etc.) (Burt, 2007).

These three dimensions or components of IC and their subcomponents directly influence each other, which has an important impact on their overall ability to generate value. For example, research in sociology (e.g., Burt, 1992; Coleman, 1988; 1990; Putnam,1993; 2000) and in management (e.g., Fukuyama, 1995; Baker, 2000) have consistently shown that social capital positively impacts human capital. Structural capital is also created and leveraged in the creation and leveraging of social capital and human capital.

2. Theoretical and Pragmatic Challenges With IC Research

The remainder of the paper is divided into three interrelated sections. The first section explores a variety of broad theoretical and pragmatic challenges that have emerged in the research literature pertaining to IC. The second focuses on an overarching theme introduced by Kianto and Cabrilo (2022), which relates to concerns that there may be a need to revisit the theoretical underpinnings of IC theory. The authors expressed particular concern with respect to the effect of changes that may be driven by the development of digital tools enabling the collection, analysis, and communication of digital data and the increasing digitization of and access to potential sources of knowledge. This section attempts to consider some of the questions posed by Kianto et al. (2022) and contribute to the discussion on the potential effects of digitization and digital tools on the conceptualization and articulation of IC. The final section provides some brief recommendations for organizations seeking to adjust to an increasingly digitized, information and communication technology intensive environment or use increasingly complex digital tools.

2.1 Challenges Related to the Explanation of Value for IC

The basic underlying proposition concerning IC theory is that firms consist of a bundle of tangible and intangible assets. Firms then gain a competitive advantage if they can mobilize or combine these tangible and intangible assets in a way that creates some unique value for their stakeholders. Customers are the most commonly noted stakeholders but there is increasing importance in creating value to a broader range of stakeholders from shareholders to society, in general. To do this effectively, organizations must be able to identify the precise nature of their tangible and intangible assets. This is important to ensure that they are in possession of the appropriate assets, and that they are able to use those assets to effectively respond to changes to the internal and external environments, to continue to create value. Some changes are likely to be endogenous and initiated by the firm itself (i.e., through strategic and other managerial decisions), and other changes may be exogenous, such as technology changes, regulatory changes, or changes with respect to customers or suppliers. Of course, there is a dynamic interplay between these endogenous and exogenous changes.

One of the early stimuli for proposing and investigating IC arose from the observation that the market valuation of many software and other professional service firms deviated considerably from the value of their tangible or physical assets (Carroll and Tansey, 2000). Physical assets, as reported on the company's balance sheet, did not reflect what may be called the 'value-in-use' or the extent to which value is contingent upon the knowledge and experience of the employees who create value by using the physical assets. Physical assets, without individuals to make use of them, were not considered have much value beyond their depreciated value on a balance sheet. Moreover, assets that relate to the production of very specific products or service may, in certain circumstances, have little to no value.

The Accounting Profession has long recognized that there was value in intangible assets (e.g., in the form of earnings capacity) but acknowledged the difficulty in assessing this value on a consistent basis. It wasn't until the 90's when several researchers from Economics, Strategy, and other related Management disciplines sought to explain why the market capitalization of many knowledge-intensive firms far exceeded their book value, particularly in such industries as software, entertainment, consulting, high tech and so on. The proposed explanation was that the 'missing value' could be attributed to the organization's IC. Even at this level a problem can be discerned with respect to the composite value of IC, as the difference between the market valuation of the organization and the value of its tangible assets. There are several flaws in this line of reasoning, putting aside that relying on the market to value intangible assets may not be the appropriate strategy or, in the case of organizations that are not publicly traded, possible.

First, the value of tangible assets is often intimately related to some components of IC and hence valuations such a book value may be an imprecise way of valuing tangible assets. Hence, the apparently 'simple' equation relating the value of IC to the 'missing value' may not be appropriate. Second, the fluctuations in market value of organizations with significant concentrations of intangible assets have shown extreme volatility over the past three decades. Whatever the cause of these fluctuations, it would be unwise to equate this directly to changes in the value of IC or its subcomponents. Third, it is incredibly challenging to establish an appropriate valuation for IC and its subcomponents because the value of each component is intimately related to other components both tangible and intangible. Even if one could make sense of point valuations, the components of IC are subject to continuous change.

Furthermore, even if researchers were able to provide some characterization of the value of IC and its subcomponents, there is still a need to provide an explanation of how this value evolves over time as a result of changes in the internal and external environment. There are a multitude of factors that may affect the value of an organization's IC over time. For example, changes in production technologies, changes in communications technologies, and changes in customer knowledge and behaviour may result in existing human capital and structural capital losing value. Kuhn (Kuhn, 2012), in the context of science, has characterized these changes when referring to the development of scientific theory/knowledge as being 'normal' or 'revolutionary'.

Thus, it is likely necessary to provide an explanation as to how the valuation of IC varies, both during times of 'normal' change and in times of 'revolutionary' or disruptive change. Conceptually, it can be argued that the value of some IC components degrade over time. For instance, digital technologies are continuously improving in terms of speed, complexity and functionality. In contrast, there are examples of revolutionary changes such as the transition from analog communications to digital communications. As noted earlier, some IC components may be 'transformed' from assets into liabilities by such changes. For example, the extensive technical knowledge possessed by Nortel's telephone engineers had value when there were dedicated analog telephone networks but ceased to have value when the analog networks were displaced by digital data networks.

It is also a somewhat trite observation that *knowledge* cannot be directly captured or measured. Instead, researchers often examine proxy measurements like intellectual property (e.g., patents), self-reported measures, or they use metrics extracted from organizational database and server logs. It is a fair contention, following long standing concerns in the Knowledge Management (KM) field, that *knowledge* is not an object that can be measured. However, it is true that certain *knowledge* may be susceptible to some proxy measurement. Patents, for example, may appear to be susceptible to market-based valuation. However, the extent to which they have value is the extent to which they can lead to the creation of products, or, in some distinct cases, services that have, or create, value for the organization and its stakeholders. In a similar fashion, in an organizational context, *knowledge* does not have value unless it is applied in a manner that adds value to the organization's stakeholders. In order to be applied, there is a need for individuals to be able to translate this *knowledge* into products and services.

Moreover, organizations often have a compelling need to update and revise knowledge. Thus, it is important to move from considering the extent to which organizations possess or have access to intangible assets to considering an organization's capability to utilize these assets to achieve its objectives. Whatever one considers to be the components of IC, their value is in their combination, not individually. There is a discrete sense in which their value cannot be measured independently. Furthermore, as the organization's internal and external ecosystems change, some components of IC will lose value, while others may increase in value.

2.2 Challenges Related to the Conceptual Structure of IC Theory

A general issue that relates to the creation of a theoretical basis for the study of IC and the Intellectual Capital Theory of the Firm (ICT) is the linkage to such theories as the Resource Based Theory of the Firm (RBT) and the Knowledge-Based Theory of the Firm (KBT). One may consider that all three theories share similar structure. Basically, each theory posits the existence of a core element, which provides a foundation for the firm's ability to create value. In the case of RBT it is *resources* which, if they have certain characteristics, will provide the basis for a firm's ability to create value and sustain a competitive advantage. In the case of KBT, the core element is *knowledge* and in the case of ICT it is *intellectual capital*.

The use of the term 'capital' also presents theoretical and practical challenges for IC theory and practice. IC and its subcomponents may have some similar characteristics to *capital*, in an economic sense, but it should not carry the same intellectual 'heft' in a theory underpinning IC. Specifically, IC and its subcomponents do not have properties attributed to capital, as it has been traditionally defined. For example, they may not be under the control of the firm or be capable of being valued, in a market-based sense. Dean and Kretschmer (2007) refer to this imprecise use of language as "conceptual negligence" (p. 574). Such conceptual negligence severely limits theory development and any conclusions or predictions that may be derived from relevant theories.

One of the central problems of all these theories is that simply having ownership of resources, knowledge, or intellectual capital is, at most, a necessary condition for generating value, but not a sufficient condition. Even if firms have ownership or access to relevant resources, knowledge or intellectual capital they also need to be able to dynamically incorporate these into value adding activities and processes. Productivity and value generation depends, not only on employee skills and expertise but also, for instance, on the organization's structures, processes, technologies, and culture. Mumford's (2000) work relating to socio-technical systems established, even as far back as the 1940s, is useful here.

Lambe (2023) argues that a similar problem exists with the use of such terms as 'resource' in the Resource Based Theory (RBT) of the firm. Resources are typically consumed in the production process and, to be a source of competitive advantage (or value), need to be scarce and non-contestable. Resources potentially create value through activities that the firm engages in that integrate resources into productive processes. Traditional resources typically only contribute to the creation over a limited lifetime.

Further concerns have been raised with respect to the use of terms such as 'tangible and 'intangible' assets and other terms such as *knowledge assets* and *resources*. Traditionally tangible assets are considered to have a physical nature. As such, they are owned by the organization, depreciate over time, and have a relatively well-defined market value. Although some types of intangible assets have characteristics similar to those of tangible assets, most of them do not. Lambe (2023) argues that "[w]hile both attributes [ownership and tradability] of an intangible asset such as a patent (although the valuation of intangible assets [such as patents] is more uncertain than tangible ones), they are not at all true of the tacit knowledge, cumulative skills, experience, and expertise of subject matter experts." (p. 211). Thus, it can be argued that using the term "asset" to refer to 'intangibles' is potentially unhelpful and leads to theoretical and practical challenges.

A somewhat different, but related, problem arises from the natural positive bias that arises from using the terms 'assets', 'resources' and to a lesser extent 'capital'. For example, it is perfectly conceivable that any of the subcomponents of IC may impede the creation of value by the organization just as much as add value. One may consider aspects of these subcomponents as, for example, intellectual liabilities or knowledge liabilities if accounting terminology is retained. Out-of-date knowledge, mental models, inappropriate organizational structures and incentive schemes or relationships that no longer function appropriately may all result in a reduction in the value of the organization.

On a final note, sometimes IC subcomponents may become valuable after having previously declined to essentially zero value. For example, knowledge of FORTRAN had little value by the end of the 1990s. However, with the Y2K challenge looming many organizations found that FORTRAN was at the heart of their critical information systems.

3. Technological Change and its Relevance to IC/KM Theory and Practice

How firms utilize information technology, in general, or their digital tools (facilitating digital communication, collaboration and collaboration) and digitization techniques, more specifically, will ultimately form an infrastructure by which they interact with their internal and external environments. This infrastructure will then largely impact the current and potential value of the organization's IC and its proposed subcomponents or

require the identification of new subcomponents. Thus, it may well be necessary to review the major components of IC in a principled fashion to potentially identify 'new' subcomponents of IC or better define how to calculate the value of current IC subcomponents.

Kianto and Cabrilo (2022) argue for the inclusion of additional components when considering human capital to reflect the increasing need for individuals to have *digital competences*. In addition, Kianto and Cabrilo (2022) suggested that changing work structures requires more emphasis to be placed in what is termed *self-leadership*. These suggestions reflect the need to be aware that human capital is not a static concept. The relative value of existing subcomponents to may change and new components may need to be considered, particularly as a result of exogenous changes in technologies. Thus, there is a continual need to assess the portfolio of specific human capital components that a firm has access. It is worth noting, however, that many other technologies potentially have an impact on human capital to add value. For example, over the years pharmaceutical companies have had to respond to the revolution engendered by the decoding of the human genome. Perhaps the main difference with respect to the impact of digital technologies is their ubiquity.

As previously noted, ownership of intangible assets is neither a necessary nor a sufficient condition for their having potential value to an organization. However, at the very least, access to information is a necessary condition. In a world of digitization, access to information has been drastically increased, and unlike traditional assets, which need to be owned to be controlled, digitization and the use of increasingly complex digital tools enables closer monitoring of information, even if it is not owned by the firm. Further, in an organizational context, once information is digitized it becomes much easier to make it available throughout the organization. Although this would seem to be a universally good thing, it has its drawbacks since it generally separates the information from its context, making the interpretation of the information problematic. Furthermore, organizations will likely run into problems if the information has any significant and/or unique structure. It can be argued that limited availability of information allows a lot of meaning to be read-into the information because the individuals share both formal and informal contexts. In contrast, having access to large amounts of information without contexts, or having limited awareness of context, is potentially unproductive or even dangerous.

The increasing access to information brought about through extensive digitization already requires increasing knowledge or expertise in using information and communications technologies and may soon require knowledge of leveraging AI technologies. It is also necessary to recognize and implement new organizational structures and processes to take advantage of these technologies to create better communication, collaboration, and data processing.

As organizations explore the potential opportunities provided by increasing the digitization of their information along with the use of complex digital tools enabling analysis, communication and collaboration, this is likely to have significant effects on the structure of employees' jobs, their work processes, means of communication/collaboration, and the overall work environment. Similar observations may be made about how the value, importance and nature of sub-components of structural capital change over time. Organizations will be able to adopt far more flexible structures both with respect to their interactions with within the organization, and those with the external environment. This has the potential of providing organizations with a wide range of options to change the way they operate.

It is also appropriate to note that, digitization and the increasing availability of digital tools may have a significant impact on relational capital and its subcomponents. As increasingly dense networks can be built as a basis for knowledge creation, exchange and mobilization, organizations may be able to support existing value generating activities and/or create extensive opportunities for new ones. However, one of the potential drawbacks of pursuing these options may be that many organizations have evolved knowledge-creation and sharing structures over a considerable period of time that enable the orchestration and coordination of knowledge to achieve organizational goals. The nature, composition, and functioning of these structures may be poorly understood by the organization. Even the organization may not be aware of the existence of these structures, as organizational boundaries become more porous, such structures may become attenuated or even cease to exist and be difficult to re-create. Furthermore, organizations will have to develop new capabilities, such as those necessary to develop sufficient trust among the stakeholders in the network in order to facilitate knowledge creation and knowledge sharing.

It is worth noting that although digitization and increasingly complex and integrated digital tools create new opportunities for extensive knowledge-intensive collaboration with stakeholders external to the organization, this has, in a sense, been true for a long time, as organizations have been paying individuals or groups on a

project-by-project basis to contribute their specific expertise, or have outsourced significant value-adding activities and processes to external agents. As a result, there may be considerable past research such as that in Computer Supported Cooperative Work and Information Systems Outsourcing that will provide valuable sources of prior relevant research.

Such collaborations raise issues as to how human capital can be identified as a component of an organization's IC, as well as its valuation. Value is created when, closer, more complex, and flexible knowledge-based interactions take place between an organization's direct employees and other value-adding stakeholders external to the organization's direct employees (e.g., suppliers, customers, partners, etc.). This expands the range of individuals who contribute to an organization's human capital well outside the boundaries of the organization and makes the valuation of its human capital more complex.

As a further level of added complexity, there are potential effects of the interaction of structural capital and human capital. Changes in the nature of human capital afford changes in the value created by structural capital and vice versa. One may note that widespread distribution made possible by the digitization of information has given individuals the ability to sidestep organizational structures, which provided for the management and control of information. All too often organizational structures are considered to be impediments to the access of information when they may have evolved to effectively manage information. Potentially, there is a wonderful opportunity to explore how the interaction between sub-components of IC provide new and unique opportunities for adding value because of digitization.

However, undue optimism concerning the positive impact of digitization and digital tools on a firm's IC may be unwarranted. For example, in a recently reported research study (Emanuel, Harrington & Pallais, 2023) the authors found evidence that there was less knowledge sharing with young and marginalized employees working remotely than working in person. This gives an initial hint that in some circumstances (the context was a software company) reliance on remote working may lead to a degradation of knowledge over time. This represents an interesting area for extensive further study.

Finally, given that managers have a wide range of increasingly powerful and complex digital tools that facilitate rich communication, powerful analytics, and machine learning, it is reasonable to propose that such technological tools may influence the value and utilization of intangible assets. Thus, such combinations may become increasingly nuanced and allow for inferences to be drawn, rather than simply providing information that satisfies certain parameters.

Organizations are at the cusp of major changes stimulated by the extensive digitization of extensive knowledge resources and fast evolving digital tools such as generative AI. AI tools such as ChatGPT along with the extensive digitization of information provide for the possibility of generating new knowledge and for developing capabilities for handling extensive data sets. However, not only does the use of these tools require significant new skills, but it is also unclear as to how their outputs may be validated and communicated. Knowledge relating to the creation of appropriate prompts, and the assessment and interpretation of responses by generative AI may become more valuable, while other knowledge may become less valuable, or of no value.

4. Some Organizational Recommendations

Organizations will increasingly be required to possess a variety of different types of knowledge relating to digital tools and digitization, along with competencies required to combine this knowledge with existing knowledge into valuable capabilities. They will also need to adapt existing work structures, or learn new ones, to facilitate the combination of this knowledge and better make decisions and judgments based on this knowledge. Furthermore, these will now be one-off adaptations or opportunities for learning. Firms will have to dynamically adjust their behaviour to reflect changes in the importance of existing resources/knowledge/IC and potentially develop new competencies and capabilities. As noted above, firms have to be alert to the emergence of new components of IC that may be necessary for the creation of value in an increasingly digitized environment.

As many of the major economies have moved from supply driven economies to demand driven economics there has been a need to tailor products and services more specifically towards their stakeholders needs, thus requiring organizations to have more knowledge of them, most specifically customers. However, as products and services become more complex it becomes more difficult for stakeholders, like customers, to assess the extent to which an organization's offerings are likely to provide them long term value. Furthermore, as production and distribution arrangements have become more complex, so has their management required more specific knowledge (e.g., manufacturing, logistics, QA, etc.). This has inevitably resulted in the increasing need for detailed knowledge of supplies and supply chains. Since these suppliers are increasingly at arm's length and

often in other jurisdictions, there is a need to build trust between the participants in the supply chain. Therefore, recognizing stakeholder (e.g., customer) needs would seem to be fundamental to creating products or services that will be valued. This requires entering into a dialog with actual or potential stakeholders or developing social capital. Such a dialog may be established because of existing business relations, or as a result of creating new channels of communication. Other necessary conditions would seem to be a level of trust, shared values, shared directions, and shared goals. In addition, it is necessary that stakeholder information flows freely and is understood (i.e., is contextual and non-ambiguous) by various individuals at different levels and functional areas of the firm, so that they can act on this information.

Finally, human capital or employee knowledge generally has a collective tipping point effect on value, in the sense that the sum of individual knowledge can, potentially, be greater than the value of any individual's knowledge. Furthermore, it is often the case that the discovery of new knowledge, when combined with existing knowledge can have a cascading effect on the value of the existing knowledge. An excellent example of this effect has been the discovery of CRISPR technology in the field of genetics. A similar analogy can be made using standard manufacturing. Any one piece of machinery may have only limited value on its own, and it gains value only when it is combined into a process with other machines. However, combinations of knowledge (or human capital) are not as simple as one machine producing the input to another machine. Consider a team of consultants working on a particularly challenging project. They may need to interact over a long period of time in varied ways with changing roles, gathering, sharing and generating knowledge.

5. Conclusion

Several different issues are raised in this paper with respect to theoretical and pragmatic challenges in the IC research literature. Specifically, challenges that relate to the valuation of IC, its conceptual structure, and its theoretical basis. Building on these arguments, the paper also revisits an overarching theme introduced by Kianto and Cabrilo (2022) which relates to challenges in the conceptualization and articulation of IC theory, because of changes driven by technology. The impact on these technological changes is then explored on the existing subcomponents of IC. Finally, some brief recommendations are presented for organizations looking to better adjust their IC and KM practices to an increasingly technology intensive environments.

This paper represents a contribution to the literature by indicating some of the fundamental issues facing IC theory and the valuation of IC, both generally, and as a result of the increasing availability of digital tools and the digitization of information. In addition, insights are provided as to how research into the dynamic behaviour of the valuation of IC and its subcomponents, and some of the factors that influence change. Finally, some suggestions as to how the insights provided by this paper may be actionable by organizations are considered.

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Knowledge About Medical Waste Management: How do Healthcare Professionals Learn and Practice?

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Abstract: The management and disposal of medical waste follow scientific protocols to ensure safety. However, the effective implementation of the medical waste management system depended on correct handling and segregation by the healthcare workers, during their daily activities. These professionals need to know about health waste management, since incorrect handling and disposal pose a potential risk to the environment and human health. This study aimed to analyze the knowledge regarding the management of medical waste of the healthcare teams working in the Family Health Strategy (FHS). Designed to provide preventive and basic healthcare using multidisciplinary professional teams, the FHS reflects many best practices. The research was carried out in a city that is the 3rd economy in southern Brazil. This was a cross-sectional descriptive study with a quantitative approach, and data were assessed by using self-administered and pretested questionnaire. The study sample consisted of 74 participants, including doctors, nurses, and nursing technicians. Descriptive statistics were carried out to express participants' demographic information, mean knowledge score, and the teaching strategies used with the team. The main research results show that the healthcare teams working in the Family Health Strategy have, in part, knowledge about the correct management of waste. Besides, they are sensitive, in general, to its impact on the environment. Nevertheless, the results highlighted that more practical training would be needed, to help healthcare workers with everyday doubts. Furthermore, the results show that it requires attention to rethinking the strategies used to train and develop knowledge and skills in health services.

Keywords: Healthcare workers,Knowledge, Social learning, Medical waste, Environmental impact

1. Introduction

We are currently experiencing an environmental crisis related to the improper disposal of solid waste. Around the world, many cities still don't have comprehensive solid waste management programs, depositing them on unregulated dumps, compromising natural resources and the quality of life of future and current generations. In Brazil, most places for waste deposits are inefficient since both home and health collection are irregular, being deposited in open-air dumps, usually located close to low-income populations, further aggravating the problem. To change the current scenario and to preserve public health, natural resources, and workers' health, many public policies and technical standards were created in Brazil since the 1970s, which include the management of solid waste. Solid waste can be defined as the materials resulting from human activities in society, in a solid or semi-solid state (Word Health Organization, 2018). These include waste from healthcare services, such as hospitals and health clinics.

Of the total amount of waste generated by healthcare activities, about 15% is considered hazardous material that may be infectious, chemical or radioactive (Word Health Organization, 2018). According to Santos and Souza (2012), healthcare professionals are directly involved in the production of waste, not only in hospitals, but also in those produced in primary care, where multidisciplinary teams work by developing actions to promote the health of the population, and to improve both disease prevention and health rehabilitation According to Matos et al (2018), it is extremely important to understand the issue of waste generated in environments that provide health services, such as in primary care, thus preventing harm to human health.

Regarding primary care, the Brazilian Family Health Strategy (FHS) model changed the individual model of care, which used to be centred only on curing illnesses, to expand the focus to a comprehensive healthcare. This model has health promotion as its central axis, adding environmental factors to health determinants. In this way, it enables professionals working in health services, responsible for making the work environment safe, to guarantee the quality of care offered, avoiding exposure to physical, chemical, and biological agents, as well as favouring their dissemination in the environment and causing disease in the population (Peres et al, 2014).

Seeking to contribute, due to the relevance of the theme, the research questions of this study were: Do the FHS healthcare team know the correct management of waste and its impact on the environment? How did they learn about this matter? What were the teaching strategies they experienced?

The objective is to analyse the knowledge of the healthcare teams working in the FHS in a city in southern Brazil about the correct management of waste and its impact on the environment. The research theme is

justified by its relevance in the purpose of identifying weaknesses in the knowledge of professionals about the waste management process. The results may contribute to reflections on this problem in order to change attitudes towards environmental preservation, and to promote human health.

2. Research Method

This is a cross-sectional descriptive study with a quantitative approach, which used structured questionnaires applied in forms as a research instrument. The study was carried out in the municipality of Canoas, in Family Health Strategy teams. The municipality of Canoas, according to data from the Brazilian Institute of Geography and Statistics (IBGE) in 2021, has 349,728 inhabitants. In the 2022 edition of the Entrepreneurial Cities Index, the city ranked 45th largest in the rankings out of the 101 Brazilian municipalities in the survey. The study is an important indicator of the competitiveness, opportunities, and development of municipalities. In addition, the city owns the 3rd largest technological park in total area in the country.

Regarding the healthcare network, there are approximately 200 professionals allocated to Primary Care, in the Family Health Strategies. The territory of the municipality is divided into four quadrants, named Southeast, Southwest, Northeast, and Northwest. From this universe, the selection of the sample was made considering the suggestion of the Health Secretary to approach the four quadrants of the municipality in the research, as an idea of collecting data in different healthcare scenarios. Also, a sample calculation was performed using proportionality, in which 138 respondents would participate. To calculate the sample, the proportional stratified sample formula was used, using a confidence rate of 95%.

To reach this sample, questionnaires were delivered in the units with the largest number of FHS, to contemplate the four quadrants of the municipality of Canoas and reach the maximum number of participants.

The research subjects were members of the multidisciplinary teams working in the FHS who agreed to participate in the study and also signed the Informed Consent Form.

The inclusion criteria listed for this research were professionals working in the FHS such as doctors, nurses, nursing technicians, and nursing assistants. Professionals who were on leave, on vacation, away from work for some reason, community agents, and Oral Health Teams such as dental surgeons, assistants, and oral health technicians were excluded from the study. Community agents were excluded because they are not exposed to the risk of accidents with biological materials, or with sharp punctures, since in their role they do not perform invasive procedures. As for the Oral Health Teams, it complements the work of the FHS teams, but since they are not allocated in all units, in this study only the minimum multidisciplinary team of the FHS will be addressed.

The project was initially submitted to the Municipal Committee of Education and Collective Health and to the Research Ethics Committee of the University of Vale do Rio dos Sinos. After approval of the research project (registration number 3,773,514) data collection was started, which was carried out through printed forms, thus allowing the research participant to fill in the alternatives of his choice, facilitating the collection process data, providing greater flexibility to respondents.

The data collection instrument with simple and multiple-choice questions were delivered to the healthcare units, along with an identified collection box, which was removed two weeks after the date of delivery. The questionnaire was previously tested with 8 health professionals in another unit of the municipality, and the results were not used in this research. Some modifications were made after this test.

To carry out the data analysis, descriptive statistical analysis was applied, through the observation of relative and absolute frequencies, in addition to the t-Student test and Analysis of Variance (ANOVA).

3. Results and Discussion

Due to the pandemic related to the New Coronavirus (World Health organization, 2020), the research was, in a way, hampered during data collection, since social isolation was recommended by the National Department of Health, and healthcare units were focused on combating Covid-19. The collection period lasted for 3 months, from May to July of 2020. To try to obtain the maximum number of responses, several visits were made by the researcher to the units. The researcher personally delivered the forms to the healthcare workers, to encourage participation. However, the modified dynamics of the healthcare teams made it difficult to reach the expected goal of cases.

3.1 Sample Characterization

The participants were 74 members of the Family Health Strategy teams, 36 nursing technicians, 12 physicians, 25 nurses, and 1 nursing assistant, distributed in the four quadrants of the municipality. Participants were mostly female (86.5%).

3.2 Knowledge of FHS Teams about Solid Medical Waste Management

The following questions investigated previous training, as well as specific knowledge about medical waste management in Primary Care (Table 1).

Table 1: Previous Training about Waste Management

		N	%
Have you received any training at your service on the topic: "Waste management?"	Yes	24	32.43
	No	50	67.57
	Total	74	100,0
If you answered yes to the previous question, how long ago was the last training on the subject?	Less than 1 year ago	1	1.4
	Between 1 to 5 years	19	25.7
	More than 5 years ago	4	5.4
	not applicable	50	67.6
	Total	74	100.0

From the results presented on professionals who received training related to the correct waste management only 32.4% marked yes. Among these, 19 reported having occurred between 1 and 5 years (25.7%), four answered for more than 5 years (5.4%) and one answered less than 1 year ago (1.4%). These findings suggest a lack of adequate and ongoing training in waste management for healthcare professionals. It is consistent with previous research by Almeida et al (2009), Santos and Souza (2012) and Rizzon, Nodari, and Reis (2015), which also reported unsatisfactory results related to the professional qualification of the healthcare team involved in waste management.

It is emphasised here that it is the responsibility of healthcare services to provide such training as a routine practice, following the regulations set by the Brazilian Health Surveillance Agency (Agencia Nacional de Vigilancia Sanitária, 2004).

In this study, it was also verified the existence of significant differences between the averages of the variables: category and previous training, through the Analysis of Variance, or ANOVA. This analysis confronts variations from specific sources, with variation between groups, which should be similar (Hair et al, 2009). Thus, the one-way ANOVA investigates the effect of a factor on the endogenous variable, examining whether or not the means of the endogenous variable in each category of the factor are equal to each other. The rule was to verify whether or not there was a significant difference ($p<0.05$) between the groups; subsequently, differences in means were examined. The result shows that there was a significant difference between categories regarding whether or not they received the training [$F(2.71) = 4.144$; $p<0.05$), as observed in Table 2.

Table 2: Difference Between Categories with Regard to Receiving Training or not

	Sum of Squares	df	Mean Square	F	Sig.
Between Groups	1.695	2	0.848	4.144	0.020
Within Groups	14.521	71	0.205		
Total	16.216	73			

To identify which categories present significant differences, Tukey's post-hoc study showed that, on average, training is significantly higher for nursing technician respondents than for other professionals, being lower for physicians (Table 3).

Table 3: Professional Category Related to Training Through Tukey's Post-Hoc Analysis

Category		Sig.	average
Nurse technician	Nurse	0.604	1.57
	Physician	0.014	
Nurse	Nurse technician	0.604	1.68
	Physician	0.116	
Physician	Nurse technician	0.014	2.00
	Nurse	0.116	

It is essential to systematically build healthcare professional understanding of their role in an interprofessional team. There is an increasing acknowledgement of the value of multidisciplinary training since errors are the result of a chain that originates from a systemic or organizational failure. That facilitates the fact that a frontline care professional makes an error that can cause harm to others and to the patients (Mira, 2019). Biosafety assumes an extremely important role for all healthcare professionals responsible for identifying and managing medical waste.

There are several steps in healthcare waste management. It starts with waste classification; when properly segregated, about 85% of healthcare wastes are general waste with the same risk as domestic solid waste. It can make possible the recycling of non-hazardous general waste as well as lower the cost of treatment and disposal of healthcare waste. However, incorrect classification and segregation can raise the risks of exposure to hazardous healthcare waste for workers. So, healthcare teams must recognize the waste classifications that pose the highest risk, such as waste contaminated with blood or body fluids, sharp objects or even chemical waste (Zhou et al, 2022).

The classification of healthcare waste varies from country to country. Medical waste in Brazil is classified into five groups in accordance with national regulations: *A* (Biological or infectious risks, such as gauzes and bandages; infusion bags, syringe, blood bags, gloves, labware), *B* (Chemical risks, such as drugs and chemotherapy), *C* (Radioactive products, such as radionuclides from x-ray sectors), *D* (Non-recyclable and compostable waste, like food waste, and recyclable waste, like paper, cardboard or plastics), and *E* (Sharps waste, such as needles, knives and blades).

One of the research questions was related to the types of waste from health services. We provide the participants with examples of materials representing groups A, B, D and E. As the units do not have type C waste, they were not included in the question.

The results showed that, concerning the identification of residues during their segregation by risk groups, 62% of the participants correctly answered the alternative that represented group A. It is important to highlight that it is the kind of medical waste that implies a great occupational risk. 79% of the participants correctly answered the alternative that represented group B, which also implies a risk, especially to the environment, if it is discarded incorrectly. 78.3% of the participants correctly identified group D, referring to common waste, and 98.6% correctly answered the alternative that represented the group E, represented by sharp objects, one of the wastes with the greatest risk to the workers' safety.

Vieira's research (2013) also demonstrates that professionals mostly identify the correct place for disposal, but they have some uncertainties during this process, highlighted in the study, due to the lack of training addressing the issue.

There is greater knowledge of the research participants about the container for the disposal of sharps, evidenced in the results. Compared to the research by Gessner et al (2013), greater attention was also observed with group E waste, relating the concern of professionals with occupational accidents due to contaminating material. In the study by Bento et al (2017), on the other hand, professionals showed less ease in identifying and disposing of waste from group E. It is important to highlight that the segregation of waste at the generating source defines the efficiency of the other management stages (Agencia Nacional de Vigilancia Sanitaria, 2004).

We cannot fail to highlight the period in which the survey was being carried out: all healthcare units were dealing with cases of Covid 19, and therefore attention should be redoubled, due to the risks that the improper handling of masks or gloves could bring. Notwithstanding, a crisis like a pandemic could be an

effective source of knowledge (Thumiki and Jurcic, 2021). By identifying deficiencies in the knowledge and attitudes of workers, leadership will be able to take measures related to knowledge management.

In the questionnaire, three questions were related to the work environment and the conduct of professionals: one question was formulated to diagnose satisfaction with the infrastructure of the professionals' work environment, like number and type of bins, and the supply of plastic bags, for example. Another question was related to evaluating their conduct as a professional in the correct management of healthcare waste, and the last one was related to the concern with their actions and impact on the environment. To demonstrate the degree of agreement, the Likert scale was used, where the participant could choose between 5 applicable alternatives: I totally disagree; I disagree in part; neither agree nor disagree; partially agree and fully agree (table 4).

Table 4: Assessing the Structure of the Workplace and Professionals'conducts

Questions	I totally disagree	I Disagree in part	Neither agree nor disagree	Partially Agree	Fully agree	mean	Standart deviation
"The structure of the health unit (number and type of bins, supply of plastic bags) favors the management of health waste in my work". **Do you agree with this statement?**	1	10	1	24	38	4.19	1.08
"In my daily work routine, I try to segregate health waste, which consists of separating and disposing of it in appropriate containers. I believe that I performed this step correctly". **Do you agree with this statement?**	1	2	2	17	51	4.51	0.95
"The lack of care during the segregation of health waste produced daily in the Family Health Strategy has an impact on the environment." **Do you agree with this statement?**	2	1	1	7	62	4.66	0.97

Regarding the health service facilities and the conditions offered to segregate waste, 38 participants responded with Fully Agree and 24 marked Partially Agree, thus demonstrating that more than half of professionals positively evaluate their workplace structure. In this research, the participants considered, in general, the structure as adequate. In different studies, Camargo and Melo (2017) and Rizzon, Nodari and Reis (2015) pointed out that the work environment was not adequate, with insufficient containers, a lack of standardisation in packaging devices and plastic bags, causing difficulties in segregating and discarding medical waste. In addition to this, there is a fact that healthcare units in other municipalities suffer from a lack of safety equipment, human resources and medical supplies to meet the demands.

In the research question regarding the findings of the self-assessment of professional conduct during the segregation and disposal stages, 51 professionals marked Fully agree, and 17 chose Agree in part, indicating that most consider their conduct as appropriate. These results are intriguing and can be more than a "Dunning-Kruger effect" (cognitive bias that leads people to overestimate their knowledge or expertise). Specifically, the study by Rizzon, Nodari and Reis (2015) showed a lack of understanding of the legislation and, consequently, the practical application of its guidelines. Maybe the translation of healthcare policies and guidelines to the daily routines is missing. Distinct professional features in terms of competencies and experiences, "could create barriers in the transfer and sharing of knowledge" (Dal Mas et al, 2020, p.199). So, developing effective knowledge translation interventions "that maximize professionals' knowledge about best practices is an important step towards closing this knowledge-to-practice gap" (Thomas et al, 2014, p.2).

In the research question related to the environmental impact of waste management, 62 of the professionals answered with the alternative I totally agree, and 7 chose I agree in part, which is interesting: even having doubts about the medical waste managing process, they recognize its importance and the relationship with the environmental preservation. Studies by Camargo and Melo (2017) and Peres et al (2014) also observed

that respondents recognize that their actions at work have an environmental impact and believe that improper disposal of waste produced in healthcare units causes environment contamination.

In addition to the objective questions on the form, we offer research participants the possibility to write their suggestions and concerns regarding this topic, specifically asking about the actions of the FHS team that could cause any environmental impact during the managing of healthcare waste. Some participants reported inadequate equipment and structure, such as insufficient amount of trash cans and lack of correct identification. It demonstrates that at some locations, despite the satisfaction with the workplace infrastructure, there are opportunities for improvement. Some participants expressed the need for further discussions on the subject, as they observed numerous mistakes in waste segregation and disposal, among healthcare professionals and patients alike. Finally, many participants highlighted the need to recycle correctly, and to promote practices that reduce the volume of waste generated in day-to-day activities. On this subject, Lattanzio et al (2022) emphasize the need for a better awareness about recycling possibilities among healthcare workers and the commitment to collect and recycle.

3.3 Training and Knowledge Sharing Opportunities

Regarding their interest in receiving training on waste handling and disposal in the workplace, 64 professionals answered yes (86.4%), only 5 answered no (6.7%), and 5 did not answer the question (6.7%). In the same question, an optional space was left so that topics related to waste management could be proposed, in which 44 professionals participated.

The topics listed by the participants were: risks to patients and professionals by handling solid medical waste; waste classification, collection and final destination; correct use of personal protective equipment; work accident prevention; environmental effects of incorrect waste disposal; and correct disposal of expired drugs and vaccines.

Other studies, such as Almeida et al (2009), Camargo and Melo (2017), Matos et al (2018) and Rizzon, Nodari, and Reis (2015), also showed the interest of professionals in receiving training on the subject, thus pointing to the need to invest in permanent education, not only in the stages in which they are directly involved, but throughout the entire process.

An interesting point of the results was that the fact that the professionals received training did not directly influence their responses. In order to verify the comparison between receiving some training in their service on the subject and the other questions, Student's t-statistic analysis was performed (Hair et al, 2009). Thus, it was evidenced that the fact that people received training or not did not provide different averages for the questionnaire responses ($p>0.05$), since whether or not they received training, the participants were correct in the same proportion.

These results may stress the need to identify successful learning strategies to reframe the topics for application in practice. Bordoloi and Islam (2012, p.116) claim that "healthcare professionals noted that continued education to keep in touch with the most updated information and evidence played a very important role in their professional life". Undoubtedly, investing in the education and training of healthcare professionals appear to be a winning strategy for managing medical waste. However, some studies show that inadequate knowledge was identified as one of the main barriers to implement correct and environmentally sustainable practices, regarding medical waste. (Wu, Cerceo, 2021; Lattanzio et al, 2022). One of the suggestions is the creation of "an 'environmental greening team' to increase knowledge, improve attitudes and facilitate the success of green initiatives." (Lattanzio et al, 2022, p.7).

Furthermore, it is essential to evaluate the effectiveness of knowledge management enabling initiatives. But what about the teaching techniques currently used with FHS teams? In this research, the participants who confirmed having received training, did so in the form of short theoretical courses. It is a common strategy to have short-term training in healthcare practice, tending to focus on techniques such as short presentations and simulations. These techniques can be effective in some matters. Nonetheless, healthcare services are very complex and are constantly facing significant challenges. We must recognize that there are a multiplicity of practices and learning processes by individuals and their peers in the healthcare context. It is relevant to consider learning as a social construct, something that people are doing, sharing and building together in their daily activities (Linden, Bitencourt and Muller, 2019). Therefore, dynamic teaching strategies, which start from practices, building knowledge in a bottom-up, and networked fashion (Coffie et al, 2023) could improve trust and safety.

4. Conclusions

The study allowed us to identify the knowledge of healthcare professionals about medical waste management. It was found, when evaluating the results, that doubts persist about segregation and disposal of waste produced in the Family Health Strategy Units. In general, the results point to the teams' mastery over some aspects, observing the number of correct answers. Doubts, however, cannot be minimized, since the topic is critical, both for human health and for the environment. Healthcare workers must be aware that caring for the environment is also part of their work routine.

Even if the conditions of workplace facilities were well evaluated, it does not mean that improvements cannot be developed. The research opens space to discuss other questions about workers' knowledge in the municipality's FHS. For example, how much do sanitation service employees know about waste management? Do they use personal protective equipment during segregation and disposal processes? Do the waste storage locations comply with the legislation and technical standards?

Another important finding was related to the continuing and up-to-date education of professionals. In the survey, even those who received the training showed uncertainties about the process, demonstrating that they need more opportunities for discussion on the subject to clarify doubts, as lack of training can increase occupational risks and impact on environmental care.

As a suggestion, it is important that the subject can be addressed at all levels of training in the field of healthcare. Beyond that, it is crucial to rethink the strategies being used for on-the-job training, to improve the process of continuing health education.

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Technological Tools, KM and Innovation in SMEs

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Abstract: Knowledge management has emerged over the past decade as one of the key issues at the heart of modern organisations. Knowledge management as a process that supports an organisation in finding, selecting, organising and disseminating relevant information and expertise, essential for activities such as problem solving, learning, strategic planning and decision making. Knowledge management is an emergent system of organisational design and operational principles, processes, organisational structures, applications and technologies that help knowledge workers increase their creativity and ability to deliver commercial value. The issue of knowledge management is primarily considered in the context of large organisations. In contrast, relatively little attention has been paid in the literature to the specifics of knowledge management in small and medium-sized enterprises. The focus of researchers attention on large enterprises is partly due to the fact that the larger the enterprise, the greater the challenges regarding key knowledge management processes, including, for example, knowledge dissemination. Awareness of the organisation's knowledge is higher in SMEs than in large organisations. Due to their size, SMEs do not have the same problems in communicating and disseminating knowledge within the organisation as large enterprises, so formal knowledge dissemination activities and processes are less frequently implemented. In addition, formal approaches to knowledge management use IT systems, which are costly and mostly designed for large organisations. Financial barriers and the different needs of SMEs therefore mean that formal knowledge management may not be fully implemented in SMEs. Therefore, it becomes important to examine the use of technological tools in knowledge management and their impact on the innovativeness of a company from the SMEs. The main research objective of the article is to analyse the use of technological tools for knowledge management in companies operating in the Polish SME market and their impact on innovation. Specific research objectives included assessing the level of ICT use in SMEs, identifying the level of employment of ICT specialists by SMEs, identifying the use of websites, social media and cloud computing by SMEs, identifying technological tools supporting knowledge management in SMEs, assessing the impact of technological knowledge management tools on innovation in SMEs. The research was conducted in 2022 using the CATI method among 600 randomly selected SMEs operating on the Polish market. The majority of SMEs do not employ employees with specialised digital competences. Such people are employed by less than 8% of small and 30% of medium-sized companies. The situation is completely different in large companies - almost 3/4 of them employ ICT specialists. Employers have a problem recruiting digitally competent employees. For this reason, outsourcing IT services is becoming increasingly popular, especially among small and medium-sized companies. Companies that use technological knowledge management tools are more innovative.

Keywords: Knowledge management KM, SME, Technological tools KM, Innovation

1. Introduction to Concept Of Innovation, Types of Innovation in the Era Of Industry 4.0 - Literature Research

In today's highly competitive manufacturing environment, companies are faced with the challenge of dealing with large amounts of data, the speed of making the right decisions or the flexibility of production processes (Griffin, Ebert, 2013). Especially the aspect of production flexibility is an important element here, as nowadays, the nature of production is shaped by paradigm shifts from mass production to on-demand, customer-oriented production (Gerwin, 1997). Such activities result in a shorter product life cycle, an increased product range, as well as a change of processes to those with high efficiency and a change of equipment and machinery to more flexible ones. The development of the technological process results in an increase in complexity in all areas of a company's activities. This leads to an increased demand for innovation in terms of new materials and technologies, innovative production processes as well as new business models as well as new business models In order to meet the expected complexity of modern production systems, a new concept based on knowledge, technology and tools was created, simulating, optimising and monitoring existing production systems. The concept of Industry 4.0 first appeared in 2011 in Germany (Lee, 2013). It was assumed then that in the area of Industry 4.0, a company's production system would consist of an information system and numerically controlled machines that would operate autonomously and exhibit elements of artificial intelligence. However, it turned out that due to the specificity of production systems in different industries, the term Industry 4.0 cannot be generalised in principle (Lasi, Fettke, Kemper, Feld, Hoffmann, 2014). This means that the scope of the definition of Industry 4.0 must be considered individually, depending on the needs of the company in question. The concept of Industry 4.0 covers areas that include numerous technologies and related paradigms. In the literature, the concept of innovation is not unambiguous, there are many definitions of innovation (Weryński, Dolińska - Weryńska, Tokar, 2014). Innovation is perceived as products and phenomena or

processes of technical, organisational, social or psychological nature. The best known and classic definition of innovation was introduced by J. Schumpeter, who considered it an innovation (Schumpeter, 2017):

- the introduction of new products or the improvement of existing products,
- introduction of new or improved manufacturing methods,
- creating a new market,
- the use of a new form of sale or purchase,
- use of new raw materials or semi-finished products,
- introducing new process organization.

Currently, the development of the business management concept has led to the creation and modification of new definitions of the term innovation. The Organisation for Economic Cooperation and Development defines innovation as the implementation of a new or significantly improved product or process, a new marketing method or a new organisational method into company practice (Oslo Manual, 2005). Innovation is treated as something new or significantly improved in some area (Yusuf, 2009). Currently, innovation is also defined as the process of creative use and transformation of knowledge, belonging to the organization or obtained from outside, as a new product, service or process (Cavagnoli, 2011). In companies, innovation becomes an interesting tool that can provide competitive advantage, enables development and gives independence, which can result in the expected success and financial benefits (Wielgórka, Trzepizur, 2015).

The systematisation of innovation concepts can be done according to different criteria. Innovations can be divided into: product, process, organisational and marketing (Hąbek, Wolniak, 2014). This method of division is also used by the Oslo OECD. Product innovation is the introduction to the market of a product or service that is new or significantly improved in terms of its characteristics or applications. These include significant improvements in technical specifications, components and materials, embedded software, ease of use, or other functional characteristics. Process innovation occurs within a process and is the implementation of a new or significantly improved production or delivery method. These are significant changes in technology, equipment or software. Their purpose may also be to reduce production costs. Marketing innovation is the implementation of a new marketing method, involving significant changes in product design or construction, or in packaging, distribution, promotion or pricing strategy. The objective of a marketing innovation is to better satisfy customer needs, open new markets or reposition the company's product on the market to increase sales. Such innovations include changes in product design. An organisational innovation is the implementation of a new organisational method in the principles adopted by the enterprise, in the organisation of the workplace or in its relations with the environment. The purpose of such innovations may be to achieve better results by reducing administrative or transaction costs or to increase the level of job satisfaction. Such innovations also include gaining access to non-traded assets or reducing supply costs. These are routine activities and procedures that regulate the operation of a company (Oslo Manual, 2005). Innovations can also be divided into tangible and intangible. Tangible innovations are products, devices, works of art, books, etc., while intangible innovations are ideas, concepts, new methods or theories, etc., expressed in words or symbols or images (Szatkowski, 2001). Innovations can also be divided due to the marketing approach. One can continue one's consumption behaviour, and minor changes only concern the benefits offered by new products appearing on the market (Karcz, 2007). Innovations can also be divided, according to the scope of the effects they cause, into strategic and tactical innovations. Strategic ones concern innovative undertakings of a long-term character. Coupled innovations are the most frequent, as the complexity of technology, technological progress and high costs of R & D force the creators to cooperate and work together with various institutions (Janasz, Kozioł-Nadolna, 2011). An interesting division of innovation is presented by D. Smith, who takes into account such criteria as: the impact of innovation on the system and the type of knowledge used. From this point of view incremental innovation, modular innovation, system architecture innovation and radical innovation are distinguished (Smith, 2006). Incremental innovation is a change that improves components in the system but does not change its structure. Radical innovation, is new elements in the system and their new configuration. Radical innovation in the strategic sense would have to be considered in action strategies and organizational processes (Therrien, Doloreux, Chamberlin, 2011). In classical economics, innovations are divided according to the criterion of the substitution effect of labour by capital. The above-mentioned divisions of innovation are difficult to distinguish unambiguously, one innovation may be classified in many types. For example, a technological innovation may at the same time be in another group as a breakthrough, tied, creative, or pro-environmental. Due to such an extensive classification of innovations, a certain scheme can be presented, which takes into account the general division of innovations, as well as the participation of the company in its creation.

2. Technological Tools KM in SME Enterprises

There is an accumulation of knowledge within the organisation, which is often not used by the organisation. This is due to the fact that knowledge is dispersed - individual organisational units create barriers to the free flow of knowledge; moreover, knowledge sharing is not always adequately supported by incentive systems and responsibilities (Bolisani, Scarso, Birolo, 2014). The authors point out that in practice there is a large discrepancy between the knowledge held and the ability to apply it (Zack, McKeen, Singh, 2019; Pfeffer, Sutton 2022). The reason for this is the lack of proven models and procedures that can serve organisations as a set of structured activities for implementation. The micro, small and medium-sized enterprise (SME) sector plays an important role in all economies around the world (Barroso, Ferreira, Meidute-Kavaliauskiene, Banaitiene, Falcao, Rosa, 2019). In Poland, there are 2.4 million non-financial enterprises, defined as active enterprises, of which 99.8% are enterprises included in the SME group (according to data for 2021 of the Polish Central Statistical Office (GUS). In recent years, entrepreneurship in Poland has been characterised by three distinct trends. Firstly, over the last few years it can be seen that the entrepreneurship of Poles is not waning. The number of enterprises is growing dynamically. Secondly, the quality of Polish entrepreneurship is improving. Polish companies as a group are contributing more and more to social welfare. The data show that they produce an increasing proportion of Polish GDP. The average company is growing steadily in economic terms. Its productivity, as measured by revenue, added value and production, is increasing. Trends also point to an improvement in the structure of companies from the point of view of legal forms. The share of companies as legal entities is increasing and that of physical persons is decreasing. Thirdly, the openness of entrepreneurs and their orientation towards growth is increasing. Companies, although still too seldom, are internationalising more and more - the proportion of exporters and the average value of exports are systematically increasing, as well as the use of the advantages of an online presence. Polish companies are also investing more and more and developing and implementing innovations, although the scale of development activities is still not high.

In the most general manner, knowledge management (Pritchard, 2010) is defined as a management method, the basic aim of which is the unconventional development of competitive advantage (Glabiszewski, Sudolska, 2009) by contemporary operating enterprises, including non-profit organisations (Perechuda, 2005). The great supporters of the knowledge management concept are T.H. Davenport and S.C. Völpel, who pointed out, however, that knowledge management primarily plays an important role in improving methods of creating new knowledge, and then in its proper dissemination and use (Davenport, Völpel, 2001). Another definition of knowledge management is proposed by P. Murray and A. Myers, who presented it as a sum of processes enabling the creation, dissemination and use of knowledge, in order to achieve the goals set by the organisation (Strojny, 2000). Knowledge management was also characterised by D.J. Skyrme, who described it as a precise and systematic management of knowledge resources and the related processes of creating, collecting, disseminating and using knowledge to ensure the organisation's proper functioning (Skyrme, 1999). Providing the right conditions to support the implementation of such a system into an organisation depends largely on a number of factors, among which the following stand out: adequate resources, the right management system and organisational structure (Liczmańska-Kopcewicz, 2017), appropriate organisational culture and communication, and a properly designed organisational strategy. However, knowledge management is still a young concept and not widely used by organisations (Dayan, Heisig, Matos, 2017). For this reason, knowledge is still a resource that, when properly used, can contribute to a given company's competitive advantage in the market (Centobelli, Cerchione, Esposito, 2017).

Implementing knowledge management in an organisation is not an easy task, which is influenced by the fact that the issue involves IT processes, human resources, possible modifications to organisational culture and, depending on the business profile, other elements relevant to the organisation. In most cases, the literature on knowledge management does not devote much space to issues related to implementation, and the implementation of a knowledge management system in SMEs hardly (Barroso, Sanguino Bañegil, 2013; Chawan, Vasudevan, 2013; Clercq, Thongpapanl, Dimov, 2014; Wong, 2005). Knowledge in small and medium-sized enterprises cannot be created according to the same procedures as in large organisations, which results from the small potential in terms of human resources, capital, technology and development. The knowledge management system should prevent the loss of knowledge possessed by the organisation, but should also create knowledge within the existing resources. This system must be an attempt at a holistic approach to organisational phenomena and processes. The management of an organisation must independently create a knowledge management system in its organisation, adapted to the specifics of the enterprise and its human and financial capabilities (Cheng, Kuan, 2014). An attempt to comprehensively implement knowledge management in an SME must, taking into account the scale, cover such areas as the IT system, organisational

culture and employee management. The functioning of modern SME organisations requires constant adaptation of management methods and development strategies to new business conditions. This is particularly important in the process of digital transformation, which has been making significant transformations in the area of the economy for some years now. This also applies to the issue of knowledge management in business organisations, which can be considered in the area of organisational structures, business processes, personnel, organisational culture, but also in the area of ICT supporting this management. This means that under conditions of extreme competitiveness as part of the digital transformation, the management methods used so far, which are aimed often aimed solely at ensuring stability and predictability. With help comes advanced ICT solutions for knowledge management (Preuss, Cordoba-Pachon ,2009), understood as systematic and knowledge, understood as a systematic and organised use of its resources to improve the functioning of the organisation, realised within the framework of the process orientation by (Unold, 2015):

- knowledge location and acquisition,
- collecting knowledge and processing it,
- its enrichment and sharing.

The knowledge management system consists of the following elements:

- knowledge management strategy - indicating priorities for action, defining the role of knowledge management in the process of achieving the organisation's strategic objectives,
- people and organisational culture - the willingness of employees to share knowledge, supported by organisational culture,
- business processes - the process orientation of the organisation to effectively collect, share and retrieve knowledge,
- information and communication technologies - these provide users with information and communication technologies - these provide users with effective collection, processing and sharing of data (transformed into information and further into knowledge).

In practical terms, this means the need for modern ICT solutions for knowledge management, enabling the support of business processes business processes as part of gaining and strengthening competitive capabilities. During evolution of the information society towards a knowledge society it boils down to treating modern enterprises as intelligent organisations intelligent. An intelligent organisation is one that bases its operating philosophy on the management of knowledge (Waltz, 2003). The term became widespread in the 1990s. due to the development of ICT, the dynamically changing economic environment and increased market competitiveness. An intelligent organisation is an organisation learning organisation, which has the ability to create, acquire, organise and share knowledge, use it to improve the efficiency of its operations and sharing it, using it to improve operational effectiveness and increase competitiveness in the global market. The idea of such an organisation is based on a systemic approach to the organisation, i.e. treating it as a complex organism based on existing structures and implemented processes with particular emphasis on the role of knowledge. Attributes of smart organisations include (Beckford, 2016), (Grösser, Zeier, 2012), (Schwaninger, 2010):

- speed and flexibility of action,
- the ability to observe the environment,
- the ability to diagnose market signals early and respond to changes in the environment,
- the ability to quickly implement new knowledge-based solutions and thereby achieve the economic benefits.

Network technology - understood as a set of network connections, mechanisms responsible for the coordination of all processes related to data exchange. This technology consists of two layers: a first hardware layer realised through. The first layer is hardware, implemented by servers, network connections and a number of tools related to synchronisation of the network synchronisation, and the second layer represented by software designed to implement the above-mentioned activities. Web technology - understood as a technology combining database technology. Web technology is implemented through websites and any mechanisms related to the representation of data on websites. The Websites present data, information, knowledge from various sources, often accumulated in many databases and files, sources, which are often combined in multiple databases and files. By means of web technology on websites equipped with the appropriate applications the web technology provides tools to share information and knowledge. Web technology provides tools for a range of knowledge management processes, such as: knowledge sharing

between experts, discussion forums experts, discussion forums, corporate portals and many others. However, it is important to remember that the foundations of web technology most perceived by users are database technology and network technology.

Each of the aforementioned technologies enables the implementation of multiple knowledge management functionalities. Many times, knowledge management tools are based on all three technologies.

3. Research on technological tools KM and innovation in SME enterprises

A comprehensive survey based on an interview questionnaire, categorised as quantitative research, was conducted in 2022 and the data obtained were analysed using statistical methods. The aim of the survey was, inter alia, to analyse the use of technological tools of knowledge management and their impact on innovation in the sector of micro, small and medium-sized enterprises in Poland. The study addressed, inter alia, the following issues:

- the level of ICT use in SMEs,
- identification of the level of employment of ICT specialists by SMEs,
- identification of the use of websites, social media and cloud computing by SMEs,
- identification of technological tools to support knowledge management in SMEs,
- assess the impact of technological knowledge management tools on innovation in SMEs.

Interviews were conducted with owners, co-owners and persons responsible for management in the segment of SME companies in Poland, from various industries. 600 randomly selected companies from the SME sector operating in the Polish market, which 40% were micro-entreprises employing up to 9 people, 30% small entrepreneurs employing up to 49 people, and 30% medium-sized entrepreneurs employing up to 249 people. The structure of the survey was weighted to the structure of companies in Poland according to the regon database operator (Central Statistical Office). The research sample prepared in this way enables the analysis of data at the level of the entire SME population in Poland. The survey has been carried out using the CATI (Computer Assisted Telephone Interview) method in 2022. It is one of the methods of collecting information in quantitative research. The CATI survey was conducted using a special program that assisted the person calling the respondent throughout the conversation. The interview questionnaire consisted of a core part (relevant questions) and a metric (classification questions). The main part of the questionnaire aimed to obtain information on knowledge management in SMEs. The questionnaire included information about the surveyed enterprises: number of employees, income, balance sheet total, legal form, type of activity according to PKD, period of operation, official position of the person completing the questionnaire. The surveyed companies gave answers to particular groups of factors according to the following scale 1 - unimportant factor, 2 - unimportant factor, 3- moderately important factor, 4 - rather important factor, 5 - very important factor. After receiving the results, the points were added up and the share in the total number of points possible was quantified (number of interviews received x 5).

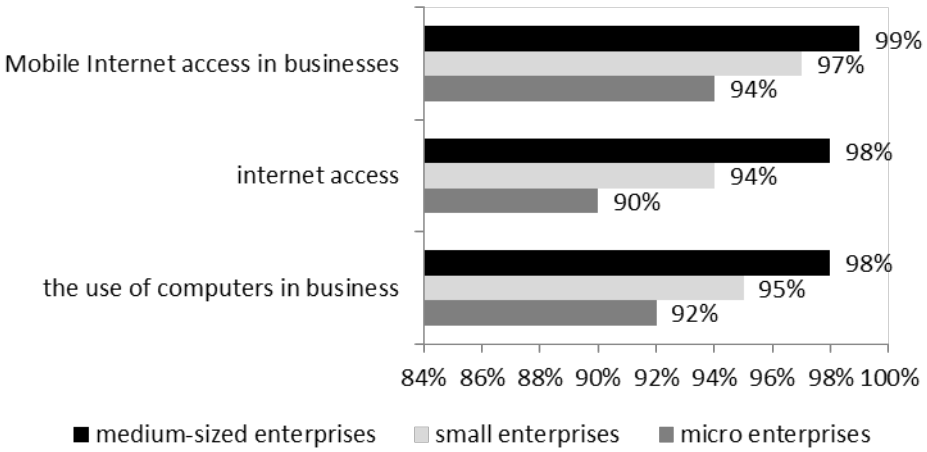


Figure 1: Computer Equipment, Internet Access in 2022 in SMEs?

Computer equipment has a significant impact on the use of technological knowledge management tools. In the 2022 surveyed, the percentage of SME companies using computers remains high at 98% in the medium

enterprise sector, 95% in the small enterprise sector and 92% in the micro enterprise sector (figure 1). The highest level of internet access is found among medium-sized enterprises reaching 99% in mobile internet access, the lowest level was reached by micro enterprises 92% in internet access. The majority of micro, small and medium-sized enterprises do not employ staff with specialist digital skills. Such people are employed by less than 2% of micro, 8% of small and 30% of medium-sized companies. The situation is quite different in large companies - almost 3/4 of them employ ICT specialists. Employers are struggling to recruit digitally competent employees. For this reason, outsourcing IT services is becoming increasingly popular, especially among small and medium-sized companies. Business managers also recognise that it is more cost-effective to partner with one specialised and experienced external provider than to develop an in-house IT department. 88% of medium-sized companies had their own website, 64% of small companies had their own website and micro companies fared the worst at 16%. Most enterprises see their website as a marketing tool. Most often, the website is used to present the company's products, catalogues, price lists of products or services (69% of all companies). Another popular function, especially among larger companies, is posting information about job vacancies. Company websites also make it possible, among other things, to place orders and check their status online. One of the least frequently used website features by companies is its personalisation for regular users.

More than a third (36%) of the companies surveyed in Poland used at least one social media, which is a result of both a greater awareness of the power of the media themselves and the hiring of communication and marketing specialists, as well as higher budgets for promoting their own offerings. Social networking sites are used in the majority of cases, with blogs and media sharing portals being used to a lesser extent.

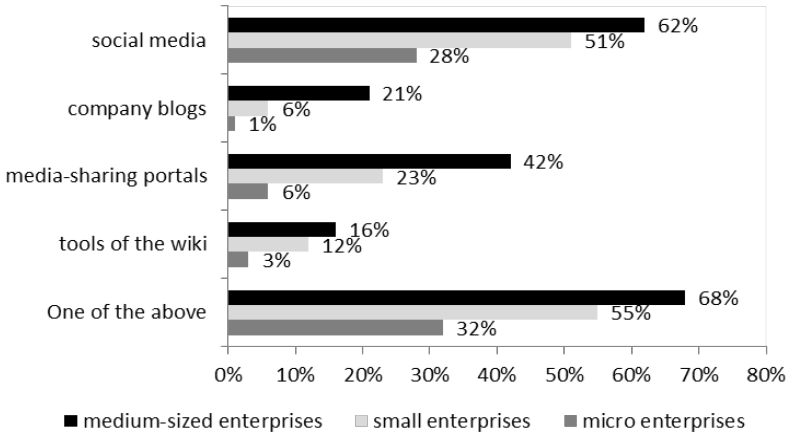


Figure 2: Use of Social Media in Surveyed SMEs

Considering the size class, medium-sized companies were the most likely to use social media 68% (figure 2). Social media is increasingly becoming the main channel for maintaining customer relationships. Some companies are abandoning telephone contact in favour of email or social networks. The rise in popularity of the latter has meant that they are increasingly used by companies to promote products and brands. This allows them to create a group of loyal customers and effectively attract new ones. By communicating on social media, companies encourage customers to share ideas, gaining knowledge that is then used in the creation or development of products and services. Increasingly, social media are being used in the recruitment of employees. It is also successfully becoming a tool for improving communication within the company, enabling the exchange of knowledge, opinions and ideas among employees.

Cloud services make it possible, especially for micro and small entities, to take advantage of the latest technological solutions without having to invest large amounts in the purchase of software and IT infrastructure, providing flexibility and optimal support for their development. Among the benefits that a company can achieve by using cloud services, there is also a reduced need for office space and a reduction in the number of IT support staff in the company. According to the companies surveyed, 35% of medium-sized companies, 18% of small companies and 4% of micro companies used cloud computing services. The most common reason for companies not using cloud computing services was insufficient knowledge 46% of the total number of companies. The digitalisation of business is unequivocally associated with positive changes also in knowledge management. It significantly increases work efficiency, improves communication and group activities, and allows for better customer service. The change of working style from analogue to digital means greater agility and competitiveness of the company. In an era of total digitalisation of life, being inactive in the

implementation of new technologies is, from a business point of view, an action doomed to failure in the long term. Digitalisation is currently the most effective tool for managing and implementing innovations. Poland can boast one of the most dynamically developing economies in the European Union. Unfortunately, a feature of the domestic market is the low level of digitisation. In terms of the Digital Economy and Society Index (DESI), Poland is ranked 24th among 28 Member States in 2022.

Within the framework of technological tools supporting knowledge management, the surveyed companies indicated, among others, the following tools: Knowledge Bases, Business Intelligence, Case Based Reasoning, Content Management System, Data Mining, E-learning, E-Room, Executive Dashboard, Experience Data Bases, Extranet, FAQ, Discussion Forum, Data Warehouses, Indexing, Intranet, Web Directories, Mind Mapping, Electronic Mail, Corporate Portal, Employee Profiles, Project Snapshots, Ranking, Expert Systems, Document Management Systems (DMS), Videoconferencing, Search Engines.

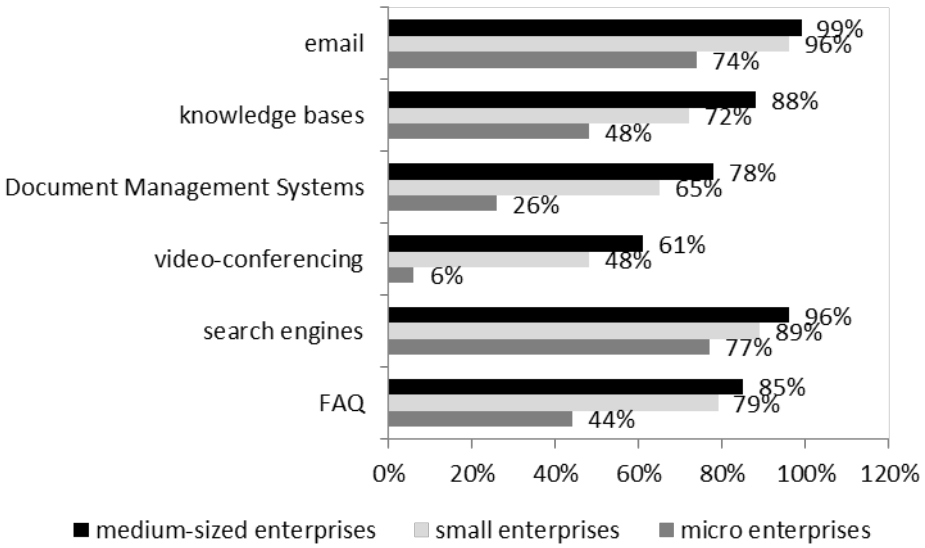


Figure 3: The 6 Most Frequently Used Technological Tools of KM

The analysis carried out on the basis of the research demonstrates the wide variety of technological tools for knowledge management. The surveyed companies identified dozens of technological tools. The most frequently used included email 99% in the medium-sized enterprise group, search engines 96% in the medium-sized enterprise group, knowledge bases 88% in the medium-sized enterprise group. The pandemic period has meant that companies are increasingly using videoconferencing to communicate information. It is worth noting that technological tools support all organisational tools and activities, especially in territorially dispersed organisations. In fact, it is impossible to organise a conference without using e-mail or a document management system. The analysis of the research shows that technological knowledge management tools also significantly support the organisation's business processes. Knowledge management tools support business processes such as:

- support of analytical evaluation processes,
- support of decision-making processes,
- acquisition, processing of analysed data (information, knowledge) from multiple sources.

This support is manifested in the provision of technological tools for knowledge management at different levels of sophistication. These tools provide, among other things, communication, coordination, logistics, management of organisational knowledge management processes, as well as efficient operational work and support for organisational knowledge management tools.

The next aspect of the research analysed is the impact of technological tools supporting knowledge management on innovation in enterprises. Following a tabular description of the classified tools, an analysis of the impact of the studied tools on innovation in enterprises was carried out based on the results of the interviews of the surveyed enterprises. The technological knowledge management tools most influencing the level of innovation (technological and in terms of organisational culture) of the surveyed SME enterprises were found to be: Good Practice Database, Knowledge Bases, E-learning, Discussion Forum, Groupware, Intranet,

Email, Corporate Portal, Employee Profiles, Expert Systems, Document Management Systems, Videoconferencing. The research conducted indicates that the tools most supportive of innovation were found to be those most frequently used in the day-to-day operational work of companies. In addition, the tools most supportive of innovation mainly in the area of organisational culture were found to be those used for communication within companies, i.e. those that build virtual communities, which was also influenced by the COVID pandemic19. These tools contribute to transforming the specificity of work by creating virtual contacts between employees and are as important as face-to-face contacts.

4. Conclusion

Concluding the considerations presented so far, on the basis of the analysis carried out, it can be stated that the use of technological tools of knowledge management in enterprises of the SME sector currently plays a very important role. It facilitates and streamlines organisational processes, supports business processes, shapes organisational culture by changing the principles, forms, habits of cooperation and communication. The advantage of using modern technologies is the improvement of work efficiency and time savings resulting from, among other things, faster exchange of information placed in the cloud, information acquisition, improvement of the level of innovation. Digital solutions are also helpful in building customer relationships, enabling feedback on the quality of service or purchasing preferences. A great potential lies in the sector of small and medium-sized enterprises, which, lacking the possibility to employ qualified ICT employees and implement modern solutions, are threatened by digital exclusion, therefore, it is necessary to build awareness of the use of technological tools of knowledge management and their influence on the innovativeness of enterprises of the SME sector. However, building this awareness is a long, complex process and requires time for the enterprise. In the first phase of implementation, technological tools for knowledge management are most often perceived as mere technical applications, software, the implementation of which causes a lot of trouble, and only after a long period of use do they bring benefits, improvements in the way the enterprise operates. This is due to a number of factors, including ad hoc implementation of IT systems without a well-thought-out long-term strategy, lack of understanding of the change process associated with the use of knowledge management tools, communication errors accompanying the implementation and change processes, etc. However, in spite of the many difficulties, it is worth implementing technological tools to support knowledge management, as the benefits of the implementation process are very broad, they comprehensively improve the operation of SME enterprises, and many of these tools influence their innovativeness, which is very important in the times of Industry 4.0.

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A Cross-Disciplinary Knowledge Management Framework for Artificial Intelligence in Business Projects

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Abstract: This paper presents a knowledge management framework for designing, monitoring, and optimizing the business value of intelligent services using best practices from both management and machine learning engineering areas. The increasing interest in artificial intelligence has highlighted the difficulty of designing an appropriate business case and monitoring the real business value generated by such services due to the complexity of machine learning methods and techniques. Managers have proven frameworks for constructing key performance indicators, machine learning engineers have developed advanced methods and techniques for evaluating and monitoring Machine Learning (ML) models, and scientists have tested methods for empirically evaluating the added value of innovations. By leveraging the strengths of each discipline, the proposed framework enables managers, machine learning engineers, and scientists to efficiently work together and optimize the value of intelligent services during their lifecycle. We propose processes and procedures for creating, capturing, organizing, storing, sharing, and using knowledge in advanced machine learning projects. He also presents key machine learning methods and techniques for monitoring and optimizing the value of intelligent services over their lifecycle, including the adaptation of MLOps methodology for continuous monitoring, reinforcement learning for continuous improvement, and CausalML methods for identifying the root-causes of changes in the business value. These methods and techniques support knowledge management activities and help formulate a competency framework for team members and project stakeholders. We point out the potential of academic researchers and external advisors as catalyzers in such projects based on real-life implementation. He also proposes a method for designing the ML knowledge flywheel to ensure continuous knowledge transfer and improvement in the business-engineer-academy triangle. The approach is illustrated by a case study of the implementation of a marketing communication optimization system in a large, multinational financial company for more than 20 thousand customers in two European countries. Managers and machine learning engineers can implement the proposed knowledge management framework in various organizations for the efficient design, monitoring, and optimization of the business value of intelligent services.

Keywords: Knowledge management, Project team competencies, Machine learning projects

1. Introduction

The relationship between artificial intelligence and knowledge management is becoming increasingly complex. On the one hand, AI solutions can effectively support KM processes (Wang et al., 2022), on the other hand, machine learning projects require teams with diverse competencies (e.g., in the marketing industry (Blomster and Koivumäki, 2022)). Additionally, the rapid development of Large Language Models (LLMs) and, more broadly, generative models, create a new bridge between machine learning and knowledge management, enabling, for example, the improvement of machine learning model quality by enriching features through LLM models.

The rapid development of machine learning methods and techniques makes it difficult for many organizations to keep track of the latest solutions that could improve the quality of their models. The shortage of data science specialists leads to their overload in projects and hinders the development of professional competencies. A solution to this problem may be projects carried out in multidisciplinary teams, where specialists from not only different fields but also organizations and environments meet.

The development of machine learning takes place in the areas of data preparation methods, techniques, and tools, training, evaluation, production deployment, and business value assessment after production launch. It is worth emphasizing that these are not only "quantitative" changes (e.g., new machine learning algorithms or new software libraries supporting the implementation process) but also, in a sense, qualitative ones (e.g., the development of experimental methods enabling a real assessment of the value of a machine learning model compared to previous methods of operation).

Narrow specialization within data science teams, IT engineers, and business representatives makes it difficult to develop and implement "horizontal" solutions: those that optimally integrate the competencies and needs of each of these groups. For example, data scientists measure the efficiency of their models using statistical measures, while business representatives using models are more interested in using business measures (various Key Performance Indicators (KPIs) measuring, for example, process efficiency). Data scientists usually evaluate models before production deployment (although model monitoring and observability systems in

production are becoming increasingly popular), while the business is more interested in managing the value of business models over time.

In the following sections, we will present various insights and observations, largely derived from a case study of a financial institution, which illustrate different aspects of the interplay between machine learning and knowledge management. These insights will provide an understanding of the challenges and opportunities that arise when integrating AI solutions into business processes and the value of multidisciplinary teams in addressing these challenges. We will discuss the role of communication and collaboration between various stakeholders, the importance of aligning business and data science objectives, and the impact of emerging technologies on the development of machine learning models. Finally, we will highlight the lessons learned from these observations and their implications for both practitioners and researchers in the fields of AI, machine learning, and knowledge management.

2. Business Value of Machine Learning Models

In this section of the article, we will focus on three key aspects of evaluating machine learning models: statistical methods, business methods, and experimental methods. We will explore their respective roles in assessing model quality, their relevance to different stakeholders, and their application in various stages of the project lifecycle.

2.1 Evaluation

Evaluation methods for machine learning models can be divided into three groups: statistical methods, business methods, and experimental methods. Among Data Scientists, statistical methods are the most popular. For example, to assess the quality of classification models, measures such as ROC AUC, accuracy, F1/F_beta, precision, recall, or confusion matrix can be applied. For regression models, measures like R2, RMSE, or MAPE can be used, while the Silhouette coefficient is used for clustering.

While statistical measures are good from a Data Science perspective, a manager formulating a business justification for a project using machine learning in practice is more interested in the real impact of the solution on processes or products. To assess business value, measures such as the confusion matrix, lift (see e.g. (Provost and Fawcett, 2013), or simply KPIs used to evaluate process performance or measure product quality can be applied.

The methods described above, assuming the availability of appropriate training sets (real historical data), allow for the evaluation of a model's quality before its production deployment. In practice, however, the actual business value may significantly deviate from the forecasted value. Factors influencing the real value generated by information technology can be divided into organization-dependent and independent factors. An organization can influence, for example, the level of adoption of a solution by employees or customers, but it will be more challenging to control market factors affecting sales dynamics.

Therefore, the optimal solution is to use the statistical and business methods mentioned earlier at the stage of constructing the business case (as a basis for, e.g., an investment proposal) and to use experimental methods (e.g., A/B/n tests) for the actual assessment of business value. Such experiments should be planned already at the project development, especially by identifying KPIs as the basis for measuring effectiveness, research hypotheses to be verified within the experiment, the sizes of the control and test samples, and the architecture of the IT solutions that enable the research.

2.2 Operationalization, Model Monitoring and Observability

The production deployment of machine learning models presents a considerable challenge, with costs often significantly exceeding those of training (as suggested in the literature). During the operationalization stage, the model is made available on the production infrastructure, an application layer is created, intelligent solutions are integrated with existing systems, and users are appropriately trained. Additionally, it is necessary to implement the previously designed systems that enable the execution of experiments assessing the actual business value of the models.

The situation is further complicated by the fact that models trained on historical data tend to lose their quality over time. This phenomenon is commonly attributed to data drift and model drift. Data drift refers to changes in the data distributions characterizing the objects being predicted (e.g., customers or products), typically resulting from natural quantitative changes in the economic environment (e.g., inflation, competitors'

behaviors, market shifts, etc.). In contrast, model drift usually arises from qualitative changes, such as the emergence of new features characterizing the predicted objects (see Figure 1).

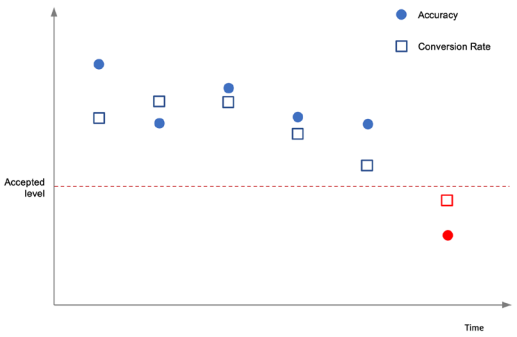


Fig. 1a

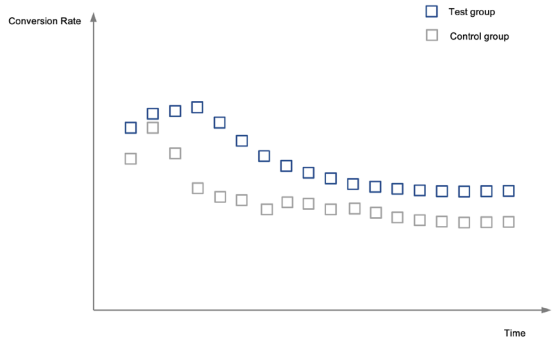


Fig. 1b

Source: Own elaboration.

Figure 1: Model Drift

On the left (Fig. 1a) exemplary statistical (Accuracy) and business (Convertion rate) drift are presented. On the right (Fig. 1b) we present experiment results, comparing the test group (here: marketing communication basing on Machine Learning model) with the test group (communication basing on current rules). One of the key projects goals is to manage the business measure drift rather than the statistical measure. The data presented in this figure are illustrative and not based on actual values.

Consequently, the experimental verification of an intelligent solution's business value (immediately following production deployment) should be complemented with solutions that enable the monitoring of this value over time.

As demonstrated, the processes of designing, implementing, and maintaining production-ready intelligent services are highly complex. Consequently, it is no surprise that numerous systems have been developed to facilitate their execution. Specifically, solutions aiding the observation and diagnostics of models can be categorized into purely analytical systems (e.g., www.arize.com) and those utilizing fundamental machine learning techniques (e.g., Bayesian inference in solutions like www.nanny.ml). Additionally, the dynamically evolving CausalML methods and techniques of the CausalML (refer to libraries like DoWhy (Sharma and Kıcıman, 2020), CausalNex (Kumar and Ravi, 2022), or gCastle (Zhang et al., 2021) hold great potential, as they enable modeling causal relationships and ultimately identifying factors with the most significant impact on model decay. Reinforcement Learning, which allows designing self-improving systems, is also noteworthy in this area, both for experiment optimization. At the management level, MLDevOps methodologies, supported by dedicated IT solutions (e.g., Google Vertex AI, Amazon SageMaker, or Microsoft Azure), play a crucial role in automating model maintenance.

A considerable challenge at present is that most of the above-described solutions support the detection and diagnostics of model drift based on statistical measures. While selected AutoML or model observability tools already offer the ability to optimize training and monitor model quality using custom measures (e.g., business-related), the habits of Data Scientists who are accustomed to employing statistical measures represent a significant barrier. As of now (April 2023), we are not aware of any solutions that integrate model monitoring with experiments utilizing, for instance, A/B/n tests (although separate solutions exist to support the execution of such experiments, they are not integrated with model monitoring systems or, more broadly, AutoML or MLDevOps).

3. Competency Framework for Team Members and Project Stakeholders in Machine Learning Projects

As engineering projects increasingly necessitate the intersection of diverse disciplines, it is crucial to understand the role of knowledge management (KM) in fostering cross-disciplinary competencies. Fakhar et al. (Fakhar Manesh et al., 2021) examined the intellectual structure and trends of knowledge management (KM) in the context of the fourth industrial revolution, Industry 4.0, uncovering six major themes and proposing future research avenues. Bjornson and Dingsøyr (Bjørnson and Dingsøyr, 2008) conducted a systematic review

of empirical studies on KM initiatives in the domain of software engineering, highlighting a significant focus on explicit knowledge and the necessity of considering tacit knowledge. Carrillo and Chinowsky (Carrillo and Chinowsky, 2006) investigated KM initiatives among major U.S. engineering design and construction firms, revealing different KM practices in design firms and construction companies. Kamara et al (Kamara et al., 2002) assessed KM strategies in the Architecture, Engineering and Construction (AEC) industry, concluding that effective KM requires an integrated approach addressing both technological and organizational/cultural issues. Chung et al (Chung et al., 2003) presented a collaborative project that aimed to enhance current workflow systems to better manage dynamic and collaborative processes, particularly focusing on new product development in the chemical industries. Finally, Ardito et al (Ardito et al., 2019) investigated the specific roles that universities play in managing knowledge for smart city projects, identifying universities' roles as knowledge intermediaries, gatekeepers, providers, and evaluators.

While the study of knowledge management in engineering projects has been extensively covered in the literature, there remains a noticeable research gap in understanding its implementation and impact specifically within machine learning projects in the business context. Below we address the competency framework key for successul implementation of such initiatives.

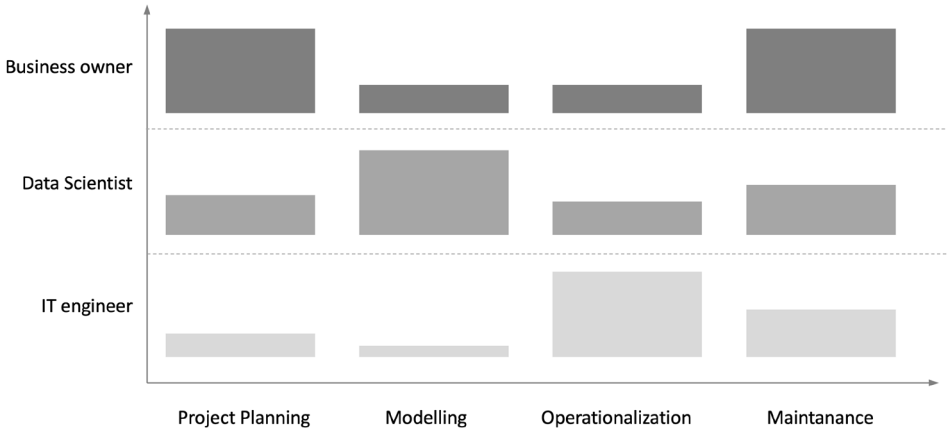
A typical intelligent service implementation project can be divided into stages of formulating a business case, planning, Data Science, operationalization, and maintenance.

Business representatives, Data Science specialists, and IT professionals usually participate in such project, with the entire process coordinated by a project manager. Each of these roles requires a specific set of skills. For the purposes of this study, we will categorize these skills as key competencies and complementary competencies, which are not directly related to the role but are essential for the project's success, focusing on the latter. The reflections presented below are based on the implementation of numerous machine learning projects for medium and large organizations - an example project is briefly described at the end of the paper.

T-shaped Competencies

Business representatives are often the initiators of the project, well-versed in market conditions, and capable of measuring the effects of actions. To effectively plan business cases, monitor project execution, and manage its business value as comprehensively as possible, they should also possess in-depth competencies in designing and conducting experiments, supplemented with skills in Data Science and IT. Using the metaphor employed in competency management, these individuals should have T-shaped competencies, where the vertical bar represents in-depth business skills (from a given area, like internet marketing), and the horizontal bar encompasses skills in general management, experiment design, data science, data engineering, and MLOps.

Among the IT professionals involved in implementing such projects, we can distinguish data engineers, machine learning engineers, integrators, application developers, and those responsible for deployment and maintenance (Ops). Naturally, each of these roles requires competencies in their respective IT/MLDevOps fields (vertical bar) and horizontal competencies, particularly in the areas of Data Science and business(see Figure 2).



Source: Own elaboration.

Figure 2: Estimate Level of Involvement of Individuals in Various Roles in a Machine Learning Project During its Different Stages

The high involvement of the business representative during the maintenance phase is due to the necessity of monitoring the business value of the solution and recommending subsequent experiment iterations.

Pi-shaped Competencies

Data Science specialists should naturally possess in-depth skills in the Data Science field (including data acquisition, analysis, and preparation, modeling, evaluation, and model quality monitoring) complemented by "horizontal" skills in business and software engineering. However, in the context of managing the value of an intelligent service, the skills related to designing and conducting experiments are so crucial that they can be treated as a second vertical bar in the competency profile, indicating the concept of Pi-shaped competencies.

M-shaped Competencies

Managing a project of this type poses a unique challenge. It requires possessing numerous horizontal competencies (e.g., in the areas of general project management, change management, or business) and at least three vertical pillars: Data Science, IT/MLDevOps, and business experiment design and planning. Consequently, individuals fulfilling this role should have a competency profile known as M-shaped.

4. Knowledge Management Framework for Designing, Monitoring, and Optimizing the Business Value Of Intelligent Services

In the section dedicated to competency profiles, we identified four key competency groups: business, data science, experiment design, and information technology. Individuals fulfilling various roles in the project (business owners, data scientists, IT engineers, and project managers) should possess an appropriate mix of these competencies: T-shaped, Pi-shaped, or M-shaped.

The success of the undertaking is contingent upon the proper flow of knowledge from these areas, both within the scope of the executed project and by leveraging experiences acquired from similar endeavors in the past. Inappropriate "proportions" between these skills may result in errors in assessing the business value of an intelligent service and suboptimal management of that value.

To measure the value (evaluation) of a machine learning model, one can employ business, statistical, and experimental approaches. Each of these approaches has its advantages and disadvantages. A predominance of competencies in one of these areas may naturally lead to an excessive focus on measures of one type, neglecting measures from another category. This may have the following consequences:

- In the case of a predominance of statistical approaches, the model evaluation may either not meet business requirements or be incomprehensible to the business recipient.
- In the case of a predominance of business approaches: an excessive amount of business metrics may generate difficulties both during training (evaluation and validation of models) and in experiments (too many tests to be conducted, difficulties in comparing results).
- In the case of a predominance of experimental approaches, difficulties arise during the formulation of the business case (assessment of potential based on historical data) and during training (evaluation and validation of models).

As a result, it is crucial for the project to select team members in such a way that their competency profiles comprehensively cover not only the skills described above for model evaluation but also business, experimental, data science, and IT competencies. Additionally, ensuring effective knowledge flow between teams and leveraging already accumulated experiences is of great importance.

This is the primary motivation for developing a knowledge management framework, particularly the processes and procedures for creating, acquiring, organizing, storing, and disseminating knowledge using appropriate technologies.

4.1 Key Knowledge Management Processes

Below, we explore various aspects of knowledge management in machine learning projects, from knowledge creation to sharing and application. We discuss the unique nature of ML projects and their potential as valuable sources of knowledge. By examining traditional and contemporary methods for capturing, organizing, storing, and sharing knowledge, we aim to provide insights into effective strategies for managing knowledge in the context of ML projects. Furthermore, we highlight the potential of conversational interfaces and generative technologies in transforming the way knowledge is shared and utilized within organizations.

Knowledge creation. Practically every machine learning project is unique, addressing various business problems using different methods and technologies and carried out by diverse teams. As a result, a well-managed ML project can be a source of valuable knowledge.

Knowledge capturing. This knowledge can be generated at various stages of the project in different areas outlined in the section dedicated to competency profiles. Typical situations conducive to knowledge creation include recurring or ad hoc project meetings, milestone summaries, documentation creation, or interpretation of experimental results.

To capture knowledge, both "traditional" methods (electronic documents, logs from project management systems, or various electronic communication channels such as email or instant messaging) and modern tools utilizing machine learning (e.g., automatically generated meeting transcriptions) can be employed.

Knowledge organization. Similarly, knowledge organization can involve traditional methods such as organizing documents into folders or assigning appropriate tags (facilitating multidimensional classification). Contemporary machine learning methods may additionally enable semantic analysis of collected content (Maulud et al., 2021), automatic tagging and annotations (Lin, 2022), topic modeling (Churchill and Singh, 2022), knowledge graph creation (Chen et al., 2020), or semantic embeddings (Sezerer and Tekir, 2021).

Knowledge storing. Organized knowledge can be stored in folders with electronic documentation, databases, or project archives. However, the rapidly evolving generative technologies encourage considering more advanced methods such as prompt retrieval (Cheng et al., 2023), document embeddings (Sinoara et al., 2019), or generative model weights pretrained on a proprietary knowledge corpus.

Knowledge sharing and application. Properly organized and stored knowledge can be utilized both within the project and in subsequent ventures. The efficiency of these processes will significantly depend on the convenience of access interfaces. Scattering documents across various locations (spatial, technical, or organizational dimensions) hinders knowledge utilization in new projects. A promising group of technologies that can solve this problem is conversational interfaces (text, audio, and graphical modes) based on the aforementioned generative technologies.

It is worth emphasizing that, as of April 2023, there are two dominant methods for using publicly available models to manage internal organization knowledge: prompt-engineering-based approaches (where knowledge is part of a query to a general generative model) and slightly more challenging implementations involving fine-tuning open models for specific tasks on proprietary knowledge resources.

Both approaches are currently implementable, so an increase in popularity of such solutions can be expected in knowledge sharing for machine learning projects as well as projects in other areas. Nevertheless, projects that create intelligent services, due to the profile of the participants, can naturally become the testing ground for developing and testing such modern knowledge transfer solutions.

4.2 Academic Researchers and External Advisors as Catalyzers in ML Projects

As mentioned earlier, in addition to business competencies, crucial skills for implementing machine learning projects and managing the value of such solutions involve Data Science, IT, and experimental design abilities.

An imbalance between these competencies can hinder the assessment of a solution's potential, the evaluation of model quality, and the verification of its business value, ultimately reducing an organization's ability to manage this value in the future.

Our observations indicate that while Data Science and IT competencies are gradually becoming commonplace in mature organizations, knowledge in the area of experimental design and implementation remains a challenge for many organizations.

Moreover, carrying out projects within the same human teams (whether internal or with consistent subcontractors) fosters the development of habitual patterns and conceptual schemas. While this has many advantages (e.g., process streamlining and standardization or improved communication), it can also result in overlooking errors or new problem-solving approaches.

For these reasons, as part of the Knowledge Management Framework, it is worth considering inviting external individuals to the team, such as freelancers or representatives from the academic world. Such individuals can be a source of new ideas, methods, and techniques, as well as bring fresh perspectives to the problem,

ultimately improving the solution's quality. Additionally, mature experimental design and implementation methods used in the scientific community can help fill competency gaps in this area.

4.3 Business-Engineer-Academy Knowledge Flywheel

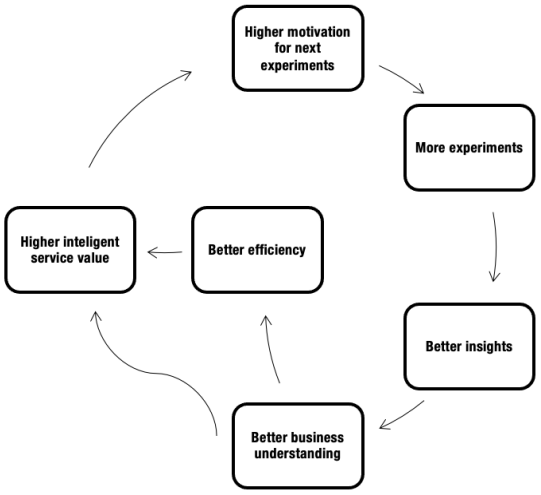
A well-designed knowledge flow within the Business-Engineer-Academy triangle (for simplicity, we combine the roles of Data Scientist and IT Engineer here) can facilitate the so-called flywheel effect: a situation in which successive iterations of knowledge flow enhance the processes of managing the value of intelligent services.

For example:

- The business recommends KPIs that are expected to improve upon implementing an intelligent solution.
- The engineering team (Data Science and IT) technically implements the solution.
- Scientists conduct experiments, analyze the results, verify hypotheses, and present key findings to business representatives.
- Informed by the new knowledge, the business proposes further experiment iterations and refines success metrics.

A well-designed Knowledge Management (KM) flywheel allows for continuous improvement of the process of managing the value of intelligent services, ultimately transcending the paradigm of model monitoring and diagnostics for maintaining their value. This is possible thanks to:

- Systematic processes of generating, capturing, organizing, storing, and sharing knowledge throughout the entire cycle.
- Machine learning methods and techniques employed, particularly CausalML for modeling causal relationships and, as a result, identifying factors that genuinely impact the level of business metrics, and Reinforcement Learning enabling optimization of conducting business experiments (see book on Experiments).



Source: Own elaboration.

Figure 3: An Exemplary Knowledge Management Strategic Flywheel for Machine Learning Projects

Consequently, an exemplary KM flywheel may follow the following scheme:

- New experiments ...
- Generate new insights ...
- ... enabling a better understanding of the business ...
- which improves
    - *business efficiency (measured by KPIs)*
    - *and increases the value of intelligent services*
- which encourages the organization to conduct further experiments.

Thus, a well-designed knowledge flow within the Business-Engineer-Academy triangle can lead to a flywheel effect, where continuous iterations of knowledge exchange improve the management of intelligent services' value. This is achieved through systematic processes of knowledge generation, capture, organization, storage, and sharing, along with the utilization of machine learning methods like CausalML and Reinforcement Learning. As a result, the knowledge management flywheel enables better understanding of the business, improved efficiency, and increased value of intelligent services, encouraging organizations to conduct further experiments.

5. Case Study

ABC (a pseudonym of a real company, which didn't permit disclousure of their actual name) is an international company operating in the financial industry, one of the larger European institutions providing loans through digital channels, with over 2 mln customers in 7 countries. A key area of operational activity is product promotion, carried out in digital channels, particularly through personal contact (phone, SMS, email) and online advertising.

The costs of conducting promotional campaigns are high, both for ABC (Contact Center services, media purchases) and for customers (too frequent contacts are irritating). Therefore, the company is developing technologies to optimize customer contact.

The primary objective of the project, which serves as a case study in this research, is to increase profits by reducing communication costs and modifying discount policies. To achieve this goal, a model predicting customer interest in a financial loan is developed and utilized as a key method. The model is run weekly and forecasts whether each customer will purchase a financial product in the following week. Based on this prediction, contact is established with the customer, the form of which depends on the customer's purchase history and the predicted probability of purchase.

The project was initiated by a mid-level manager coordinating marketing activities in multiple countries. Based on experience from one market, a decision was made to design a similar solution for two more, for over 100,000 active customers. The project is, however, carried out by a newly formed team, which includes representatives from business, IT, and academia. This approach was motivated by the heavy workload of the existing Data Science team, and the need to look at the problem from a fresh, new perspective. The project management methodology is based on the proven CRISP-DM methodology, but its specifics required some changes in this case.

Due to allowing representatives from the academic world to access sensitive data, it was necessary to implement appropriate legal procedures and grant IT permissions. This procedure significantly extended the initiation of the project but laid the foundation for further ventures of this type.

At the design stage, a decision was made to focus on the experimental verification of the business value of machine learning models. As a result, it was necessary to develop an experiment plan and a dedicated IT architecture.

Planning the experiment, especially selecting the business measure (KPI) to help determine the business value of the model and the historical values and expected test reliability, required the alignment of many concepts and was the first situation allowing for intensive knowledge exchange between company representatives and academics. In turn, the plan to integrate production machine learning systems with systems automating marketing communication forced changes in many communication rules. In summary, the planning and implementation of the experiment required not only the development of new concepts but also significant changes in the architecture of marketing communication systems.

At the modeling stage, one challenge was determining the subject of the forecast. As already mentioned, the primary goal was to optimize marketing communication, focused on "just-in-time" communication: sending the right message to a person with a specific level of product purchase readiness. From a Data Science perspective, this could be achieved either by classification methods (predicting whether (YES/NO) the customer will buy the product in the next week) or regression (forecasting how many days from the current date the customer will contact to purchase). Business representatives, on the other hand, having experience and certain habits from previous similar projects, expected a probability of purchase prediction (which is not the goal itself, but an artifact of the predictive process). Achieving conceptual consensus in this area was somewhat challenging, but by the end of this stage, it was achieved. Moreover, the approach of basing communication not so much on the binary prediction of the model but on the probability value of purchase

propensity, which was the starting point for complex procedural rules, was a new experience for representatives from the academic world.

The production launch, using the Google Vertex AI platform, was an opportunity for ABC Company to test the latest MLDevOps tools in production and a basis for assessing their potential in subsequent implementations.

In summary, the experiences described above indicate 1. The significant value of involving individuals from outside the organization in the process of developing intelligent services, 2. The substantial impact of implementing experimental measures on the processes of training, operationalizing, and evaluating the business value of machine learning models, and 3. The necessity of having diverse (T-shaped, Pi-shaped, and M-shaped) competency profiles among team members.

6. Conclusions

This article explores the complex relationship between artificial intelligence and knowledge management, focusing on the practical application of machine learning models in a business context. It discusses various evaluation methods, operationalization challenges, and monitoring and observability techniques for such models.

Drawing from the case study of a financial loan interest prediction model several key lessons were learnt. First, the initial phase of the project (data acquisition) can be significantly shortened by implementing a data governance system and introducing a Data Engineer into the team. Notably, this approach may also simplify procedures concerning data access. Next, in interdisciplinary projects, aligning terminologies in the early stages is of vital importance. It has been observed that the same term may be interpreted differently by different individuals, based on their prior experiences, which can lead to misunderstandings. Therefore, investing time and resources in creating a shared vocabulary can be a significant factor in preventing such communication pitfalls. Finally, one of the crucial business competencies that can influence the pace and quality of a project utilizing machine learning is the practical skill of planning and executing business experiments, and cultivating a culture of their use for empirical validation of the value of new initiatives. This culture can enhance the practicality and relevance of the project, ensuring that initiatives are not only theoretically sound but also empirically validated.

For future research, it is suggested to investigate the effectiveness of cutting-edge machine learning techniques in knowledge management and to explore the potential of advanced methods like CausalML for managing the value of intelligent services, ultimately leading to a better understanding of causal relationships within business processes.

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Fostering a Virtual Knowledge Sharing Community in a Malaysian Financial Institution

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Abstract: The purpose of this research was to study the set-up process of cultivating a knowledge sharing community in a financial institution comprising of 500 over employees. The areas that were researched were – what major issues can be identified during the set-up phase, the critical success factors, and way-forward plans to sustain this program. This paper proposes in adopting an IS model in implementing a virtual knowledge sharing community. Conforming to a case study approach, the study investigates the outcomes of a 14-month on-going implementation program, encompassing of strategic discussions and multiple workshops in assessing critical knowledge assets and developing techniques in how best to manage explicit and tacit knowledge, amongst knowledge workers. The valuable insights were focused, in particular on KM training for the newly designated 'KM Stewards' who were responsible of driving the organisational KM strategic initiatives and the implementation of a KM capability assessment technique that can be adopted in a financial sector. Special emphasis was made in building the skills in intra-organisational cooperation and management engagement for meeting the challenge of 'capturing' and codifying tacit knowledge and ultimately the generation of lessons learned and fostering of virtual communities of practice in promoting a new form of 'collective intelligence' in the organisation. With practitioners' experience in adopting an IS model, this paper will highlight the implementation road map for assessing the usage of knowledge management systems, challenges faced by the KM Task Force, action plans and outcomes with the user community. Finally, this article will be able to contribute to the theoretical knowledge on knowledge sharing in the financial sector of domain. The research methodology is discussed, followed by results and a discussion of the results. Finally, conclusion and future research are presented.

Keywords: Implementing KM systems, Knowledge sharing communities, KM Task Force, Lessons learned, KM success factors

1. Introduction

Knowledge is always changing. Renewing knowledge and making it accessible is key for organisational competitiveness. Organizations rely on effective management and knowledge at every stage of the business cycle (Mia & Chowdhuary, 2021). With the work-from-home era, Management is driven to develop technological strategies and action plans to ensure knowledge is virtually accessible and expertise of knowledge workers can be globally connected at an anytime and from an anywhere paradigm. Knowledge management systems are essential building blocks of a business's overall success formula and strategy execution shows where an organization excels, survives, or succumbs to external pressures (Twum, 2021).

Intensifying competitive pressures associated with globalization coupled with increasing project complexity have brought about a greater demand for all employees in the Malaysian Industrial Development Finance (MIDF) to be equipped with appropriate knowledge and skills. The value of knowledge was emphasised in Malaysia's Vision 2020, which indicated that the country needed to shift from a production-based economy to a knowledge-based economy. With the support of continuous government programs to encourage the sharing and managing of knowledge in the Malaysian agencies, there had been an increase of public and private agencies embarking on knowledge management (KM) initiatives albeit gradually. Specifically, tacit knowledge management is crucial in executing day-to-day job functions effectively, efficiently, and eventually enhancing the performance of organisations (Milton, N., Lambe, P., 2020). The organisational drive is to harness embedded knowledge residing amongst its employees and leverage in technological platforms to engage in creative problem solving. Thus, organisations are developing effective and efficient KM methods to address problems and benefit from opportunities (Tiwari, 2022), making KM increasingly vital.

There may be a wide range of KM implications in organisations, but there is also a growing body of evidence that shows that few are successful (Alharbi, G.L., 2023). This has caused controversy regarding KM's effects on various organization performance indicators [Al-Ahbabi SA, et. al., 2019). Due to these conflicting results, there is a call to shed more light on the organizational processes, systems, and other influencing factors that may determine the benefits in the association between KM and service efficacy (Alharbi, G.L., 2023). According to

research performed by Narayanan et al. (2020) on Malaysian SMEs, the perceived benefits include innovation speed and organizational performance. Kassim et al. (2016) in their research, suggested that effective KM will impact enhanced customers relations and better services. This research was to study the set-up process of implementing KNetwork, a knowledge management system (KMS), and cultivating a knowledge sharing community in MIDF. The areas that were researched were – what major issues can be identified during the set-up phase, the critical success factors adopting the De Lone and McLean IS model, and way-forward plans to sustain this program.

1.1 Research Problem

The KNetwork is designed as an online platform that can provide an effective knowledge sharing environment, which is independent of time and space, allowing practitioners to be connected to information well as the people who are able to provide this information. For Knowledge Workers who want to access latest policies, minutes of meetings, documented research and 'captured and codified conversations' via the AskMIDF forums, KNetwork can be utilised as an enabling environment to seek, embrace new knowledge that is focused on enhancing and expanding their collective awareness and capabilities. However, the mammoth task of an organisation, to implement and manage a successful knowledge repository, will require a solid understanding of the factors and skills that affect its usage and acceptance of KNetwork. The purpose of this study was therefore, to investigate determinants that influenced the successful implementation of KNetwork in a financial services organisation. Data collected from a sample of 68 professionals from 4 sub-agencies in the organisation was used to test how relevant KNetwork can be developed as an online knowledge repository, to address daily operational issues for problem solving or even decision making.

1.2 Research Questions

The research was descriptive and empirical in nature because the primary data was collected using the survey method through fact finding techniques such as online questionnaires and interviews. The main purpose of this research was to obtain information concerning the current status of the phenomena to describe "what exists" with respect to variables or conditions in a situation and what are the factors perceived to enhance the usage of KNetwork to eventually serve as an online knowledge sharing and learning mechanism to MIDF. The questionnaire survey items and the feedbacks from the focused discussions were utilised to assess the usage and acceptance of KNetwork as a knowledge sharing tool and to answer the following questions:

- What are the critical success factors of enhancing the usage of KNetwork?
- How can KNetwork be sustained to facilitate a knowledge sharing and learning environment in MIDF?

The results demonstrated factors that will be required to accept KNetwork as a collaborative platform to share and acquire explicit and tacit knowledge assets. This study provides insight into acceptance and sustenance of a knowledge repository on the part of professionals in a financial community and the changing roles of a KM Implementation Force in the digital era.

1.3 Significance of the Study

In order to keep abreast of the latest needs and to ensure that community continuously use the KM products and services, there is a need to constantly study community information requirements, engage with them and ensure the products and services provide the 'cutting edge' that is critical for organisations to sustain and be relevant to their users. In this respect, identifying the elements for the effective implementation of KNetwork would be an important contribution for organisations themselves wishing to improve their service delivery. The exploration of information, technology and service quality elements of an existing Information Systems Framework, the feedbacks from the survey, and the discussions with users will aim to address the research questions and provide an insight on how best to improve the service delivery of KNetwork. Thus, a study is proposed to explore the implementation of KNetwork in MIDF, and what is required for the KM Task Force to sustain and embrace the implementation challenges and consider leading activities in 'trailblazing a path towards knowledge management and service efficacy' in the organisation.

2. Literature Review

2.1 The KM System

The strategic importance of knowledge is widely acknowledged, especially since it is a key asset for employee development, innovation, creativity, and organisational competitiveness (Bolisani, E. & Scarso, E., 2016; Gao, T., Chai, Y., & Liu, Y., 2018). The access to knowledge allows the organisation to generate value from their

intellectual and knowledge-based assets and makes it possible to get the right information into the hands of the appropriate people at the time they need it to make decisions (Sharafat, F., D., 2017). Having discovered that the real value in managing knowledge is in sharing ideas and insights that are not documented and hard to articulate, which is referred to as tacit knowledge, the challenge is sharing and compiling this knowledge in a usable way (Wenger and Snyder, 2002). Some researchers have identified knowledge sharing as a way for organisations to expand intellectually (Dodla, T. R., & Jones, L., 2023). Because knowledge sharing is an essential organizational activity, research on knowledge-sharing types has increased in the 21st century (Ahmad & Karim, 2019). Hence, the area of focus that the authors considered is – how can organisations adopt the knowledge management system (KMS) to capture and share knowledge and implement this system effectively to deliver value to the organisation. MIDF's KNetwork is a KMS that was developed to host explicit as well as tacit knowledge assets in the form of experiences, with a virtual communities of practice tool (VCoP) to 'capture and exchange' these experiences.

2.2 The Virtual Communities of Practice (VCoP)

VCoPs target professionals operating in a knowledge domain who share common problems, interests, or topics; are deliberately created or planned; and have a light "management structure," which facilitates interpersonal interactions and knowledge exchange (Ettore, B. et al., 2020). Employees in VCoPs rely on group learning in order to accomplish objectives (Frank et al., 2017). These virtual tools occupy a prominent place among KM practices adopted by organisations in several sectors, as education, engineering and especially healthcare (Haas, A., et al., 2020). The information areas such as discussion forums, newsletters, and recommended articles in a VCoP website constitute its knowledge/experience repository. Therefore, CoPs occupy a unique role and are key success factors, which enhance the comprehensive competencies of an organisation (Choi, H. Y. et al., 2020).

2.3 Assessing KNetwork With an Information System (IS) Model

DeLone and McLean (2003) have indicated the success of an information system (IS) can be determined by the use and satisfaction of prior user experience, which are both influenced by the system quality, information quality and service quality of the system. Factors affecting the success of IS technological support, design, and the number of participants and quality of content (Hassan, N. A., 2020; Ali, M., Ju, X. F., 2019). The authors intend to use the D&M (2003) IS success model (specified in Figure 1), as the research framework to assess the perceived benefits of adopting KNetwork in MIDF. Net benefits (success) in this study are defined as the degree of correspondence between perceptions of KNetwork users and KM Implementation staff concerning specific KM services and information provided to management suggesting actions to improve KNetwork.

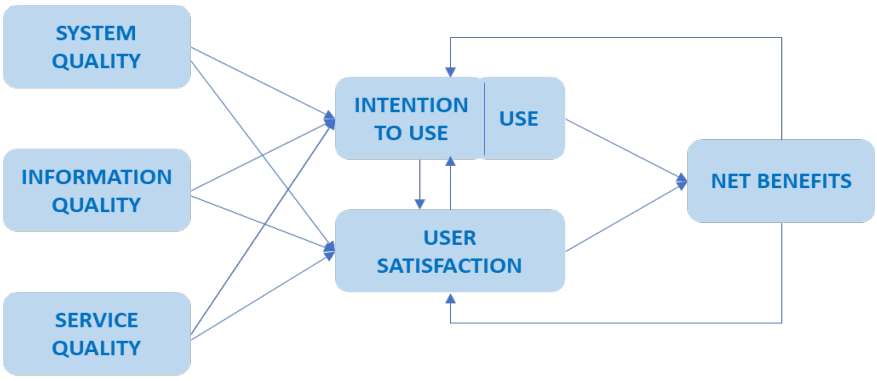


Figure 1: The Factors Used to Assess KNetwork (Adapted from the Updated D&M IS Success Model (2003))

According to D&M (2003), the term "net benefits" is preferred because the original term "impact" may be positive or negative, thus leading to a possible confusion as to whether the results are good or bad. Also, the inclusion of "net" in "net benefits" is important because no outcome is wholly positive, without any negative consequences. Thus, "net benefits" is probably the most accurate descriptor of the final success variable.

The other determinants or factors that are key to the success of the model are:

- Systems quality accesses the desired characteristics of the KMS accessibility, flexibility, reliability, adaptability, and response time are examples of qualities that are valued by the users;

- Service quality will be defined as the overall support delivered by the service provider, regardless of whether this support is delivered by the principal or their selected partners. Its importance is crucial since users are critical stakeholders and poor user support will translate into users accessing alternative sources of knowledge;
- Information quality represents the output of the system in terms of how relevant, understandable, accurate, concise, complete, timely, and useable the content is;
- User satisfaction captures how the user feels about the whole experience with the knowledge repository starting from the module, moving to the features, and finally including the support services that are critical and
- System use, then, is defined as the quantity and manner of utilization of the system. In terms of the system use is assessed.

Net benefits are the most important success measure as they capture the balance of positive and negative impacts of the KMS on the stakeholders.

3. Research Method

This section describes the setting-up of KNetwork and explain the data collection, procedure and data analysis method in MIDF, a financial organisation in Malaysia.

3.1 MIDF Case Study

MIDF Group is a 63 year old financial services provider with 544 employees focussing in three core business areas: investment banking-related services (including debt capital market, corporate finance, underwriting of equities, treasury activities, equity broking services and economic and equity research), development finance promoting the development of the services and Investment sector in Malaysia through the provision of financing for Malaysian enterprises and asset management providing fund management services.

MIDF embarked on knowledge management in January 2022. With a vision of creating a world class knowledge-sharing culture and environment that will continuously contribute to MIDF's success, key strategic initiatives were developed to generate and preserve individual and corporate knowledge, build faster and effective access to relevant knowledge assets and promote collective learning among its community of financiers. A Knowledge Management (KM) Implementation Task Force was established, spearheading a series of knowledge engagement programs with subject matter experts to identify critical processes and determine key knowledge assets. MIDF's newly appointed KM Stewards who were responsible for advocating knowledge generation and dissemination, spearheaded the development of a KMS, "KNetwork", designed to provide web access to the MIDF's explicit knowledge assets comprising of technical reports, research papers and policy guides. With easy and instant access to an online repository, MIDF's financial community was able to view, acquire new knowledge and eventually use KNetwork as a source for online learning.

For a matured institution like MIDF, a major concern is the loss of tacit knowledge when experienced staff gets transferred or leaves the organisation. It was critical to communicate with the community to "capture" work-related problems that the community faced, experiences on how to "fix things" and workarounds that are employed to address them (Scarso et al., 2016). From August 2022, MIDF had begun identifying and validating lessons learned. A standard lessons learned capturing tool was designed by the Lessons Learned Committee and rolled out in a template format to accelerate identification of new practices by the community and making it easily accessible in KNetwork's repository. To increase efficacy, Heads of compliance and audit are currently involved and have begun integrating capturing lessons learned practices into its audit work processes, and infrastructure.

Another key activity in amplifying the lessons learned, is the generation of 'questions' pertaining to the lessons report. These questions are key links into crafting MIDF's VCoP content in the knowledge sharing forums, which was the next scheduled phase of MIDF's KM implementation.

In November 2022, MIDF 'AskMIDF', a knowledge sharing VCoP was developed, adopting the 'Yammer' social network service, used to foster and enable employees' collaboration across departments. With a user-friendly web interface resembling Facebook, users can collaborate, view discussions, or ask a question on a specific topic. MIDF employees can join in a discussion forum, tag key conversations, and also link them with related materials that are available in KNetwork (for example data, case studies, lessons learned reports, etc.). If a user

does not find what is needed in the existing knowledge sources, other members can be requested to help. Any relevant, additional information becomes available through a Yammer conversation ("people to people") where Q&A are easily exchanged or through the sharing of original contents and materials ("people to contents") made available on the community (Scarso et al., 2016). It is the responsibility of the AskMIDF committee members and subject matter experts to evaluate and rate the best contents and promote them within the KNetwork knowledge platform. Hence, quality content via experiences (which can be recurring issues in the organisation, or innovative ideas and best practices) of subject matter experts can be voluntarily captured and disseminated to the community.

As of April 2023, there has been 15,300 visits accessing the portal content. To encourage usage of the KNetwork portal, several awareness programs are conducted in a consistent manner to cultivate the habit of using the knowledge repository contents as a valid and relevant source of information or connect with the domain experts to 'Ask for Help'. These 'stickiness' promotional programs with easy links to KNetwork, are made available via KM outreach activities such as 'Infographic display of knowledge via 'KM Bites', Information quizzes via 'KM Hunt' and collaboration with KM Practitioners via quarterly 'KM Exchange' programs. With roll-out of these initiatives and 'fun' created in the usage of KNetwork portal, traffic on that particular day spiked between 250 – 300 daily views. A remuneration model has been crafted and management approval is being sought for provision of quality lessons learned, popular forum discussions and prolific knowledge contributors in KNetwork.

3.2 Data Collection and Analysis

The authors had decided to adopt a case study approach, that fits its descriptive and exploratory goal (Yin, 2003). The authors believed that such an approach was appropriate, as it provides an exploratory and inductive stand that is the foundation for the study; in order to gain a holistic understanding and a deep view of the case in hand. MIDF conducted a series of KNetwork Awareness workshops from April to November 2022. The workshops aimed to introduce KM to all new joiners, MIDF staff who had worked for less than 3 years in MIDF (as of April 2023, there were 208). The workshops covered various topics related to KM, such as the purpose of KM, the benefits of sharing knowledge, and the functionalities of the KNetwork portal that was created in April 2022.

During the workshops, the trainer guided the participants through the KM portal and demonstrated how to use it. The portal was designed to provide a platform for employees to share and access knowledge easily. Participants were encouraged to explore the portal and provide feedback on its functionalities, as well as suggest any additional features they would like to see in the portal. After the KM Awareness workshops were completed, an online survey was conducted to gather feedbacks from the participants. The survey was designed to assess the effectiveness of the KM Awareness workshops and the KM portal. Participants were assured that their identities would be kept confidential, and they would not be identified through their comments. This was to encourage truthful responses from the participants.

The survey instrument covered three main areas. The first section was the demographics profile of the participants, such as their gender, age, job, and agency. The second section focused in assessing the user satisfaction in the usage of KNetwork which covered Information, Service and Technology elements. Participants were asked to rate their level of agreement with various statements related to the survey. The third section of the survey was about recommendations. Participants were asked to provide feedback on KNetwork, suggest improvements, and provide recommendations on how to enhance knowledge sharing and learning in the MIDF.

4. Results

Overall, the KM Awareness workshops, and the KNetwork portal were well-received by the participants. The majority of participants agreed that knowledge sharing and learning are important in the organisation. The survey sample size of 68 respondents encompassing 33% of MIDF's new joiners, responded to the survey after attending one of the 5 KM awareness workshops conducted between April to November 2022. While the sample size may seem small, it has provided valuable insights into the new joiners' perceptions of KM in the organisation. The survey results also revealed that the participants found the KNetwork portal useful and user-friendly. However, some participants suggested that additional features could be added to the portal to improve its functionality. The survey findings also helped identify areas for improvement. MIDF Task Force plans to use these insights to enhance KM initiatives further to promote a knowledge-sharing culture in the organisation.

The quantitative data generated by the questions was plotted on bar charts that used percentage response rates. The feedbacks included 58 opinions and suggestions on how KNetwork can be improved. These responses provided a rich source of views and ideas for the KM Task Force.

4.1 Section A- Demography of Respondents

Table 1: Section A- Demography Profile of Respondents in the KNetwork Awareness Workshops

Demographic Characteristics	Sub-Category	Total	Percentage (%)
Gender	Male	26	38
	Female	42	62
Age	20 - 29	50	74
	30 - 39	13	19
	40 - 49	3	4
	> 50	2	3
Job	Executive Vice President	0	0
	Senior Vice President	0	0
	Vice President/Director	4	6
	Assistant Vice President/Associate Director	10	15
	Senior Associate	5	7
	Associate	38	56
	Non-Executive	0	0
	Others	11	16
Agency	MIDF Inc.	31	46
	MIDF Amanah Investment Bank (MAIB)	32	47
	MIDF Amanah Asset Management (MAAM)	2	3
	Amanah International Finance (AIF)	0	0
	Malaysian Investment Development Finance (DFD)	3	4

4.2 Section B – KNetwork Technology Usage and Benefit

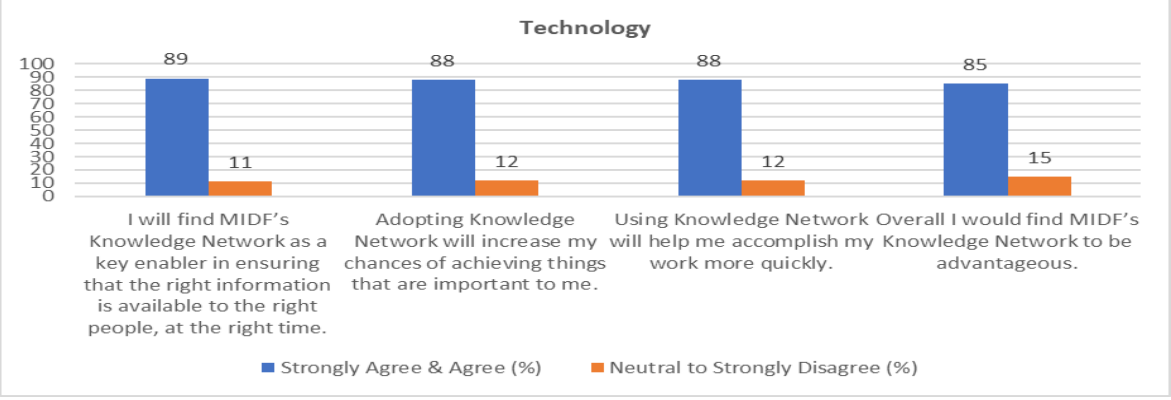


Figure 2: Quality Technology and User Satisfaction

The majority agreed that the KNetwork portal will help employees in getting the right information which will led them to accomplish their work more quickly. 85% agreed that KNetwork will be advantageous to all of them and they will use the portal without any doubt and hesitation.

4.3 Section C – KNetwork Service Element

4.3.1 Provision of Resources and Technical Assistance

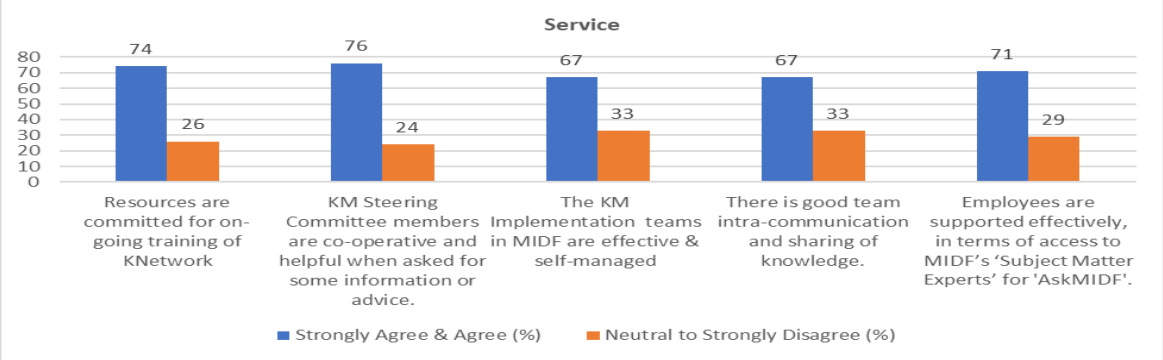


Figure 3: Quality Service for KNetwork Adoption

The respondents were satisfied with the KM Awareness, assistance and service provided by the KM Implementation Team.

4.3.2 Top Management Support for KM

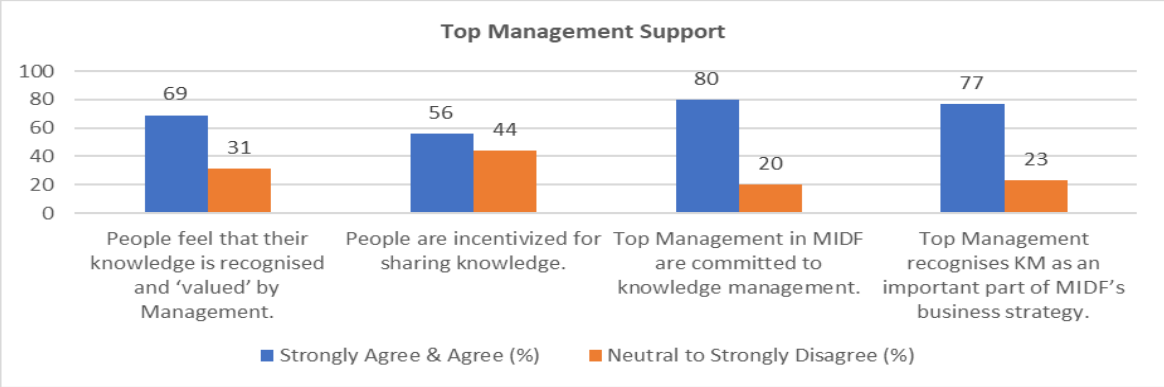
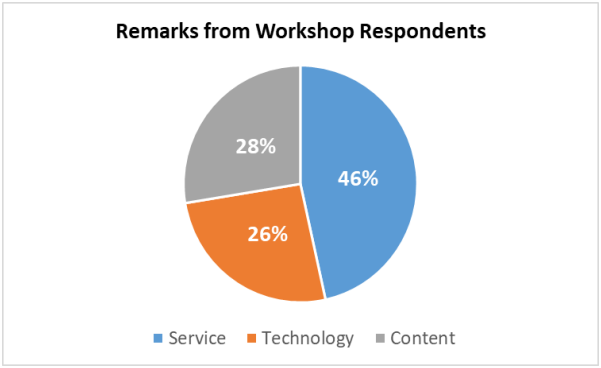


Figure 4: Quality Service with Top Management Support

4.4 Recommendations on how to Enhance Usage of KNetwork



The recommendations covered three main components which are content, services and technology. The majority of participants recommended on enhancing the KNetwork services (46%) which include more KM Awareness workshops, more forums for knowledge sharing and networking. 28% recommended increase of knowledge assets in KNetwork. Being a new portal, these comments were envisaged. 26% suggested better search functions with a more intuitive interface.

Figure 5: KNetwork Recommendations

Overall, the survey feedbacks will help the KM Task Force to identify areas for improvement and develop strategies to promote a knowledge-sharing culture within the organisation.

5. Discussion

This article first explores the critical success factors required to enhance the usage of KM Systems, in particular KNetwork**.** Findings from participant survey suggested the following 3 factors that can be considered: *(1) Quality systems* – that encompasses a single, easy, and speedy access to KNetwork's information and the

ability to request for assistance via AskMIDF; *(2) Quality content* - which has been validated, relevant and current, with access to subject matter experts and ***(3) Quality service*** - to KNetwork's community in the form of a facilitating environment that involves top management support (providing resources, time, and budgets), regular promotion programs, and access to KM stewards for immediate assistance.

The above factors conform to the the DeLone & McLean (2003) IS success model. The results of feedbacks from the survey instrument and observations are consolidated and presented, to determine attributes that will need to be considered for the adoption of KNetwork as the knowledge sharing and learning tool (as presented in figure 6).

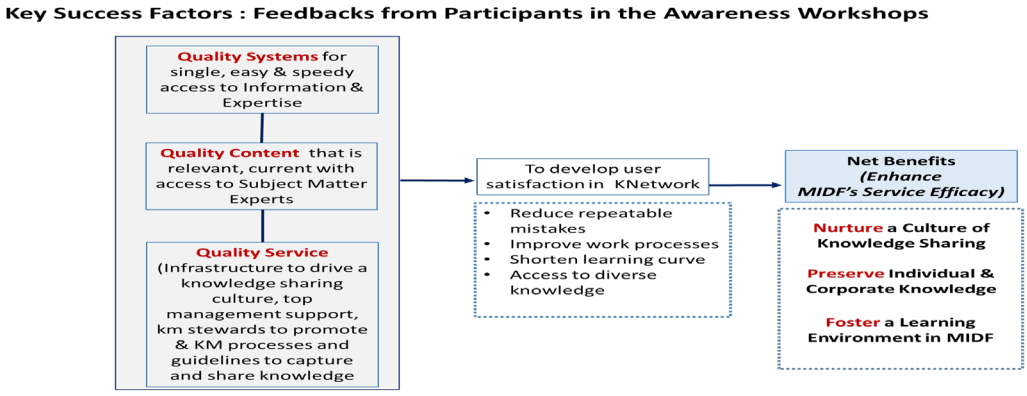


Figure 6: Determinants for Success in Implementing KNetwork

The other area of discussion in this research is to determine how KNetwork can be sustained to facilitate a knowledge sharing and learning environment in MIDF. The findings in this study suggest that KNetwork with its web technological platform, content creation and awareness workshops provided a platform for users to be able to access quality knowledge and connect to subject matter experts with ease. The D&M determinants provided implementers with a guide to determine gaps and mitigate them with strategies and action plans that can enhance KNetwork's user satisfaction.

5.1.1 Enhancing KNetwork's content: The need for relevance and velocity

Based on the results, it can be concluded that the key issues enabling the success of using KNetwork, is to make every-day work easier and faster. As stated above, the general attitude towards KNetwork is positive and it is found useful, that is, the respondents see the value of using KNetwork. The employees' attitude towards sustaining the usage of KNetwork is to improve the velocity and diversity of content and to enhance its quality. Hence, the following strategies are in place: (1) Identifying and generating new lessons learned from multiple approaches; (2) Building a Directory of Experts for MIDF employees to connect and collaborate; (3) Study the questions generated by the lessons learned reports and develop AskMIDF Chats that are relevant to the user and (4) Have regular content creation workshops to enhance explicit knowledge assets.

5.1.2 Building the KNetwork service infrastructure

The suggestions were geared to marketing programs in promoting the value of KNetwork to the community in a systematic and effective manner. The feedbacks suggested on-going face-to-face domain management workshops to validate KNetwork's content, capture and build new content scenarios in KNetwork, regular communication plans to promote the latest lessons learned or viable chats that MIDF community would find relevant. MIDF KM Stewards play a pivotal role in communicating the needs of their users and engaging with the implementation team to manage or exceed user expectations.

5.1.3 Building a reliable and committed KM Task force to support MIDF's KM infrastructure

With positive feedbacks from the community and support from Management and the IT Department, KNetwork functional enhancements are on-going. AI Chatbots are being piloted to explore interest and usage of these tools. Plans for designing and implementing a directory of industry experts for quick and easy engagement in the AskMIDF forums are being explored. The KNetwork development plans and resource management actions are presented in figure 7 below.

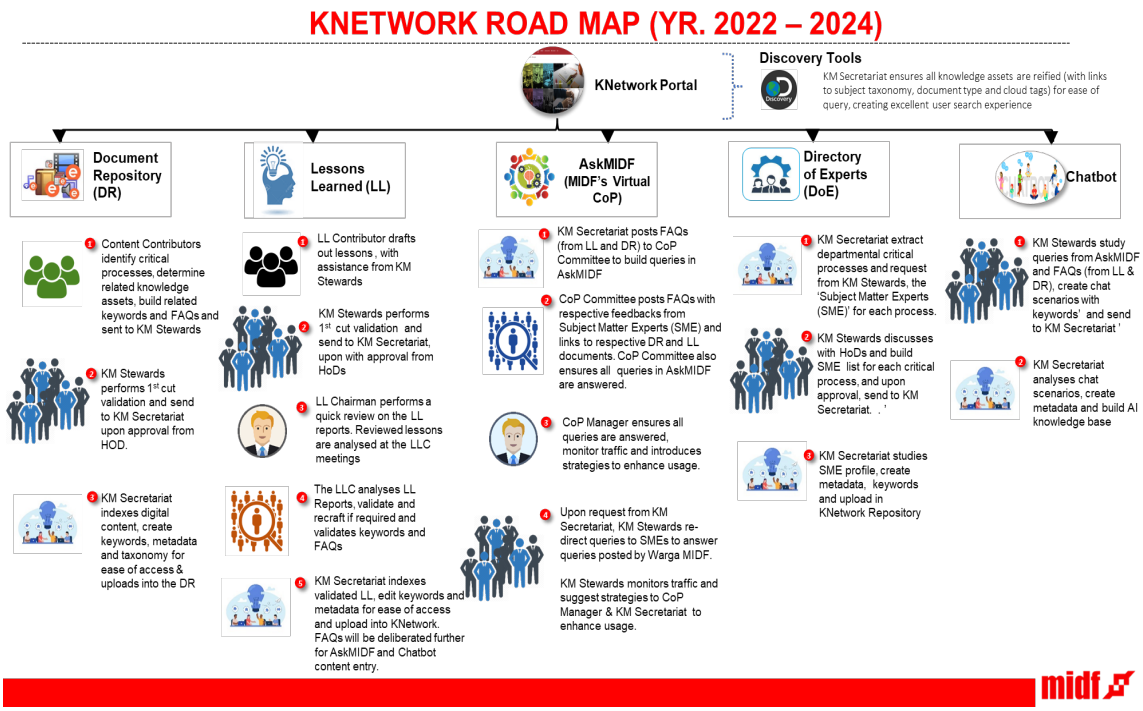


Figure 7: KNetwork Implementation Road Map

At the end of last quarter 2023, an organisation-wide survey will be conducted to ascertain user satisfaction of KNetwork, following by the assessment of the capability of the KM task force. Further research will be made to derive measurement attributes to assess the KNetwork and AskMIDF CoP. Assessing the CoP Maturity (Albert, G. et al., 2019) will be key to the KM Task Force, to understand MIDF's knowledge sharing behaviour, their information needs and the facilitating conditions that they require to cultivate a habit of engagement.

6. Limitations

This study has few inherent limitations. First, the authors collected our data from one specific organisation in Malaysia. Hence, whether or not the key findings can be generalised to all types of knowledge sharing communities is uncertain. Second, KNetwork being in its coalescing stage, the emphasis was to create awareness, promote the usage and enhance the quality of content. Thus, the study may not be applicable for matured KMS. Third, the IS model that was adapted, limited our focus on specific elements that are widely related to technological characteristics. As such behavioural elements (Venkatesh et al., 2012) were not emphasized at this stage. Future studies could incorporate a more encompassing IS framework studying the determinants in the various stages of the KNetwork's life span.

7. Conclusion

The aim of this study was to obtain a clearer picture on the determinants of a successful knowledge sharing community. As KNetwork is in its coalescing stage, building a sustenance program will be a constant challenge for managers who are in charge of enhancing the community engagement and facilitating an infrastructure for KM to thrive. This study brings a possible contribution to the KMS literature by providing insight to the determinants that support to the success of virtual knowledge sharing communities in cultivating an online learning environment.

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MIDF Group, KM Sponsor – Dato' Charon Wardini Mokhzani, KM Steering Committee lead by Zurina Che Awang, Lessons Learned Committee lead by Johnson Rudd, CoP Committee lead by Abdul Mui'zz, KM Task Force, and KM Manager are greatly acknowledged in their efforts in spearheading our KM journey in MIDF.

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Knowledge Management and Interorganizational Networks of the Wine Industry

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Abstract: Interorganizational networks have stood out in the agribusiness sector as arrangements in which people collaborate and cooperate to obtain external knowledge resources, and to drive innovation and sustainability. Therefore, knowledge management (KM), through its practices and processes, assists in the creation and sharing of knowledge collaboratively among network participants. The present study aims to analyze the knowledge processes adopted in interorganizational networks of the Portuguese wine supply chain. The research is applied in nature and adopts a qualitative approach through a descriptive exploratory study. The multiple case study method was used, carried out in three wine networks in the wine regions of Tagus and Alentejo in Portugal. Field data were collected using the interview technique, supported by a semi-structured script. The results indicate that the companies participating in the networks have common goals: to access external knowledge resources, reach international markets, develop product innovations, and create sustainable brands. However, the findings also allow us to consider that access to knowledge resources depends on the capacity of each company in the network. Thus, the mere formation of networks does not guarantee that the dissemination of knowledge will occur.

Keywords: Inter-organizational network, Knowledge management, Knowledge management processes, Wine, Portugal

1. Introduction

Environments characterized by complexity and dynamism stimulate organizations to establish collaborative interorganizational relationships, Ketonen-oski and Valkori (2019). Thus, the relationships formed in networks become strategic alternatives to promote organizational competitiveness, Balestrin and Verschoore (2016) and provide access to external resources of knowledge, Ceesay (2023) capable of generating innovations and competitiveness, Franco and Esteves (2018).

Recent studies of knowledge management (KM) in interorganizational contexts seek to explain how organizations use relationships in networks to access external knowledge and transform them into strategic resources, Ceesay (2023). It is observed that research that explains and expands the understanding of how this process occurs in traditional sectors, such as agribusiness, is relevant and timely, see for example (Wiśniewska and Paluszak 2019; Vesperi and Coppolino, 2023).

As Agostini et al (2020) observed, analyzing KM processes under the context of interorganizational networks is among the managerial challenges considered critical, since absorbing the knowledge that is dispersed in the networks, internalizing it, transferring it, and using it as a strategic resource demands effort so that the networks can really be effective for the organizations that participate in them, Del Giudice and Maggioni (2014).

Thus, it is considered that KM processes are essential elements for the development of the capabilities of a company that establishes strategic alliances, Flatten et al (2011). Therefore, it is important to expand the understanding of how to create, acquire, store, and share knowledge among the network, so that knowledge flows through the network structures, through its nodes (participating organizations), and lines (links between organizations), as observed by Marchiori and Franco (2020).

For these processes to be effective, some conditions are necessary, such as the cooperation and collaboration of the company with its stakeholders, Buenechea-Elberdin, Kianto and Sáenz (2018), the organizational culture compatibility of the network participants, Magnier-Watanable and Senoo (2008), strong relationships and cohesive groups—which create conditions for the formation of trust among network participants—and the participant's commitment to establish a successful network, Yoo, Sawyerr and Tan (2016). Research of Saikouk et al (2021) highlights that trust is a fundamental construct that significantly reduces opportunism and asymmetries in interorganizational relationships.

However, even when considering the positive effect of network participation, it is assumed in the present research that it is KM processes that enhance the capacities to take advantage of external sources of knowledge, which can explain the competitiveness of small and medium-sized companies, as observed by De Paris Caldas,

Paula and Da Silva (2021) and Vesperi and Coppolino, (2023). In this sense, the present study aims to answer the following questions: How do the KM processes of knowledge acquisition, storage, distribution, and use occur in the interorganizational networks in the Portuguese wine chain? Do KM processes help interorganizational networks achieve their common goals? Thus, the objective of the present study is defined as analyzing the KM processes adopted by the interorganizational networks of the Portuguese wine chain.

The present study contributes to the advancement of studies on KM in the context of interorganizational agribusiness networks, through the understanding of the processes of acquisition, storage, distribution or sharing, and use or application of knowledge. These processes contribute to organizations being able to access the external knowledge, transforming it into strategic and competitive resources.

2. Theoretical Foundation

2.1 InterorganizationalNnetworks and KM Processes

Interorganizational networks are defined as a group of three or more autonomous and geographically distributed organizations (Müller-Seitz, 2012), which establish relationships of mutual exchange, Wiśniewska and Paluszak (2019) also considered as a strategic alternative adopted by companies to facilitate joint actions and resource exchanges in order to achieve similar organizational objectives (Gibb, Sune and Albers, 2017).

According to the literature, KM in interorganizational environments has become a necessary management strategy despite being a complex challenge (Agostini et al, 2020), since, in networks, knowledge becomes an open and collaborative process and no longer an individual and endogenous process of mastery of a single organization (Franco and Esteves, 2020).

The central objective of KM processes is the dissemination of knowledge for its subsequent reuse by individuals and groups and the consequent transformation of its content, generating new knowledge, as observed by Gonzales and Martins (2017). Knowledge management also makes it possible to integrate the knowledge of different companies in the search for results-oriented, reciprocal, and cooperative actions, as they drive the flow of knowledge between organizations that are part of the network (Gonzales and Martins, 2017).

Thus, when KM processes are conducted in an integrated way, the development of initiatives and strategies to maximize organizational effectiveness and growth occurs (Wig, 1997; Sveiby, 1998), also driving innovation (Papa et al, 2021). Franco and Estevan (2020) mention that KM processes drive the flow of knowledge between organizations that establish networks. Thus, for knowledge to be created, acquired, and transferred collaboratively, the processes between the network participants must be interactive and organized (Ortiz, Donate and Guadamillas, 2017).

The present study adopts the theoretical proposal of Magnier-Watanable and Senoo (2008), which considers that KM processes are constituted by the acquisition, storage, dissemination, and application of knowledge. The option for this model is justified as they are in line with the KM models described by other authors, such as Sveiby (1998), Probst et al (2002) and Dalkir (2005) used in research such as Gonzales and Martins (2017), De Lucca, Hinnig and dos Santos (2020). Table 1 shows the description of the processes.

Table 1: Description of Knowledge Management Processes

Knowledge management processes	Description:
Acquisition of knowledge	It consists of the creation of knowledge within the organization through a learning process and in the acquisition of external knowledge, originating from associative action with other organizations, consultancy, and universities.
Storage of knowledge	It is the process of organizational memory formation. Knowledge is formally stored in physical memory systems and informally retained in the form of values, norms, and beliefs, which are associated with organizational culture and structure.

Knowledge management processes	Description:
Distribution (sharing) of knowledge	It is the process by which new information from different sources is shared and can promote the creation of new knowledge, understanding, and information.
Use (application) of knowledge	It is the process associated with the ability of individuals in an organization to locate, access, and utilize the information and knowledge stored in the organization's formal and informal memory systems. Knowledge is used as a basis for the development of new knowledge and for decision-making.

Adapted from Magnier-Watanable and Senoo (2008)

For the field research analyses, the four KM processes were considered: acquisition, storage, distribution, and use of knowledge; supported by the understanding of the need for interaction between the different participants that make up an interorganizational network.

3. Methodology

The present study is empirical in nature, adopting a qualitative and exploratory approach, following the recommendations of Creswell (2007). The research used the method of multiple case studies, as recommended by Eisenhardt and Graebner (2007) as it is presented as a research strategy that involves the use and analysis of cases from more than one organization.

Portugal was chosen for research due to access to data collection from wine chain networks. For the sample, three interorganizational networks established in the context of wine in Portugal were selected. This delimitation is justified as the wine industry competitively represents the agribusiness segment of the country. This segment has advanced through internationalization and globalization, gaining international recognition, both in production and marketing in the world wine market, Almeita et al (2023). The networks surveyed were chosen due to their representativeness in the wine sector of the country—called networks A, B, and C in the present study—and their descriptions are presented in Table 1.

The data collection process was carried out in two stages. Firstly, collections were carried out through analysis of secondary databases for mapping the wine producing networks in Portugal. Afterwards, those responsible for the management and members of the surveyed networks were contacted and four interviews were conducted: two representatives of Network A—one of them a network manager and the other one a representative of an associated company—one representative of a company associated with Network B, and one manager from Network C. Respondents were selected by accessibility and availability criteria. As shown in table 2.

Table 2: Description of networks and survey respondents

Network name	Characterization	Interviewees
Network A	Founded in 1996, it is an association composed of eight professional organizations, representing approximately 300 wineries throughout the country, with the mission of promoting the quality and excellence of Portuguese wines, being the managing entity of the Wines of Portugal brand.	One network manager; one company representative associated with the network.
Network B	Created in 2008, it is an association that represents the production and trade of the wine sector. Its responsibility is to monitor compliance with the rules and the certification of wines from the region entitled to denomination of origin and geographical indication. Its mission is to help producers increase their presence in strategic markets and it has more than 80 associates.	One company representative.

Network name	Characterization	Interviewees
Network C	Created in 2007, it develops actions and activities of common interest to all its associated municipalities—national and European—and has as its mission the affirmation of the historical-cultural, patrimonial, economic, and social identity of Portuguese municipalities linked to wine production. It currently represents 117 associated municipalities.	One network manager.

Source: prepared by the authors

To collect the data, a semi-structured interview script was used, based on the proposed theory, which follows guidelines that allow replicability with the use of the same results, Yin (2014). This semi-structured interview script was reviewed by three researchers before data collection. The script has four blocks of questions: (I) identifies the profile of the interviewee/organization; (ii) analyzes the network objective; (iii) analyzes the interorganizational relationships of networks; and (iv) analyzes the KM processes. All interviews were conducted online on the platform Zoom and recorded and later transcribed in full. The interviewees were named E1, E2, E3 and E4. After analyzing the data, thematic categories were organized according to the proposed theoretical framework.

To analyze the data, we opted for the discourse analysis technique, as recommended by Lefevre and Lefevre (2006). This technique considers the social representation of testimonies collected in empirical research and seeks to analyze how discourses produced by different social actors such as individuals, groups, and/or institutions translate representations of reality. In order to achieve scientific rigor, validation and reliability criteria were adopted, including data triangulation.

Each case was analyzed individually and then a cross-analysis was carried out between the cases, the content of each interview and the excerpts that dealt with the categories and subcategories of analysis, are represented in the data analysis session according to table 3.

4. Results and Discussion

4.1 Characterization of Networks

The networks that are part of the present study are characterized by networks of marketing companies and wine producers in Portugal, and have as their main objectives to promote wine-producing regions in the national and international context; to carry out joint marketing actions; to promote the quality of Portuguese wines and wine tourism; to promote certification of wines with the right to designation of origin and geographical indication; as well as to represent the municipalities in the territories linked to the production of wines.

The promotion of interorganizational relationships to achieve the objectives of the network can be perceived as reported by interviewee E2*: [...] allows the construction of community and relationship with certainty, also allows strategic contacts, promotes sustainable development, and therefore ends up promoting all network's objectives.*

For the interviewees, good working relations, trust between the partners of the network, and communication between the partners enables the sharing of information and knowledge in order to achieve the objectives of the networks. In the view of the research participants, their companies are committed to networks, as leadership plays a key role in promoting the integration of network partners and in the arbitration role to mediate possible conflicts between network partners.

The report of interviewee E2 corroborates with this perspective: [...] *I have always been a defender of networking, only in this way is it possible to evolve. I think that if companies are too closed around themselves they end up not evolving, because they are involved in their own reality, which is different from the reality that is out there, so there are companies more open than others.*

It is also noticed that joint actions strengthen relationships in the network. According to interviewee E1: *[...] when we go on a mission [...] we do a meeting the day before at the hotel as a briefing to prepare the event, to go over the rules and the procedures that we are going to apply, because these types of events create unity between the network participants, and it is different if each person comes on separate flights, arriving at different times, the idea is to always be together in order to be united.*

4.2 KM Processes

As for the process of acquisition of knowledge in interorganizational environments, it is perceived that this is driven in the networks by different activities, since new information, ideas, and best practices are promoted and shared, seeking to maintain the competitive advantage in the dynamic market in which Portuguese wine companies are part of. Among the practices adopted for the acquisition of knowledge are the organization of courses and training, hiring advisory services and consultancy for the network, and setting up a training academy for network members.

The reports of the E1 interview address that [...] *it is foreseen in our objectives to create a training program, which we will call an academy… for example: for this year, the training of technical English in order to be prepared for a trade fair.* Interviewee E2 explains that they seek to raise funds for training through projects funded by the European community, so they can disseminate knowledge *[...] we disclose what knowledge we managed to gather in that project and then share it with the group.*

These findings corroborate the literature by observing that the process of knowledge acquisition is a social process that occurs between individuals (Nonaka and Takeuchi 1995), where the role of the organization is to provide the appropriate contexts or situations for the acquisition of knowledge to occur according to the corporate objective (Magnier-Watanable and Senoo 2008) the same situation applies in interorganizational networks, Martínez-Pérez, Elche and García-Villaverde (2019).

However, it is worth highlighting a relevant factor identified in the research, which is that not all companies in the same environment can access and internalize the knowledge resources available in the network. Interviewee E1 comments that *[...] The greater the company's capabilities, the more it appropriates the benefits that the network offers. We have various types of companies, small and large, but they all coexist in harmony.*

These findings corroborate the research of Yoo, Sawyerr and Tan (2016) who observe that knowledge is not absorbed equally among the organizations participating in the network, since its internalization depends on the capabilities of each organization, i.e., merely networking and participating are no guarantees that the dissemination of knowledge will occur. This aspect is extremely relevant when addressing the practices that support KM processes in interorganizational networks.

As for the stage of storage of knowledge recognized as organizational memory formation, examples of storage practices adopted in the network were identified. Interviewee E1 explains: [...] *we have everything recorded and stored, all our events have their own site on our internal network to store the information, with photos and surveys from the events. Everything that was done is recorded. Sales are recorded as well.*

It is noticed that the networks adopt practices that store explicit knowledge in different ways, such as reports, compilation of the results of the questionnaires applied, the registration of indicators, and brand protection. However, the storage of tacit knowledge should also be foreseen as highlighted by the studies of Gonzalez and Martins (2017) on the importance of people as an instrument for retaining tacit knowledge.

Thus, the risk of loss of knowledge generated in the networks is identified, as reported by interviewee E3: […]*the people of this network have been around for many years and already know a lot, so they pass it on informally, but when that person is away, the information that is with them is missing, or if that person leaves the network they are also not taking the care to register and store the information; this is a risk.*

It is noteworthy that the application of information technology (IT) is a key tool in the process of storing knowledge, allowing the coding and sharing of knowledge and the creation of knowledge directories (Alavi and Leidner, 2001). The use of information technology is identified in the report of interviewee E3: [...] *in addition to email, they have a platform where we can consult all the information at the level of events, programs, and initiatives that will happen in the future and have happened in the past.*

As for the process of distribution and/or sharing of knowledge the research findings make it possible to identify that the sharing of strategic knowledge in the network occurs in different situations, as reported by interviewee E4 […] *every month we hold a meeting with all the technicians connected to the network to evaluate what is happening, report on the initiatives they do, and exchange experiences among them.*

In the networks surveyed, it was possible to observe that there are different KM practices that help knowledge sharing. Interviewee E1 points out that [...] *once a year we make an annual report with all the actions we have done and it is available to all our associates and to anyone who is interested. The report has all the events done and all the sales in the different markets.*

It is also noteworthy that sharing can occur through exchanges through social contact, as identified in the speech of some interviewees: E3 […] *the work of the commission (network) is very important.... when carrying out business events, the region's producing companies are very close, being that people travel in groups and are invited to share information within the group. Therefore, far beyond what happens in the spaces of the event, the fact that we have approached each other leads us to maintain the relationships and channels that were opened, allowing exchange of information.*

The network participants highlight that they carry out research projects with other partners, create research communities, and share specific knowledge beyond the network members. According to respondent E4, there is also the interaction of the network organizations with others: *[...] therefore the sharing of knowledge goes beyond the partners of the network itself, we often use it in the training not only of our partners, but also the people who visit our partners.*

These findings corroborate the research of Ortiz, Donate and Guadamillas (2017) who observe that the network promotes the sharing of external knowledge for member companies, and notes that knowledge is created and transferred collaboratively through interactive processes of the participants.

The process of using/applying knowledge deals with the organizational ability to use the knowledge gained for the purpose of gaining competitive advantage. The research data allow us to observe that networks develop practices that result in knowledge application processes. Practices related to the use of knowledge for the creation of new products and processes, and the creation of strategies to manage crises or unforeseen events (war and Covid pandemic) were identified; the networks also cite the proposition and creation of marketing plans to promote the brands in the national and international markets, how they generated learning for export, and use of knowledge for innovation.

The creation of strategies to manage crises or unforeseen events (war) is evidenced in the E3 interviewee report: [...] *there is a lot of discussion and information, for example now with the war (Ukraine and Russia), they passed on a lot of information to us because we exported a lot to Russia, they gave a lot of feedback and passed it on informally, but it is still valuable.*

The research of Kianto, Saenz and Aramburu (2018) reinforces the positive effect of external relations of companies and recommend that companies seek to strengthen the existing external relationships in different organizations, combining the external knowledge obtained with the existing knowledge in the organization, which enhances this relationship to develop innovation.

The innovation and importance of the network in promoting the use of knowledge can be verified in the E2 interviewee report: [...] *The commission (network), by creating, for all these years, the development of marketing, has allowed the producers to reach many markets, which if it were not for this route, probably many of them would never be present in these markets. So, allowing this contact contributed to their learning on how to export, approach markets, and etc., allowing learning and innovation by providing opportunities of contact with the world market and trends for producers who do not have enough scale and would not do this work alone.*

The present study made it possible to map and analyze the KM processes that allow networks to promote access to external knowledge, which is considered a strategic asset that can generate competitive advantage. In view of the results and to help understanding, table 03 presents a summary of KM processes identified in the field research, prepared according to the reports of the interviewees.

Table 3: KM Processes in Interorganizational Networks

KM processes	Description of KM practices
Knowledge acquisition	The network raises funds for investments in research projects and development (e.g. European community projects for marketing and product development), hiring new employees, or companies that represent new knowledge. The network offers advice and consultancy, training, holds meetings (face-to-face and online) and workshops, and has created a training academy. Carrying out national and international technical events to promote products, services, and other industry elements. It adopts an internal and external communication process and performs benchmarking.

KM processes	Description of KM practices
	IT tools such as intranets, web pages or websites, and digital platforms.
Knowledge storage	Identify and record best practices and lessons learned; the knowledge gained is recorded in the format of reports; brand protection (eg. Wines of Portugal); use of IT as an aid for electronic document management; information available on the intranet, web pages; and digital platforms for information and KM.
Distribution of knowledge	Promotes and shares knowledge to achieve the objectives of the network; shares best practices and lessons learned; benchmarking (internal and external) to improve results and performance (e.g. meetings, technical visits, fairs, and excursions); promotes learning to prepare organizations to participate in trade fairs; adoption of collaboration tools (portals); adoption of information and communication technology (email, whatsapp, intranet, digital platform, e-commerce, mobile/mobile phone app, etc.).
Use/application of knowledge	Development of product and process improvement activities; changes in the routines and procedures of the organization; use of knowledge to create new products and processes; creation of strategies to manage crises or unforeseen events (e.g. war and Covid pandemic); creation of a marketing plan to promote the network and associated organizations; generates learning for exportation; and use of knowledge for innovation.

Source: prepared by the authors

The findings of the present study indicate that the use and adoption of KM processes enable companies that participate in interorganizational networks to use external knowledge resources when effectively shared by the network. These findings corroborate the research by Vesperi and Coppolino (2023) and reinforce the positive effect of interorganizational relationships as an important alternative for obtaining knowledge.

The results show that the most developed KM processes are the acquisition and distribution of knowledge, through the adoption of different KM practices adopted by the researched networks, these findings are better identified in networks A and B that have similar network objectives. Network C presents different characteristics that can be correlated with its network objective.

The knowledge storage and application processes should be better conducted by the networks, the reason may be related to the need to increase financial investments in the information technology infrastructure and in the improvement of the capacities of the organizations inserted in the networks.

However, they need to adopt and promote practices that strengthen knowledge processes in a formal way, since the role of networks as facilitators of cooperation and collaboration between companies to access knowledge is evidenced in the study.

5. Final Considerations

The present study contributed to the advancement of research in the areas of KM, as it indicates that the KM processes of acquisition, storage, distribution, and use of knowledge are essential to strengthen the competitiveness of organizations inserted in interorganizational networks of the Portuguese wine production sector. In the context of the study, it is highlighted that the intangible resources of knowledge are presented as an alternative for collaborative networks to contribute to the associated companies in the sector to meet market requirements and develop competitive strategies to promote innovation.

The data analysis shows that the interactions between the participants of the networks generate external knowledge, which is created and transferred collaboratively and accessed by organizations that alone would not be able to obtain this knowledge. This research finding can be verified in the companies participating in the studied networks, many of them small companies, which have few resources to increase their competitiveness.

It is important to highlight that although the findings of the present study indicate that the adoption of KM processes in the networks surveyed does not occur through a formal project, the results show that the most developed KM processes are the acquisition and distribution of knowledge, and through the adoption of different KM practices used in the relationships of cooperation and collaboration of associates, promoted by network managers, the absorption of knowledge can happen, even if only partially.

It is stated that the KM processes of storage and use of knowledge can be strengthened with the adoption of new KM practices and better promoted by network managers. The results lead to an understanding of the relevance of the KM processes for better network performance. In this sense, it is interesting that managers continue to establish strategies to improve the capabilities of organizations to access the knowledge available in the networks.

The present study has some limitations, for example only Portuguese wine networks were analyzed, organized according to national public policies and culture of the country—Portugal—which should be different from other countries. The sample and number of respondents is also limited for generalization of our findings at the international level. Thus, it is suggested that future research expand the sample and/or analyze different contexts and cultures of the same wine sector, analyzing different producing countries, as well as applying the study of KM processes in the networks of other agribusiness production chains. It is also suggested that future studies research factors related to knowledge loss in an interorganizational network.

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Law and Judicial Records in Israel: Invalid Management and Sharing of Public Knowledge

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Abstract: Valid management and sharing of public knowledge is a critical aspect for any competent legal system and for the safeguard of human rights. The duty of government to make the law known is commonly accepted legal norm, relative to laws that are enacted by the legislature. Yet, how are laws, which are embedded in cyber platforms by programmers, to be managed and shared? The problem was presented by L. Lessig as a legal theory - "Code is Law". Lessig primarily addressed commercial platforms that were used for sharing knowledge, claiming that such platforms effectively established new rules, which were not enacted through any democratic process, were not explicitly stated, and might threaten constitutional principles. E-government systems are a critical subset of such cyber platforms. Instant case study presents data from a series of Israeli court cases, pertaining to rules that are embedded in e-government systems, which determine tax liability, using the Tax Authority system, and valid signing and entry of criminal judgments of the courts themselves, using Administration of Courts Net-HaMishpat system. In both cases, government agencies refused to provide any information regarding such rules, pursuant to the *Freedom of Information Act*. Following lengthy court battles, such rules have not yet been provided. The Israeli Supreme Court has avoided ruling on the issue whether software or IT system code constitutes "information" pursuant to the *Freedom of Information Act*, deeming it 'not ripe for review and decision'. The obvious concern is that the rules, which are implemented in the respective e-government systems are out of compliance with the publicly shared law and violate constitutional rights. In both cases, the issue is directly related to authentication and validation of e-government systems and the knowledge they share. Such circumstances raise further concerns regarding knowledge management and sharing - lack of integrity and dissemination of invalid public knowledge by governments, undermining the public's capacity to keep a watchful eye on the working of government agencies. Particularly regarding the courts, such circumstances can undermine the rule of law and human rights. IT experts should assume a more active role in human rights protection.

Keywords: Knowledge management, e-Government, Code is Law, Due process, Liberty, Rule of Law, Israeli courts

1. Introduction

Sharing knowledge is a critical aspect of knowledge management. Sharing knowledge is of crucial importance in any competent legal system: First – regarding the duty of government to make the law known (Murphy, 1982); second - regarding the right to inspect and to copy judicial records, which was ruled a constitutional right by the US Supreme Court in *Nixon v Warner Communications, Inc.*, 435 U.S. 589 (1978) and by the Israeli Supreme Court in *Association for Civil Rights v Minister of Justice*, 5917/97 (2009).

Both the duty of government to make the law known and the right to inspect and to copy judicial records were substantially transformed with the implementation of e-government systems. Such systems present a unique problem in knowledge management. How are rules that are embedded in e-government systems by administrators and programmers to be regulated and to be shared with the public at large?

The issue was presented by Lessig (2000) as a legal theory - "Code is Law". Lessig developed his theory by focusing on cyber platforms, which are used for sharing knowledge, particularly music and other copyright-protected materials. Lessig argued that cyber platforms effectively established new rules, which were not enacted through any democratic process. Such rules might pose "a threat to liberty" and to constitutional principles such as the right to privacy, freedom of speech and access to knowledge. Lessig argued that such rules should be recognized and regulated.

E-government systems are a critical subset of cyber platforms. In implementing e-government systems by various branches of government, from the tax authority through the prison service (Zernik, 2010) to the courts (Zernik, 2010), rules are embedded in computer codes, which are often invisible to the public, and may or may not comply with provisions of the published law. Therefore, sharing knowledge regarding rules, which are embedded in e-government systems, is critical for the duty of government to make the law known, the rule of law and human rights from liberty to the right to own property. Sharing the knowledge regarding such rules is critical for public scrutiny of the conduct of government and protection of human rights.

1 The author represented the NGO in court actions outlined in this report.

Instant case study presents the issue by describing recent Israeli court cases and Israeli Supreme Court judgments, pertaining to the rules that are embedded in e-government system of the Tax Authority, which is used for calculating tax liability, and e-government system of the Administration of Courts, which is used for valid signing, entry and publishing court judgments.

2. The Har Shemesh Affair

In *Har Shemesh v Israeli Tax Authority,* 65/22 (2022) in the Israeli Supreme Court, Appellant Har Shemesh sought to discover the rules, which were embedded in the Tax Authority e-government system ["SHA'AM"], which were used in calculating his tax liability. The Tax Authority denied his requests to provide such information pursuant to Freedom of Information Act ["FOIA"] requests, and the lower court denied his FOIA petition. Therefore, the case was critical for the right to own property and to prevent arbitrary and capricious actions by government against private property.

First, Har Shemesh asked to obtain the algorithm, on which the calculation of his tax liability was based. The Tax Authority responded that that the relevant law and regulations were implemented into the its e-government system without being drafted first as human language specifications, assertions or formulas.

Next, Har Shemesh asked to obtain the actual code of the system. The Tax Authority denied such request, claiming that the code was protected as proprietary information.

In the next round, Har Shemesh claimed that given the significance of the information, the Tax Authority should undertake "reverse engineering" and extract the specification/formulas which were embedded in the system. The Tax Authority denied that request as well, claiming that such efforts required unreasonable allocation of resources.

The lower court denied the Har Shemesh FOIA petition in its first judgment in this affair [Judgment in *Har Shemesh v Tax Authority*, 2663-05-19, (Sept 5, 2019) in the Jerusalem District Court]. Har Shemesh appealed to the Supreme Court, and the Supreme Court granted Har Shemesh's first appeal and overturned the first judgment, sending the case back to the lower court [*Har Shemesh v Tax Authority*, 6782/19, (Dec 24, 2020) in the Supreme Court]. However, in its second judgment in this affair, the lower court defied the Supreme Court and again denied Har Shemesh's petition [Judgment in *Har Shemesh v Tax Authority,* 2663-05-19, (Nov 29, 2021) in the Jerusalem District Court].

In Har Shemesh's second appeal, the Israeli Supreme Court ruled that Har Shemesh could file a new "focused" FOIA request with the Tax Authority, and that the Tax Authority should respond within 60 days after receiving the new FOIA request [*Har Shemesh v Tax Authority*, 65/22 (Feb 8, 2023) in the Supreme Court]. However, it is doubted that the second Supreme Court judgment will end the Har Shemesh affair, which started around 2015.

The Tax Authority appears adamant to avoid sharing the knowledge pertaining to the rules, which are embedded in its e-government system, pertaining to the calculation of Har Shemesh's tax liability.

3. The Human Rights Alert Affair

In *Human Rights Alert NGO v Director of the Courts* (3763/22) in the Supreme Court Appellant Human Rights Alert sought to discover the rules, which were embedded in Net-HaMishpat (case mangement system of the Israeli courts), which provided the manner in which valid and effectual criminal verdicts and sentences were signed and entered in electronic court files. The information, sharing of which was sought, was critical for the right for due process and for liberty itself – indeed to the Rule of Law.

The Administration of the Courts denied FOIA requests to provide such information, claiming that providing any of the information that was requested would undermined the system's "information security" and would cause "close to certain disruption in operation of the system."

The lower court denied Human Rights Alert's FOIA petition [Judgment in Human Rights Alert v Director of the Courts, 56030-02-22 (Apr 14, 2022) in the Jerusalem District Court]. The lower court's judgment was based on its two judgments in the Har Shemesh affair, although the lower court's first judgment in the Har Shemesh affair had already been overturned, and the lower court's second judgment in the Har Shemesh affair was then pending appeal in the Supreme Court

Human Rights Alert arguments in the Supreme Court were in part based on Lessig's (2000) "Code is Law" theory, claiming that the information, which was the rules that were embedded in Net-HaMishpat amounted

to laws or regulations, which had to be published and could not be hidden from the public. Appellant further argued that such rules in fact replaced *Rules of Court* (1936), promulgated during the British Mandate for Palestine, which regulated the work of the Office of the Clerk and the maintenance of paper court files. The *Rules of Courts* were abolished in 2004 in conjunction with development of Net-HaMishpat, and replaced with the *Regulations of the Courts – Office of the Clerk* (2004). However, the rules, which were embedded in Net-HaMishpat system, pertaining to the maintenance of electronic court file, remained hidden.

The same 3-justice panel of Israeli Supreme Court, which heard the Har Shemesh appeal, also heard the Human Rights Alert appeal, in the same seating. During the Supreme Court hearing, Justice Uzi Vogelman stated: "The information, which Sir is seeking, does not exist" [Hearing Protocol in *Human Rights Alert NGO v Director of the Courts,* 3763/22 (Feb 8, 2023) in the Supreme Court]. Appellant argued that such reasoning was inaccurate. The Administration of Courts had indeed claimed that there were no user's manuals for Net-HaMishpat. However, relative to the relevant specifications information the Administration of Courts denied the FOIA request by claiming "information security" concerns.

Furthermore, Appellant argued that claiming that no information existed was clearly unreasonable. For example, the system surely had user's menus, which in themselves reflected some of the rules, relative to operations which were permitted for the users - the judges (Lessing, 2000). Screen shots of Net-HaMishpat menus could be easily produced and provided to Appellant.

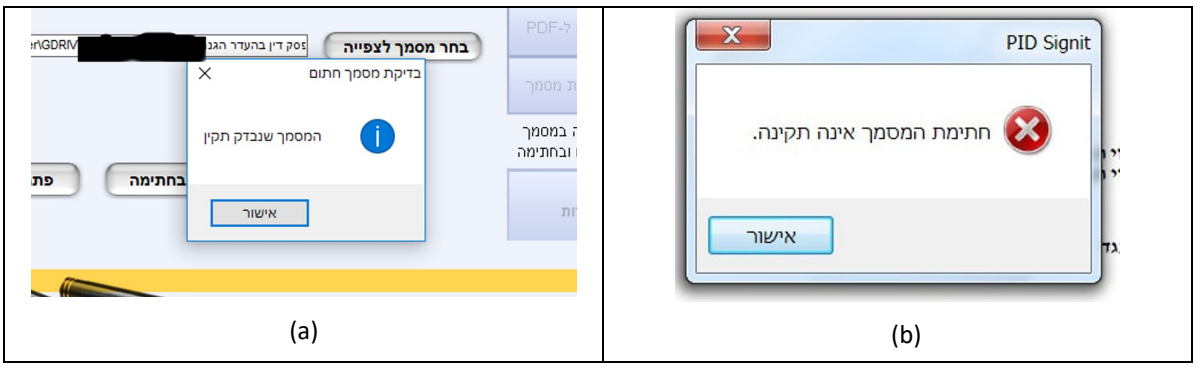
In contrast with the panel's judgment in the Har Shemesh affair, which recognized Har Shemesh's right to obtain at least some of the information from the Tax Authority e-government system, the Human Rights Alert appeal was flatly denied: "After reviewing the arguments of the parties in the appeal, we have found no cause for intervening, and the appeal is denied". However, the Supreme Court panel added an interesting cautionary statement: "...our judgment does not constitute a decision on the issue whether software or IT system code constitutes "information" pursuant to the Freedom of Information Act" [Judgment in *Human Rights Alert NGO v Director of the Courts*, 3763/22 (Feb 8, 2023) in the Israeli Supreme Court]. In the hearing itself, one of justices stated that such question "is not ripe for review and decision."

4. E-signatures in Net-HaMishpat

Article 182 to the Israeli *Criminal Court Procedure Law* (1982) provides: "The Court shall read the verdict and its reasoning in public, sign it and inscribe it with the date of its reading" [underline added – jz].

Until early 2010, when the courts were administered in paper files, the valid signatures appeared on the originals of court decisions as "wet" hand signatures of the judges (see *Figure 2(a)*). The public could inspect and review the judges' signature as part of the right to inspect court records.

In contrast, the visible signatures that today appear on judicial records in Net-HaMishpat are "cut and paste" "graphic signatures", which hold no validity. Administration of the Courts Word Procedure 114/10 clarifies that only the judges' electronic signatures pursuant to the *Electronic Signature Law* (2001) are the valid signatures on judicial records. However, the judges' electronic signatures are information that is not shared – they are inaccessible for review by the public. Judges' electronic signatures can be accessed only when judicial records are electronically served by the court, using dedicated software (*Figure 1*).



(a) (b)

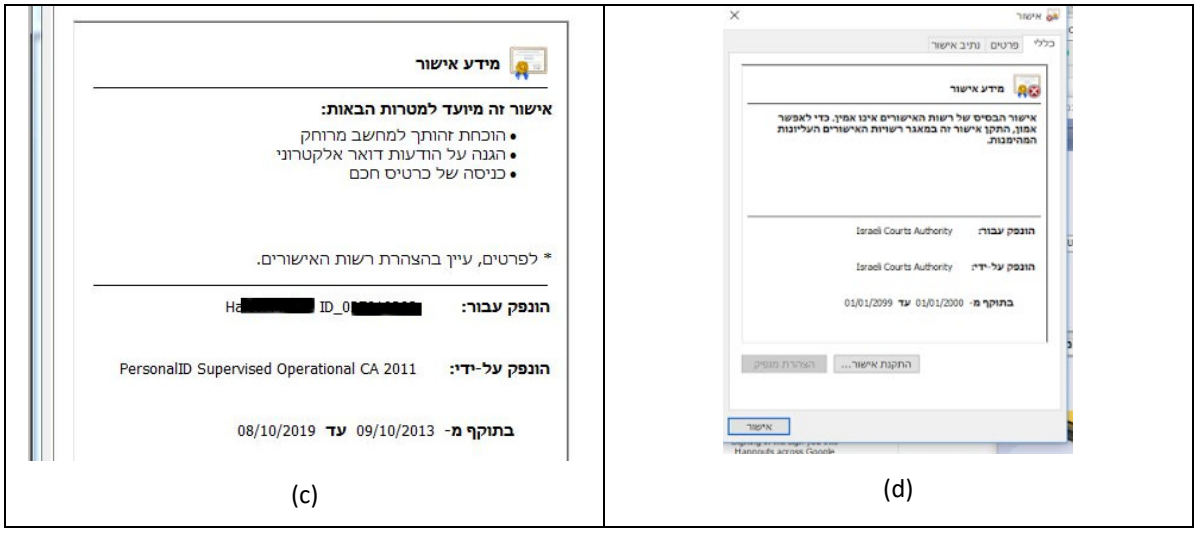


Figure 1: Comparison of Signature Data on a Court Record, which was Filed by an Attorney, and a Judicial Record in Net HaMishpat, using the Dedicated Software of the Israel Bar Association

(a) Inspection of the electronic signature on a court record, which was filed by an attorney: "The document is valid." (b) Inspection of the electronic signature on a judicial record: "The signature of this document is invalid." (c) Signature information of a pleading by an attorney: The signer of the record is identified by name and attorney's license number or ID number, the Certifying Authority is PersonalID corporation, which is registered by the Israeli Registrar of Certifying Authorities pursuant to the *Electronic Signature Act* (2001), and validity of the signing instrument is limited to 6 years. (d) Signature information of a judicial record: "The certification of the signer is invalid"… The purported signer is Israeli Courts Authority, which is also the purported Certifying Authority, and the signature instrument is valid for 100 years…

Comparison of the signature data in Net-HaMishpat of a record filed by an attorney and a judicial record, using the dedicated software of the Israel Bar Association, shows:

- (a) In both cases, the dedicated software fails to indicate the date and time of the signatures.
- (b) Relative to attorneys' signatures, the software shows - "The document is valid." All judges' signatures show - "The signature of this document is invalid."
- (c) Attorneys' signatures identify the signer by name and license number or ID number. All judges' signatures show the signer as "Israeli Courts Authority."
- (d) Attorneys' signatures are certified by PersonalID or Comsign LTD – the two Certifying Authorities that are lawfully registered with the Registrar of Certifying Authorities pursuant to the *Electronic Signature Act* (2001). In contrast, all judges' signatures are certified by "Israeli Courts Authority."

What is "Israeli Courts Authority"?

The question was addressed in separate FOIA requests and FOIA petitions in the courts [*Human Rights Alert v Director of the Courts,* 11963-09-21 and 39537-05-20, in the Jerusalem District Court], at the end of which it was established that there was no lawful government entity named "Israeli Courts Authority," it was merely a "nickname" [Paragraph 1 to Judgment in *Human Rights Alert v Director of the Courts,* 11963-09-21 (Oct 7, 2021) in the Jerusalem District Court].

The conclusion is that the judges' signatures in Net-HaMishpat fail to uphold the two fundamental requirements for validity of an electronic signature: (a) unambiguously identifying the signer, and (b) verifying that the signed document has not been altered after the date of its signing (Weisman, 2001). It should be noted that the issue of user's identification and certification of user's identification (or leaving the identity ambiguous) are among the basic rules, which are embedded in computer codes of cyber platforms, according to the "Code is Law" theory (Lessig, 2000).

Under such circumstances, the mechanism, which was implemented in Net-HaMishpat does not prevent judges from altering a signed document after the date, which appears on its face as the signing date, and there is no simple way for any person, inspecting a judicial record, to ascertain the identity of the signer, the date of the signature, or validity of information, which is shared by the courts as a judicial record.

It should be noted that the electronic signatures in Net-HaMishpat were implemented as "detached electronic signatures." Therefore, the public at large and parties to court case have no simple way to inspect the electronic signatures. The only time that electronic signatures can be inspected is when a judicial record is electronically served by the court. However, as noted above, the Israel Bar Association's dedicated software for inspection of the electronic signatures fails to display the date of the signature. Regardless, the actual date and time of the signature can be retrieved by using an XML reader on the electronic signature file. Using XML reader on judicial records shows that the purported judges' electronic signatures are in fact automatically generated by the system only when the judicial records are served, even when the service is executed years after the date, which is stated on the face of the judicial record as the date of its signature.

Moreover, it is evident that even in judicial records, which were purportedly signed by a panel of 3 judges, there is only one electronic signature, by the fictitious "Israeli Courts Authority."

5. Singing and Entry of a Criminal Verdict – the Roman Zadorov Affair

Roman Zadorov, a Ukrainian citizen, was convicted in September 2010 in the atrocious murder of a 13 year old girl, Tair Rada, and sentenced to life in prison. After Zadorov's appeal in the Israeli Supreme Court in 2014, Prof Mordechai Kremnitzer, one of Israel's leading criminal law experts (who drafted parts of the revision of the Israeli *Penal Law* (1977)) stated: "Conduct of the State Prosecution in the Zadorov file is scary… when you add to it the stance of the Supreme Court and conduct of the Attorney General in recent years, we are left with a justice system that is primarily defensing itself" (Hovel and Linder, 2014). Other criminal law experts and crime investigators also sharply criticized Zadorov's conviction. More than 200,000 Israelis joined social network groups, where the evidence was reviewed in detail, and called for a true police investigation and repeat trial. Finally, in 2023, Zadorov was acquitted after he was granted a second trial.

The 2010 Verdict of the Nazareth District Court file in the Nazareth District Court fails to appear in Net-HaMishpat public access system. It was entered neither in the Decision tab nor in the Judgments tab.

Regulation 2(b) of the *Regulations of Inspection* (2003) provides: "Any person is permitted to inspect judicial decisions that are not lawfully prohibited for publication." Request to inspect the verdict were filed by Human Rights Alert already in 2015. Presiding Judge of the Nazareth District Court Avraham Avraham denied a request to inspect the Verdict in a decision stating [Decision in *State of Israel v Roman Zadorov,* 502/07 (Jan 24, 2016) in the Nazareth District Court]:

> *Requester repeats his requests, which are, allegedly, inspection of judicial records. However, such are not requests to inspect, but an investigation by Requester pertaining to validity of Net-HaMishpat system and an array of arguments relative to conduct of the judicial panel in instant court file. In such matters this Court shall not engage...*

Following the appointment of a new judicial panel for the repeat trial, Human Rights Alert again filed a request to inspect the 2010 Verdict and the corresponding electronic signature. Judge Asher Kula granted the request (Decision in *State of Israel v Roman Zadorov*, 502/07 (June 15, 2022) in the Nazareth District Court]. As a result, the 2010 Verdict was electronically served on Requester. The record appeared invalid and perverted.

Based on all data, which are available to date, the picture that emerges, relative to the September 14, 2010 Verdict, is that on or about September 14, 2010, the Verdict document was generated in the Court's old IT system (*Figure 2(b)*), although at that time, such system was no longer the Court's valid IT system. By September 14, 2010, Net-HaMishpat was already the Court's valid IT system, and the court was administered in electronic files and electronic records.

The old IT system was intended for generating paper judicial record, to be signed using "wet" hand signatures of the judges. However, no copy of the Verdict from the old IT system has been discovered, bearing hand signatures of the judges. An unsigned copy of the Verdict from the old system was discovered as Attachment A to the October 28, 2010 Notice of Appeal, which was filed in the Israeli Supreme Court. Therefore, it is evident that Zadorov's counsel also held at the time an unsigned copy of the September 14, 2010 Verdict (Inspection pursuant to request by Human Rights in *Roman Zadorov v State of Israel,* 7939/10 (March 23, 2015) in the Supreme Court].

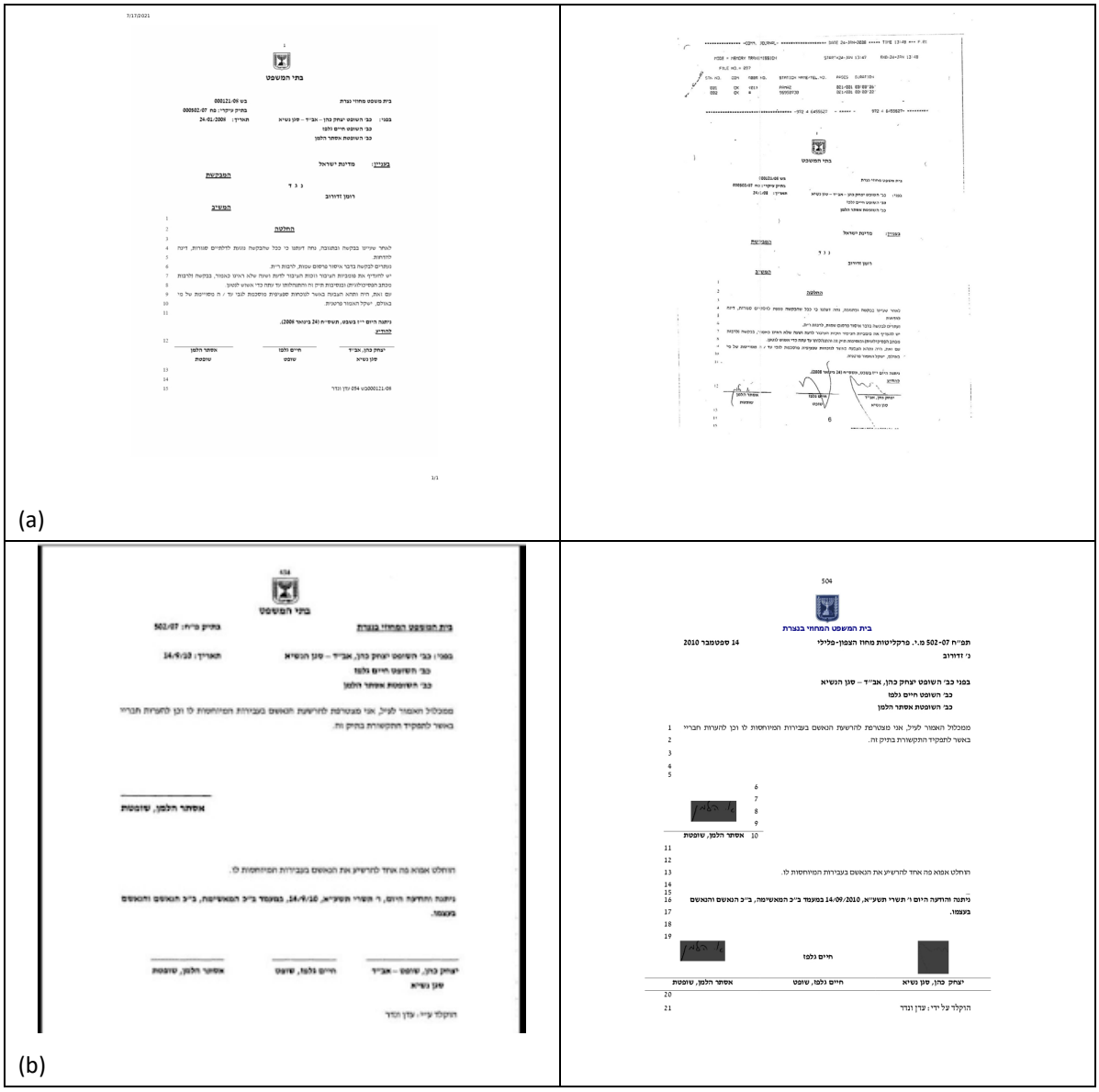


Figure 2: January 24, 2008 Decision and September 14, 2010 Verdict in *State of Israel v Roman Zadorov,* 502/07 in the Nazareth District Court: (a) January 24, 2008 Decision in *State of Israel v Roman Zadorov,* 502/07, while the court was administered in paper court files, prior to the implementation of Net-HaMishpat: Left **– the decision as generated and maintained in the Nazareth District Court's old IT system.** Right **– the decision as it was maintained in the paper court file, and as it was served on the State Prosecution, showing the "wet" hand signatures of the three panel judges [State of Israel response in *Human Rights Alert v Roman Zadorov and State of Israel,* 5501/21 (Nov 29, 2021) in the Supreme Court]. (b)** Left **- the signature page of the September 14, 2010 Verdict, as it appeared in the Nazareth District Court's old IT system.** Right **- as maintained today in Net-HaMishpat**

Prior to the implementation of Net-HaMishpat (in early 2010), the Nazareth District Court was administered in paper court files. Paper decisions and judgments were generated in the Court's old IT system, then printed out and signed using "wet" hand signatures of the judges, and maintained in paper court files (**Figure 2 (a)**).

The Verdict, which is today maintained in Net-HaMishpat was apparently generated at an unknown later date, through a perverted process, as a derivative of the Verdict document from the old IT system (**Figure 2(c)**). For example, the Verdict in Net-HaMishpat bears the page numbers at the head of the page, above the coat of arms of the State of Israel, as was the format in the old IT system, and not in the lower margins, as is the format in Net-HaMishpat. Additionally, the Verdict in Net-HaMishpat shows the "graphic signatures" of only 2

of the three panel judges, and those too appear in the negative form (white on black). Such phenomenon has never been discovered in any other judicial record in Net-HaMishpat.

Furthermore, following Judge Kula's decision, which granted the request to inspect, several old decisions from *State of Israel v Roman Zadorov* (502/07) were served on Requester. The electronic signature files of these judicial records were inspected using an XML reader. It was discovered that the electronic signature files of judicial records, which were over 10 years old, were all generated only on the date of service – July 12, 2022. For example, the data in the electronic signature file of the September 14, 2010 Verdict show that the September 14, 2010 Verdict's electronic signature was generated only on July 12, 2022:

<DocumentCreationDate xmlns="">

2022-07-12T17:53:44.423+03:00

</DocumentCreationDate>

The plausible explanation for such finding is that the signed decision records are generated by Net-HaMishpat only ad hoc – at the time of their service.

Given the dubious validity of the September 14, 2010 Verdict, which was served on July 12, 2022, Human Rights Alert filed a request with the Chief Clerk of the Nazareth District Court to provide a copy of the September 14, 2010 Verdict, certified "True Copy of the Original."

Regardless of repeat requests, the Chief Clerk failed to respond.

The request for certification, which was addressed to the Chief Clerk was eventually referred to Presiding Judge of the Nazareth Distinct Court, Esther Hellman, who denied with prejudice the request for certification [Decision in *State of Israel v Roman Zadorov ,* 502/07 (Sept 11, 2022) in the Nazareth District Court].

Therefore, the right to distinguish between valid and invalid knowledge - in this case, murder conviction and a life imprisonment verdict - which was shared by the court itself, was denied.

Human Rights Alert appealed Presiding Judge Esther Hellman's decision [*Human Rights Alert v State of Israel,* 7215/22, in the Supreme Court]**.** In the appeal, Human Rights Alert argued that the certification of judicial records by the Chief Clerk is a testimonial, wherein the Chief Clerk operated in her capacity as Prothonotary of the Court (Bentham and Bennett, 1959), that a request for certification falls within the duties and authority of the Chief Clerk, and that the judges had no authority to intervene in the autonomous decision of the Chief Clerk, pertaining to certification of judicial record.

Human Rights Alert asked in the appeal that the Supreme Court mandate that the request for certification be returned to the Chief Clerk of the Nazareth District Court for her decision regarding the request for certification of of Roman Zadorov's September 14, 2010 Verdict.

Before the appeal reached a hearing in the Supreme Court, Respondents in the appeal informed Human Rights Alert that a certified copy of the September 14, 2010 Verdict was ready in the Office of the Clerk of the Nazareth District Court (Figure 3).

The certification that was provided by the Nazareth District Court Chief Clerk to Human Rights Alert appears perverted and invalid or dubious at best *(Figure 3)***.** In the certification stamp itself (Right, in blue), the space that was designated for the date of the certification was left empty, and the date of certification was inscribed by hand in the space that was designated for the Chief Clerk's signature. The Chief Clerk's signature was inscribed on a separate stamp (Left, in blue), which is not the certification stamp.

However, since the Chief Clerk responded on the request for certification, the appeal in the Supreme Court was rendered exhausted, and the appeal was dismissed.

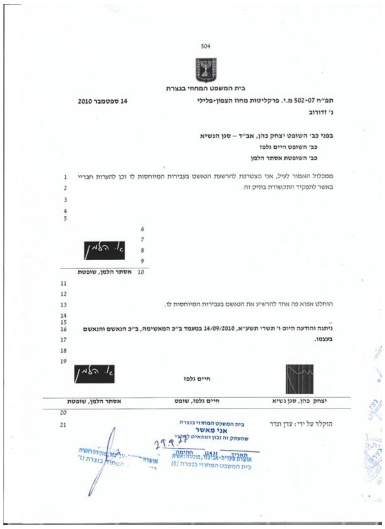


Figure 3: **A copy of the September 14, 2010 Verdict in *State of Israel v Roman Zadorov,* 502/07 (Sept 14, 2010) in the Nazareth District Court – as provided to Appellant Human Rights Alert in *Human Rights Alert v State of Israel,* 7215/22, in the Israeli Supreme Court, in response to a request to obtain the Net-HaMishpat Verdict certified, "True Copy of the Original," by the Chief Clerk of the Nazareth District Court. The certification appears invalid, or dubious at best**

6. Discussion

E-government systems in Israel are usually developed by outsourcing. Therefore, supervising compliance of e-government code with the corresponding law is further complicated. Israeli government decision (1991) prescribed that such systems be developed, validated and implemented pursuant to an elaborate "IT Systems Development and Maintenance Methodology" protocol, which was developed and published by the Israel Accountant General, Ministry of the Finance (2013). The methodology prescribed, *inter alia*, drafting formal specifications prior to signing development contracts and independent inspection and validation of IT systems by state employees before implementing the systems for government service.

Furthermore, procedures of the Accountant General of the Ministry of Treasury prescribed that payment for IT system development and maintenance not be issued , unless documentation was filed of compliance with the Methodology.

However, Israel Government Decision (2014) abolished the requirement for compliance with the methodology. The reasoning was "reducing bureaucratic burden" and promoting the "Digital Israel" project. Therefore, the current state of affairs permits more informal development procedures. Under such circumstances, it is doubted that effective inspection and validation of e-government systems can be performed at all.

The outcome of such informal approach to e-government system development, validation and implementation is clearly demonstrated in the two Israeli Supreme Court cases, outlined in instant report, pertaining to the Tax Authority and the Administration of Courts.

Relative to Net-HaMishpat system of the Administration of Court, Instant report addresses only the issues of signing and entry of criminal judgments. However, Net-HaMishpat is replete with other serious failures in integrity and validity. For example, the Israel State Ombudsman (2022) notes that about 30% of the court files are hidden from public view, including their own existence, mostly with no legal foundation. Entering the court file number of such court files in Net-HaMishpat generates a false and misleading "pop-up message" - "error in court file number." In contrast, the maintenance of a public Index of All Cases is deemed a quintessential requirement in a competent court of record.

Paper administration of government in general and the courts in particular, as well as management and sharing valid information regarding the conduct of government have evolved over centuries, given their preeminent significance for the rule of law. The management and sharing of official public information in a valid manner, which can be distinguished as such by the public at large, was also provided as a constitutional norm already in Article IV, Section 1 to the *U.S. Constitution* (1789):

> *Full Faith and Credit shall be given in each State to the public Acts, Records, and judicial Proceedings of every other State. And the Congress may by general Laws prescribe the Manner in which such Acts, Records and Proceedings shall be proved, and the Effect thereof.*

The office of the Clerk of the Court holds a unique role in managing, sharing and validating court records. It was already provided in the U.S. *Federal Judiciary Act* (1789). Likewise – in England and Australia (Bentham and Bennett, 1959).

Similarly, the British Mandate for Palestine's *Rules of Court* (1936) provided the authority and duty of the Clerk of the Court in the maintenance of court records. In contrast, the Israeli *Regulations of the Court - Office of the Clerk* (2004), which replace the British Mandate's *Rules of Court*, fail to provide the Clerk of the Court, or anybody else, with such authority and duty.

The circumstances pertaining to e-government systems in Israel, documented in instant report, reflect a global trend: The transition from paper administration of government to e-government systems has been implemented with insufficient public oversight. The outcome is loss of fundamental norms, pertaining to the management and sharing of government information in a manner which guarantees the public's ability to ascertain the validity and authenticity of such information.

The proposed solution for the circumstances pertaining to Net-HaMishpat – e-government system of the Israeli courts - includes:

- External, authorized inspection and validation of Net-HaMishpat subject to the joint authority of the Minister of Justice and the Knesset (parliament) Constitution, Law and Justice Committee: The outcome of such review should include defining key failures in the system and methods by which such failures should be corrected and future failures avoided. Such methods may require drafting explicit specifications and their approval by the Minister of Justice and Knesset Constitution, Law and Justice Committee. Furthermore, on site representative of the Minister of Justice with an inspection authority may be required within the technical team of the Administration of Courts, which is charged with maintenance of Net-HaMishpat.
- Amendment of the *Regulations of the Courts – Office of the Clerk* (2004): Regulation 5, which authorized the Director of the Courts to change the regulations at will in e-courts systems should be abolished. Key specifications of Net-HaMishpat should be explicitly promulgated, as well as appointment of Chief Clerks under the authority of the Minister of Justice, and a requirement of periodic reports by the Chief Clerks to the Minister of Justice and Knesset.

The failures, which are outlined in instant report relative to Net-HaMishpat are not unique to Israel. Similar failures have been documented in the past by Human Rights Alert NGO relative to e-government systems in the California and the US federal courts (Zernik, 2010b) and the Los Angeles Sheriff's inmate registration system (Zernik, 2010a). It is likely to be the case in other nations as well.

The 2010 Human Rights Alert submission was in part based on analysis of IT systems of the Superior Court of Los Angeles County and the Los Angeles County Sheriff's Department inmate registration. The submission was incorporated into the final Universal Periodic Review ["UPR"] report of UN Human Rights Commissioner, pertaining to the United States, and summarized as follows (U.N., 2010):

> *45. …HRAlert referred to corruption in the courts and the legal profession, and discrimination of US law enforcement in California.*[70]

The 2015 Human Rights Alert submission was incorporated into the Universal Periodic Review ["UPR"] report of UN Human Rights Commissioner, pertaining to the United States, and summarized as follows (U.N., 2015):

> *57. HRA NGO recommended restoring the integrity of the IT systems of the courts, under accountability to the Congress, with the goal of making such systems as transparent as possible to the public at large.* [193]

The 2018 Human Rights Alert submission was incorporated into the Universal Periodic Review ["UPR"] report of UN Human Rights Commissioner, pertaining to the Israel, and summarized as follows (U.N., 2018):

> *24. HRA-NGO highlighted the serious deterioration in integrity of law and justice agencies as a consequence of the implementation of e-government systems. It affirmed that the validity and integrity of any legal and judicial records of Israel should be deemed dubious at best.*[5]

The transition of government in general, and the courts in particular, from paper administration, which has been developed and established over generations, to e-courts was implemented without sufficient public and elected authorities review and supervision.

The final outcome is fundamental failure in government public knowledge management and sharing – the law and judicial records. Such outcome has generated a clear and present danger to the rule of law and human rights. IT experts should assume a more active role in human rights protection.

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Validation of a Framework for Evaluating Knowledge Mobilization Strategies: A Delphi Method Approach

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Abstract: *Background***.** A growing number of knowledge-oriented organizations, such as granting agencies, governments, public organizations, universities, and health authorities, are investing considerable resources to increase the use of research knowledge to improve professional practice, decision making, and public policy. The proliferation of research on knowledge mobilization (KMb) over the past two decades has deepened our understanding of the dynamics of this process and of the factors that can impede its deployment, such as knowledge users' capabilities (their beliefs, capacity to absorb knowledge, etc.), contextual conditions (resources, leadership, facilitating factors, etc.), and the availability of effective mobilization strategies (frequency, implementation, fit with context). However, as yet, few good-quality studies have evaluated the impacts of KMb, such that we still know too little about the effectiveness of the different strategies and the contextual conditions in which they may be effective. This is problematic, in that their development cannot be fully grounded in empirical evidence. In fact, their evaluation is complicated by the virtual absence of evaluation tools and validated indicators that would allow organizations to assess the impacts of their KMb strategies. Moreover, the difficulty that these organizations experience in relation to evaluation (due to lack of expertise and resources) is a concern that has been raised many times. *Aims***:** This study will address this expressed need to improve organizations' capacity to conduct KMb evaluation studies. Using a collaborative co-construction approach with key actors in KMb, our aim is to design and validate an integrative and operational framework for the evaluation of KMb strategies in the social domain. *Design/approach:* a first step in this project, we conducted a scoping review of frameworks and theories commonly used to evaluate KMb strategies. 71 articles were selected from this scoping review. Our analyses of these articles, we identified four potentially relevant dimensions for planning and evaluation: the context, implementation process, effects, and impacts of these strategies. Using the Delphi approach, a consultation has been undertaken to enrich and validate the dimensions of this framework developed after a scoping review. *Results*: This paper presents the results of the Delphi consultation with an international panel of experts working in the field of knowledge mobilization. This evaluation exercise should lead to a validation of the framework components and potential indicators to be considered when evaluating knowledge mobilization strategies.

Keywords: Knowledge mobilization, Knowledge translation, Framework, Validation, Delphi method

1. Introduction

It is well-recognized that research evidence has the potential to inform, guide and improve practices, decisions, and policies (SSHRC, 2019). Unfortunately, for different reasons, the best available evidence is still too little considered and used (Boaz et al, 2019, Straus et al., 2010). The field of research on knowledge mobilization

(KMb) has been growing rapidly since the early 2000s (Barwick et al., 2020, Strifler et al., 2018). The purpose of this field is to better understand how to effectively promote, and support evidence use.

Knowledge mobilization is one of the many terms used to qualify the processes, strategies, and actions to bridge the gap between research and practice. Other known terms often used interchangeably are translation, uptake, exchange, sharing, dissemination, and implantation science IS (Esmail et al., 2020).

We used the term knowledge mobilization as an umbrella concept. Knowledge mobilization represents all the efforts made to translate knowledge into concrete actions and beneficial impacts for populations. Moreover, KMb represents all processes from knowledge creation to action, but it also includes all strategies implemented to facilitate this process (Phipps et al., 2016).

A KMb strategy is understood as a coordinated set of activities to support evidence use such as dissemination activities to effectively reach the target audiences (e.g., educational materials, practical guides and decision support tools) or activities that aim to facilitate the application of knowledge in a specific context and support professional behaviour change (e.g., community of practice, educational meeting, audit and feedback, reminders, deliberative dialogue) (Gervais et al., 2016). A KMb process may vary in its levels of intensity, complexity, or actors' engagement depending on the nature of the research knowledge as well as the needs and preferences of evidence users (Graham et al., 2006, Straus et al., 2010).

2. Background

KMb is understood as a complex process since a multitude of factors can facilitate or hinder its implementation and subsequent evidence use. During the last two decades, we gained a better understanding of these factors (Curran et al., 2011, Scarlette et al., 2020). These may be related to the knowledge mobilized (e.g., relevance, reliability, clarity, costs), the individuals involved in the KMb process (e.g., openness to change, values, time and resources), the KMB strategies (e.g., tailored to needs and preferences, regular interactions, trust relationships, timing), and the organizational and political contexts (e.g., culture of evidence use, leadership, resources) (Boaz et al., 2019; Orton et, 2011). However, more studies are needed to understand which factors are more important in which contexts and to evaluate the effects of KMb strategies (Rosella et al, 2018). On this last point, although essential, it is often very complex to empirically study KMb impacts to demonstrate the effectiveness of KMb strategie (Fazey et al., 2014, Reed et al. 2018). Partly because of this, high-quality studies that evaluate process, mechanisms, and effects of KMb strategies are still relatively rare (Nilsen, 2015; Langer et al., 2016; Scarlette et al., 2020). As a result, we still have limited knowledge about the effectiveness of different KMb strategies (Proctor et., 2011, Dagenais et al., 2013, Langer et al., 2020). Hence, the development of KMb strategies cannot be totally evidence-informed (Gervais et al., 2016) which may seem paradoxical with the core values and principles of KMb.

As a first step in this project, we conducted a scoping review of frameworks and theories commonly used to evaluate KMb strategies. 71 articles were selected from this scoping review. The analysis of the identified TMFs revealed many factors of interest relevant for the evaluation of KMb strategies. These specific components were inductively classified into four main dimensions: context, process, effects, and impacts. The context dimension refers to the assessment of the conditions in place when the KMb strategy is implemented. These include both the external (i.e., sociopolitical, economic, environmental, and cultural characteristics) and internal environments (i.e., characteristics of organizations, individuals, and stakeholder partnerships). These factors are understood to influence the selection and tailoring of a KMb strategy. The process dimension refers to the assessment of the planning, levels, and mechanisms of implementation, as well as to the characteristics of the KMb strategy implemented. The effects dimension refers to the assessment of outcomes following the KMb strategy implementation. The potential effects vary depending on the strategy's objectives and can be either the immediate results of the KMb strategy or short-, medium-, and long-term outcomes. The conceptual gradation of effects was generally represented in a similar way in the TMFs analyzed, but the temporality of effects could vary. A medium-term outcome in one study could be understood as a long-term outcome in another. Finally, the impacts dimension refers to the long-term effects of KMb products or interventions on end-users, as measured by the organization (Phipps et al, 2016: p. 34). The evaluation of these ultimate effects can be measured by the integration of a promising practice into organizational routines, by the effects on service users, by the effects on the health and wellbeing of communities and society in general (See table 1).

In the second step of this project, we plan to validate the framework by international experts in knowledge management. This article presents the results of this consultation process involving experts who gave their opinion on the relevance and coherence of the dimensions of the proposed framework.

Table 1: Dimensions, Sub-Dimensions, and Components for Evaluating KMb Strategies

DIMENSIONS	SUB-DIMENSIONS	COMPONENTS
1. CONTEXT	External context	Supportive external environment Response to needs Accessibility to knowledge Priority given to knowledge
	Internal context - Organisation	Structural characteristics Organizational culture Available resources Networks and communications Implementation climate Leadership
	Internal context – Individuals (target population)	Personal characteristics Attitudes (e.g., receptivity, motivation) Beliefs (e.g., perceived value and utility) Knowledge and skills (pre-strategy objective assessment) Perceived knowledge and skills (pre-strategy)
	Internal context – partnership and collaboration	Functioning of the partnership or collaboration Perceived quality of the partnership or collaboration Characteristics of the group of partners or collaborators
2. PROCESS	Planification	Presence of a KMb plan (intervention logic) Presence of an evaluation plan for the KMb strategy
	KMb strategy	Characteristics of the strategy (e.g., types of activities) Characteristics of the content (e.g., knowledge quality) Characteristics of those responsible for the KMb strategy
	Implementation	Level of participation Reason (motivation) for participation Participants' attitudes and commitment Implementation fidelity Adaptation of the KMb strategy Implementation and evaluation follow-up
3. EFFECTS	Immediate results	Participants' satisfaction Perceived learning Objective learning Sense of competence (self-efficacy) Change in beliefs and attitudes.

DIMENSIONS	SUB-DIMENSIONS	COMPONENTS
		Intention to use knowledge
	First-level of evidence use	Knowledge adoption Knowledge appropriation Knowledge application Decision-making support using acquired knowledge. Intent to maintain knowledge use Collaboration development
	Second-level of evidence use	Effectiveness of knowledge use Development of competence Individual behavior change Collective behavior change Organizational change Sustain knowledge use Updating (adaptation) of knowledge through practice Improved practices and services Sharing of acquired expertise. Maintaining the collaboration
4. IMPACTS	Impacts of evidence use	Impacts on people receiving services. Impacts on professionals. Impacts on organizations, policy, or systems. Impacts on the community or population

3. Design/Methodology/Approach

Using the Delphi approach, a consultation has been undertaken to enrich and validate the framework developed after a scoping review (McMillan, et al., 2016; Paquette-Warren et al., 2017). This consultation method is designed to collect, in successive waves, the informed opinions of experts, who are consulted remotely using a questionnaire containing both closed and open questions. Besides preserving anonymity, this method offers the advantage of providing feedback after each stage of the consultation to show areas of consensus and divergent opinions, and, in that process, to give participants the opportunity to revise their opinions. Participants in the Delphi process were selected based on their expertise in KMb and evaluation, as well as on their willingness to be involved in the various steps required for this method. We initially selected 132 experts. The majority were academics (66%); a smaller proportion were professionals (20%) or managers (9%). Of the selected experts, the majority (71%) had expertise in knowledge mobilization, 24% had combined expertise in evaluation and knowledge mobilization, and 5% had expertise in evaluation only. In terms of geographical provenance, the majority came from Canada (53%), while others, in smaller proportions, came from Australia (15%), the United Kingdom (13%), and the United States (10%). A marginal number came from France, Mexico, Brazil, Chile, Switzerland, Belgium, the Netherlands, Burkina-Faso, and South Africa (1% for each of these countries).

In the first round, a total of 28 participants responded to the questionnaire, of which 22 responded to the French version and 6 to the English version. the participants are invited to consult the framework developed and to comment (using a Likert-type scale) on the relevance and clarity of each component and the proposed definitions. After assessing each component of the framework, they can suggest improvements or additions to the basic structure in the box provided for open-ended questions. In subsequent rounds, the proposed changes are included. Once consensus, set at 80%, is reached, the new enriched version of the framework was produced by the research team. Of the 28 participants in the first round, 24 indicated their interest in participating in the second round of validation. Thus, following the first wave, the framework was improved, and the 24 voluntary participants were solicited for the second round.

4. Findings or Expected Outcomes

This paper presents the results of the Delphi consultation with an international panel of experts working in the field of knowledge mobilization. This evaluation exercise should lead to a validation of the framework components and potential indicators to be considered when evaluating knowledge mobilization strategies.

The first round of consultation tested the relevance and clarity of the framework elements. This first round resulted in the full validation of 12 elements and partial validation of 24 others. A second round of Delphi was launched to validate those elements of the framework that did not achieve more than 80% consensus (scores of 6 and 7) for relevance and clarity.

5. Practical/Social Implications

This study will contribute greatly to the field of KMb research and practice. It will make it possible to use a common methodology based on an evaluation framework validated by a rigorous scientific approach. Our project is in line with initiatives aimed at better evaluating the benefits of research in terms of the health and well-being of individuals and of society in general. Thus, our framework will focus on the intermediate (short- and medium-term) effects that are produced during the implementation of KMb and that help explain the long-term impacts. The added value of this framework is, unquestionably, the validation process proposed.

Moreover, the framework will be tested in a real-world context, with two organizations dedicated to KMb in the third step of this project. This will ensure the acceptability and applicability of the proposed dimensions and indicators of the framework. It will be useful for all knowledge-oriented organizations that need or want to demonstrate the difference they make through the knowledge they produce or use. In the long term, the use of the framework in different settings will better document the effectiveness of KMb strategies as well as the mechanisms for facilitating research use. Ultimately, this will provide KMb strategies with more empirically sound foundations.

6. Directions for Further Research/Limitations

In future research, it would be advisable to test the framework for evaluating KMb strategies in different settings and to refine the measurement tools, an element that has been neglected by KMb researchers to date.

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Great Resignation and Quiet Quitting as Post-Pandemic Dangers to Knowledge Management

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Abstract: Purpose: COVID-19 pandemic aftermaths include the emergence of new tendencies, such as the Quiet Quitting, and continuation of trends such as the Great Resignation, both of which have multiple knowledge-related impacts on individual, organizational and even national level. The aim of this paper is to show the mechanisms behind the Quiet Quitting and the Great Resignation from individual and organizational perspectives. Understanding them is the first step to developing remedies and building business resilience. Methodology: The paper uses systems thinking approach to analyse the phenomena of the Quiet Quitting. Causal loop diagrams are used to show the mechanisms behind those tendencies, their antecedents and the impact they have on several aspects of business operation and management. Findings: The Quiet Quitting and the Great Resignation are multifaceted phenomena and pose several knowledge-related dangers to organizations, including disturbed knowledge flows, knowledge loss, diminished efficiency, lost informal friendship networks, and knowledge leakage to competition. Causal loop diagram indicates that complicated relations between various elements may produce surprising and unexpected outcomes. It presents also opportunities to use leverage points in order to substantially reduce negative outcomes. Research limitations: The paper is of a conceptual nature. In order to transform causal loop diagrams into full systems thinking models extensive data is required. Hence this paper is intended as a basis for further research. Practical implications: The understanding of mechanisms behind the Great Resignation and the Quiet Quitting is crucial for managers trying to develop strategies that would tackle those problems. The papers shows what leverage points can be used to mitigate risks of their adverse impact on business organizations. Originality/value: The Great Resignation and the Quiet Quitting are often perceived as results of the COVID-19 pandemic, yet data suggest they remain strong also in the post-pandemic business reality. The paper offers a holistic approach to those phenomena using individual and organisational perspectives. It provides important insights into their nature, which can be useful to numerous stakeholders, including knowledge workers, managers and business owners.

Keywords: Great resignation, Quiet quitting, Knowledge sharing, Post-pandemic, Systems thinking

1. Introduction

Both Quiet Quitting and Great Resignation pose a serious problem in contemporary economies. Nonetheless, many organisations are unprepared to handle the problem, or they lack abilities and willingness to do so. Today's leaders fail in this matter and as a result, the number of quiet quitters grows (Smith, 2022). Quiet Quitting spreads through the world of academia (Morrison-Beedy, 2022), social workers (Scheyett, 2022) and finance (Constantz, 2022), just to name a few. A recent survey carried out by Qualtrics indicates that between 2021 and 2022 the share of workers trying their hardest to do good job for the company they work for diminished in 14 out of 15 U.S. industries. The greatest changes appeared in "Finance and Insurance", "Art, Entertainment and Recreation", "Accommodations and Food Services" as well as "Professional, Scientific and Technical Services" (Constantz, 2022). In those industries knowledge is an important resource, making Knowledge Management (KM) and Knowledge Sharing (KS) vital processes for most companies operating there.

Knowledge is the most valuable resource that contemporary organizations may possess. It is the foundation of intangible assets, routines and creative processes that are difficult to imitate (Renzl, 2008). Proper Knowledge Management is the source of sustainable comparative advantage. Knowledge Management is vital for the development of new technologies, products and services. It also facilitates organisational performance improvements, when people exchange information, best practices, insights and experiences (Renzl, 2008).

Knowledge Sharing (KS) is a phenomenon already deeply rooted in in the field of Knowledge Management (Boer, 2005; Zheng, 2017). Schwartz (2006) defines it conveniently as "the exchange of knowledge between and among individuals, and within and among teams, organizational units, and organization". KS is a voluntary activity, hence apart from its technical aspects (such as know-how or technology), willingness to share experiences is vital. Such willingness calls for trust among people involved in the KS process (Bolisani and Bratianu, 2018) and this trust is an indispensable factor for successful KS (Ogunmokun *et al.*, 2020). While the complexity of tasks that are handled by employees increases, it is required to rely on interdisciplinary approach more than ever. That makes knowledge sharing even more important and useful for organizations (Cummings, 2004), but it does not make knowledge sharing easy (Argote & Ingram, 2000).

This paper addresses the following research questions: How do the Great Resignation and the Quiet Quitting impact Knowledge Management and Knowledge Sharing in contemporary organizations? What can be done at individual and organizational level to mitigate the risks and negative consequences of those phenomena? The paper tries to answer those questions using Systems Thinking theory.

Systems Thinking is a term having a few meanings. It can be treated as a perspective, a language or as a set of tools, which include causal loops used in the model presented in this paper. Systems Thinking is defined as opposite to linear thinking and offers holistic approach to the analysed phenomena. Its possible applications span across various fields and disciplines (Monat and Gannon, 2015).

Systems thinking can be also perceived as a valuable methodology, particularly suitable for Knowledge Management-related considerations (Rubenstein-Montano *et al.*, 2001; Cavaleri, 2005), offering new ways of thinking and a useful toolbox on different levels and phases of Knowledge Management for practical knowledge users (Gao, li and Nakamori, 2002).

The paper develops as follow. In the first part the Great Resignation is introduced and its economic consequences are presented. This is followed by a discussion on its implications for KM at individual and organizational levels. This part is concluded by proposed remedies. The second part is dedicated to the Quiet Quitting, presenting the scale of this phenomenon and its reasons. On the basis of literature, the Quiet Quitting model is presented and explained. The model is then used to show possible ways of preventing and reducing the Quiet Quitting in organizations. The paper is summed up by a brief concluding part.

2. Great Resignation

The Great Resignation is a term coined by Anthony Klotz, referring to a surprisingly high number of employees quitting their jobs since March 2021. For any economy some job turnover is quite natural, but the scale of this turnover associated with the Great Resignation is much more above that. For the US economy, the usual turnover is slightly above 2% and even during the time of COVID-19 pandemic employees used to stick to their jobs. During the recovery, however, the voluntary turnover rate increased first to 2.6% (as of March 2021), and later to 3.0% by the end of 2021. The aggregated data does not show the real problem, though. Over half a year, from March till September 2021, the turnover rate in accommodation and food services sector oscillated around 6.0%, resulting in the total loss of more than 40% of workforce in this sector. Over the same period of time, knowledge-intensive professional and business services sector lost a quarter of its workforce (BLS, 2021). High resignation rates are also reported in engineering, technology and healthcare – all of them quite knowledge-intensive industries (Cook, 2021; Rozgus, 2021). To make matters worse, this trend is not restricted to the USA. There is evidence suggesting the UK experiencing similar problems and other Western European countries may also be affected (YPluse, 2021).

The changes observed here are not purely of a quantitative nature. They are qualitative as well. Malmendier (2021) suggests that COVID-19 pandemic changed affective, cognitive and also behavioural processes. Hence, many employees may be reluctant to returning to their usual office work, as they have realised that commuting is tiresome and wasteful process. Additionally, the COVID-19 related lockdown allowed people to re-evaluate their life priorities and log-term career goals. As a result, many employees accelerated their retirement plans, are more oriented towards maintaining work-life balance than before, and determined to reduce burnout (Dean and Hoff, 2021; Hsu, 2021; Kaplan, 2021; Thompson 2021).

Although it remains unknown whether the Great Resignation would prove to be a fundamental social shift with great economic impact or just significant, yet temporary event, its importance is already noted. Toxic corporate culture is often blamed in this context and this view offers also some strategies for employees retention (Sull et al. 2022). Preserving the existing workforce by creating a supportive environment as well as proactive addressing their concerns are suggested as very important (Hirsch, 2021; Sheather and Slattery, 2021).

Looking through the lenses of knowledge management, the Great Resignation may have profound implications, both at individual and organisational levels. At the individual level, COVID-19 triggered lockdowns resulted in a sudden shift to new communication and collaboration practices. Remote work spilled over to external collaboration with business partners, suppliers or major customers. Understaffing, experienced by organizations due to the wave of resignations, prompted managers to look for workers outside the traditionally defined boundaries of organizations. Missing workforce started to be replaced by freelancers or independent contractors supporting the trends already existing in the labour market. Between 2005 and 2015 in the US economy, the share alternative work arrangements, such as temporary help agency workers, on-call

workers, contract workers, independent workers and freelancers increased by 50% (Katz and Krueger, 2019). Research shows that in post-pandemic times more than 50% of managers believes that the growing reliance on freelancers is the effect of the COVID-19 pandemic and at the same time more than 70% of them declares they intend to maintain or increase this reliance in their organizations in the near future (Ozimek, 2021). Remote workers also feel their organizational ties loosen and the character of their work becomes more like freelancing as well. Most employees who work remotely may be considered as knowledge workers. The above mentioned trends strengthen their position in labour market and labour market for their skills grows. Knowledge workers become more aware of the fact that their main capital is knowledge, and that their career is actually based and dependent on personal knowledge management. Personal knowledge management differs from the traditional organizational knowledge management, as it places an individual far above the organization. The process of personal knowledge management development will call for new and/or improved approaches and methods of knowledge accumulation, retaining and application. Individual, personal perspective of knowledge management will present a challenge both to employees and organizations.

From the organizational perspective, the Great Resignation certainly means knowledge loss, as employees equipped with valuable knowledge leave and at least some of their knowledge cannot be retained (Massingham, 2018). The consequences, however, are broader. Organizational capability to integrate the knowledge of the remaining employees in business processes may be undermined. Missing elements in knowledge-based value creation process are difficult to replace and even if it is possible, it takes time. As a result, organizations may lose their competitive advantage. Moreover, massive loss of knowledge workers impedes both intra-organizational and inter-organizational knowledge flows. In case of intra-organizational knowledge flows, the problem arises when quitters possessed important *know-how* and *know-what* (as they most likely handled a lot of internal inquiries) or *know-who* (in which case they served as nodes connecting various employees. As for inter-organizational knowledge flows, they may become disturbed because of the loss of the relational capital. The capability of organizations to interact with external stakeholders is inter alia dependent on the knowledge embedded in the relations that used to be maintained (Mention and Bontis, 2013). Personal connections that quitters had are gone with them and it may take a lot of time to rebuild them (DeLong, 2004).

The remedies are problematic. In the short-run, the human capital that is still available to organizations, should be used in the most efficient possible way. Hiring is obviously the first and most natural thing for managers to do, yet acquiring new employees is unlikely to solve problems in an immediate way. Lost knowledge tends to be unique and even if it is possible to hire somebody who held a similar job elsewhere, their knowledge would probably be different (Massingham, 2018). To make matters worse, increased competition in the labour market, triggered by high turnover, may result in new hires being of a temporal character. If they are not emotionally attached to their new organization, they may be easily tempted with higher salaries or sign-up bonuses offered by competitors. The existing knowledge gaps can be filled in using outsourcing. This can be perceived as a step towards a virtual organization (Durcan, 2016). Employee-empowering initiatives should also work, as they tend to boost organizational performance (Cillo *et al.*, 2022). Managers may also consider restructuring their organizations as a response to the difficulties they face. Proper restructuration allows to improve intra-organizational knowledge flows (Serenko, Bontis and Hardie, 2007). Additionally, efficient use of the existing employees' knowledge improves their self-perception and creates bonds with organization, thus preventing from their quitting (Zhuo and Yuan, 2022).

3. Quiet Quitting

The Quiet Quitting is a relatively new phenomenon and publications on this topic are still scarce. Although used for the first time in 2009 by Mark Boldger, it remained widely unknown until recently (Yikilmaz, 2022). The name itself is misleading as quiet quitting is not about literally quitting one's job, but it is rather about performing basic duties of a job without going above and beyond usual expectations. Those who could afford to leave their jobs formed the occurrence of the Great Resignation. Those who could not or for some other reasons decided not to, contributed to the Quiet Quitting. Unlike the Great Resignation phenomenon, the Quiet Quitting is not visible in labour market statistical data. Hence, it is more difficult to capture and the challenge of measuring it is much more problematic. According to Gallup poll, quiet quitters may have constituted more than half of US employees as of the second quarter of 2022 (Harter, 2022). Even if this particular number is somehow overrated, the problem seems to be serious. Going beyond assigned duties and being engaged in citizenship behaviours is often the source of competitive advantage of a company. the Quiet Quitting may therefore lead companies to losing it. Additionally, employees not willing to go their "extra mile" make it necessary for their colleagues to take increased burden of extra work (Klotz and Bolino 2022).

Considerations pertaining to the Quiet Quitting can be divided into two streams. The first one perceives quiet quitting as a sign of setting the right balance between job-related duties and private life (Nilufad, 2022; Kilpatrick, 2022). In this view, quiet quitting is just a response to the hustle culture, where overworking becomes a norm (Bunting, 2005). The other stream sees quiet quitting as being disengaged, precluding passion, and real interest in performing job. From this perspective, quiet quitters do not contribute truly to their workplaces and they use their behaviour as a way of expressing dissatisfaction with their job and working conditions. In some cases it could be even a way of exacting a small scale revenge against employers or managers (Klotz and Bolino 2022). On the one hand, the Quiet Quitting may be a serious threat to knowledge-related processes in businesses, especially to knowledge sharing. On the other hand, it may also pose a major ethical challenge in some cases, such as social workers, where this problems seems to be systemic (Astvik, Melin and Allvin, 2014).

The reasons for the Quiet Quitting are diverse. One of them is lack of commitment to employees' career development. Organisations able to commit to professional staff development and their job satisfaction are also able to retain their employees. When organisations lack that ability, employees become uncertain of their future (Kruse, 2022) and they perceive the current job as a dead end (Kelly, 2022). That leads to disengagement (the Quiet Quitting) or even leaving the job (the Great Resignation) (Hom, Allen and Griffeth, 2019). Lacking empathy and compassion toward employees can have similar effects. Personal commitment appears when employees know the organisation cares about them (Hamill, 2019), which includes providing what is needed for individual well-being, welfare, mental health and protection (Clifton, 2022). Yet, in the post-pandemic reality, pressure on meeting high expectation at the cost of long working hours and work-life balance is rather common (Klotz and Bolino 2022). The sense of disconnection adds a lot to the picture. Employee engagement is closely connected to a sense of belonging (Anderson and Caldwell, 2020). For maintaining the sense of belonging, it is crucial to be fully informed and included in making decisions related to their jobs. The COVID-19 pandemic transformed work environment, making remote work much more popular. Remote work, however, brings isolation, loneliness and the feeling of disconnection (Luchetti *et al.*, 2020), thus contributing to the Quiet Quitting. Last but not least, low organisational trust is possibly a powerful factor driving the Quiet Quitting. In recent years organisational trust generally deteriorates (Edelman, 2022). On the other hand, when employees are not included in problem solving and decision making related to their own job, they perceive it as lack of trust from leaders and managers, which in turn leads to frustration and lower productivity (Nwosu, Okoh and Goodluck, 2020).

On the basis of the above-mentioned literature, the following model of the Quiet Qutting process has been proposed. As can be seen in Figure 1. the driving force for the Quiet Quitting is a job-related dissatisfaction. Its main source is the discrepancy between the actual performance of an employee and the expected one, referred to as Performance Gap.

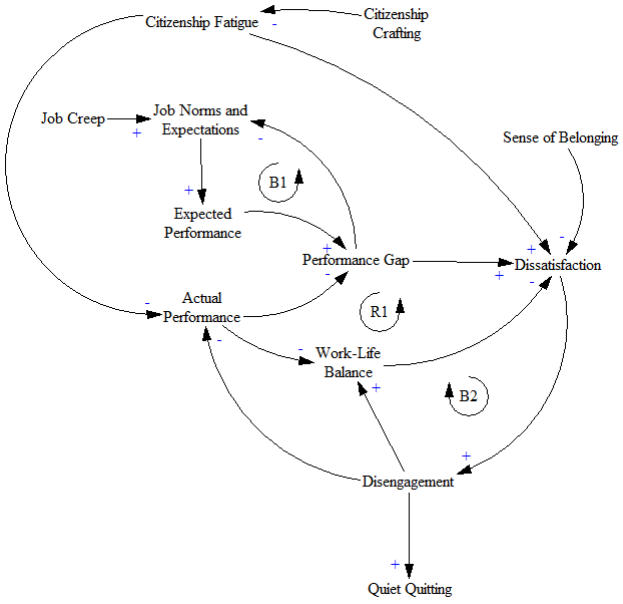


Figure 1: The Quiet Quitting Model – Causal Loop Diagram (own Elaboration Using Vensim PLE)

Three important loops can be identified across the model. A reinforcing loop R1 is the main mechanism behind the Quiet Quitting. When the Actual Performance is lower than the Expected Performance, the Performance Gap grows and results in increased level of employee Dissatisfaction, which is turn leads to greater Disengagement in job-related activities. Lower engagement would cripple the Actual Performance, making Performance Gap even bigger and thus leading to intensification of the problem till the level of the Disengagement leads finally to the Quiet Quitting. Within this R1 loop there is also a balancing loop B2 that plays an important role stabilizing the situation. While dissatisfaction increases disengagement, the latter positively influences the Work-Life Balance, improving the mental situation of an employee and hence reducing the level of dissatisfaction.

The character of the third loop (referred here to as B1) is not clearly determined. In the proposed model this loop is a balancing one. In this view the Expected Performance may increase the Performance Gap, but when that happens, norms and expectations towards employees are revised and adjusted (i.e. reduced). This would lower the Expected Performance, producing some equilibrium. However, if the management response is different (increasing pressure on employees by rising norms and expectations instead of lowering them), the loop becomes a reinforcing one, resulting in the increase of dissatisfaction and finally, contributing to the Quiet Quitting.

When it comes to the Quiet Quitting prevention, the proposed model offers a few solutions for managers. The most obvious one is connected to the causal loop mentioned above (B1). Workloads, expectations, norms, etc. should be regularly revised and the expected performance should be benchmarked against the actual one. Job creep (gradual increase of employee's duties over time) is entirely natural. Temporary burdens tend to become permanent. However, during pandemic those temporary duties were often very much "above and beyond". And if they become permanent, they may erode the engagement of even the most motivated workers. Now it is the time to redefine core jobs tasks and calibrate job responsibilities to match sustainable abilities of employees. The actions of management should be aimed at keeping the balancing character of the B1 loop.

The second set of recommended actions is to provide employees with the sense of belonging. Listening to their needs, and investing in workforce in general (not just in the key employees) is vital. The workforce is not homogeneous, hence the need to offer them diversified support. One of the priorities should be setting safe environment where employees would share their experience and have confidence that management is dedicated to address their problems and concerns. The sense of belonging may significantly lower the level of dissatisfaction, thus reducing the likelihood of the Quiet Quitting.

The third element that can be shaped by management in order to mitigate the risk of Quiet Quitting is the Citizenship Fatigue. Non-mandatory meetings that are actually almost obligatory, the culture of staying late and showing up early when needed – all these may lead to gradual burnout. The suggested solution is the Citizenship Crafting. Those additional activities can be matched with individual preferences of employees. Some of them may be motivated by, for example, public recognition and for them citizenship activities should be carefully selected to make them visible in the organization. Others may be motivated by helping other people (both within and outside of the organization) and they should be engaged in such activities. The Citizenship Crafting is therefore about making the involvement in extra tasks energizing for the employees rather than tiring, hence lowering the Citizenship Fatigue and improving the Actual Performance.

4. Conclusions

How common the Quiet Quitting is and to what extent it poses a problem for companies and national economies is still an open question. Evidence from different research remains contradictory. While data obtained by Gallup suggest that even more than 50% of US workforce may be considered quiet quitters, data from Qualtrics indicates the scale of the problem may be considerably smaller, ranging from 10 to 20%, depending on the industry. This is a significant discrepancy, but it may be attributed to the ambiguity of the term and lack of standardise measurement.

That being said, we need to emphasize that hardly anything is known about the scale of this phenomenon in other countries. Methodological obstacles and doubts about how to detect and how to measure the Quiet Quitting must be addressed by academics in order to promote research initiatives in other countries. The quiet nature of this phenomenon makes it difficult to capture and therefore, it should make organizational leaders really concerned about it. The disruption of the Quiet Quitting may be less visible and obvious than the one of the Great Resignation, but it may be equally or even more damaging to businesses.

Both the Great Resignation and the Quiet Quitting can be - to a certain extent - prevented. And even if they occur in some organizations, their leaders and managers have possibilities to take actions mitigating risks those phenomena bring into organizations. What is needed, is the knowledge on how to do it, the openness to notice when the first symptoms appear and the courage to introduce the changes that are needed. This paper is aimed at providing some of the first of those three ingredients.

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Knowledge Management Based on the Dynamism of the Character of Students who are Members of Teams Implementing Social Projects

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Abstract: Education for social work requires students to perform many tasks, ensuring interdisciplinary preparation for this profession. The usefulness of social design and its didactic value should be seen in this context. Didactic projects, thanks to multi-tasking, stimulate students' activity, teach responsibility, moreover, they enable combining knowledge with action, and develop reflectiveness. The implementation of social projects requires cooperation of students in project teams. However, the efficiency of team cooperation is determined by the proper configuration of the individual characteristics of team members, in accordance with the assumptions of M. Mazur's (1999) psychocybernetic theory of character. In terms of this theory, a man with a specific dynamism of character has a better chance of effective cooperation when he cooperates with people of the same dynamism. These chances are greater because allied people have a greater sum of their powers (synergy effect), it is easier for them to take challenges together. The aim of that paper is to present the results of the conducted diagnostic research - questionnaire research, in the field of the character of students in psychocybernetic terms. In total, 19 students, who were registered for the implementation of didactic social projects, took part in the study. Based on the estimations of character parameters, the most favorable configuration of members of 3-person project teams was indicated. This procedure is part of the knowledge management process - as improving the education process in the field of dynamic, time-limited, temporary and team-implemented didactic projects, where the problem is sharing knowledge in order to achieve team effects (through a group), resulting in low effectiveness undertaken projects, low quality of results, etc. Research objective: researching the usefulness of knowledge in the field of individual, autonomous character traits of students for designing effective teams implementing didactic social projects.

Keywords: Project management, Social work, Psychocybernetics, Knowledge management, Entropy

1. Introduction

The world in which we operate is subject to dynamic changes. They also concern the problems that social workers have to face (Kromolicka and Kosc, 2021; Kantowicz, 2018). It seems, however, that in this confrontation with the turbulently changing multi-problem reality, it is not possible to develop ready-made, schematic algorithms of action. This contemporary reality of permanent change requires constant crossing of patterns in thinking and acting, causing the constant expansion of the scope of tasks for various social services, especially social workers. These social, economic and cultural conditions, as well as the variability of the environment of social welfare institutions, have determined scientific discussions on professional preparation and proper education for the profession of a social worker (DuBois and Miley, 1999; Kromolicka and Kosc, 2021; Urbaniak-Zajac, 2016). These discussions raise the issue of the essence of professionalism and fostering the professionalization process in both education and practice (Kantowicz, 2018, Urbaniak-Zajas, 2016). The professionalization of the profession is also perceived as a process in which experience and its internalization play an important role, as well as the development of contacts as part of cooperation between other professionals and institutions (Kantowicz, 2015; Kantowicz, 2014). In addition, apart from the formal requirements that social workers must meet, it is emphasized that they should be people who are able to assume new roles, eg the role of initiator of projects focused on solving socially severe problems; the role of coordinator of social activities; the role of originator and designer of prevention programs (Marynowicz-Hetka, 2018; Wolska-Prylinska, 2010). Referring to the above statements - a social worker needs extensive knowledge and practical skills related to social design.

Social design as an issue of education has its origins in educational work with children with developmental deficits. With regard to social professions, this approach developed rapidly in Western Europe, in social schools from the 1980s. At that time, other, more effective forms of educating practitioners were sought, who, in the course of developing the experience acquired during practice, would be able to participate in creating knowledge about in this field (Barbier 2016; Baines, 2007; Chojecka, 2020). And therefore, training for the field of practice through social design has been recognized as one of such ways of educating practitioners (Dąbrowska, 2019). Education through design is an opportunity for the student to build a theoretical, methodological and methodological workshop (Leśniak-Berek, 2018; Marynowicz-Hetka, 2018). The project

can integrate all educational content and, moreover, emphasizes the links between theoretical teaching and the practice of social action (Hennessey, 2014; Kienhuis and, Świtek, 2007). In addition, the need to take on a number of roles in the process of project preparation and implementation, on the one hand, gives the opportunity to test oneself in new activities, and on the other hand, allows to verify the degree of individual readiness to perform the profession (Barbier 2016; Jong and Berg, 2007; Kaczynski, 2019). Thus, a social project, as a type of methodical activity in the field of social work, is a response to the challenges faced by a social worker, "preparing more for comprehensive thinking and action than for fragmentary and receptive thinking" (Marynowicz-Hetka, 2018).

Social design has a team character and assumes shaping the individual through their own effort together with other participants. Therefore, the ability to cooperate and collaborate among project team members is of particular importance. This skill, in a way, determines the possibility of using the potential of the project method in social work education. However, the level of cooperation, its efficiency and effectiveness is determined by the proper selection of project team members (configuration of personnel), taking into account the characteristics of individuals in terms of psychocybernetics. Character traits (e.g. dynamism, tolerance, susceptibility) determine the likes, goals and preferences of individuals, which determines the quality of cooperation. Therefore, it is an important aspect of knowledge management, conditioning the efficiency of knowledge sharing and achieving results through the group.

2. Methods of Selecting Students for Training Project Teams

The methods of selecting members for effective teams are varied. Methods commonly used in commercial (also non-commercial) organizations include: analysis of biographical data; job interviews; competency tests, psychological tests, knowledge and skills tests; psychological tests; intelligence tests; knowledge and skills tests; medical research and physiological tests; integrated assessment (assessment center). In the case of adaptation to the team and organization, the assessment refers only to the theory of fit (person-environment fit model) - however, poorly embedded in diagnostic tools. The fact is that there are no tools to accurately describe and measure the factors that should be taken into account during the selection process of team members (Wozniak, 2013).

When creating a project team, the principle of maximum usefulness of its individual members in the context of a given project should be followed. In a situation where the task is complex, complicated and characterized by a high degree of uncertainty, members with the appropriate knowledge and skills to perform it should be included in the team (Hoegl, 2005; Wróblewski, 2005; Chow and Cao, 2008). In addition, weak points of teamwork should be controlled by taking measures to: reduce the scale of social loafing, stimulate constructive interactions, efficient coordination of activities, as well as greater satisfaction of team members (Kozusznik, 2005; Melo et al., 2013).

In general, the science of effective teams is fairly well documented. However, it does not take into account character traits that would predispose or limit the usefulness of individuals to specific teams. Thus, little is known about how specific team configurations can affect team performance (Hysong et al., 2019). Configuration has a significant impact on how team members interact. Team members do not typically interact as independent individuals; rather, they interact with the subgroup identities to which members belong based on their demographic characteristics (Lau and Murnighan, 1998; Cramton and Hinds, 2004; Li and Hambrick, 2005).

It is the interaction between subgroups that actually determines team performance, and it is only by identifying the patterns of subgroup interaction that we can fully understand how team structure affects team performance (Xie et al. 2015). A properly selected team will use the advantages of teamwork, while an incorrectly configured team will waste the potential of its members (Chau and Maurer, 2004; Nijssen and Pauwe, 2010). Consequently - even the best-planned tasks will not be performed if the team does not consist of properly selected people.

Undoubtedly, the procedure of configuring the composition of project teams should be implemented in order to determine the most appropriate composition of teams (Belbin, 2009), in particular for the purposes of effective education. The use of stochastic methods in supporting the process of selecting employees into project teams can contribute to improving the efficiency of human resource allocation through the appropriate allocation of roles and responsibilities, e.g. avoiding the situation of wasting the individual potential of individuals (Ariely, 2011; Twardochleb, 2014). Of course, methods in this area, dedicated to

selection processes, personal configuration, should be supported by verified and possibly simple to use diagnostic tools.

This paper presents a tool for configuring student project teams using the theory: cybernetics of character by M. Mazur (1999), which he related to the theory of autonomous systems, i.e. those that have the ability to control and resist the loss of this ability). Mazur proved that character is a set of rigid human control parameters and therefore it is impossible to change. In connection with the above, this work takes into account the often neglected factor responsible for the effectiveness of the team, the so-called rigid character traits of its individual members, understood as the energetic properties of the human body. Currently, interviews or tests to diagnose soft skills are commonly used. However, their use does not give a full opportunity to learn the basics of human functioning. Increasing the number of measurement methods used only causes fatigue of the tested person and giving random answers that distort the measurement. On the other hand, the sense of measuring rigid characters results from the fact that they are "impossible to change" - which cannot be changed, for example, by training. And this is the essence of the selection of personnel in terms of psychocybernetics (Jedrecki, 2003-2017).

3. Selection of Project Team Members in Terms of M. Mazur's Cybernetic Theory of Character

The selection of project team members based on the character of its members in cybernetic terms is an important parameter that determines the success of teamwork and the achievement of goals. Character is defined as "a set of rigid human steering properties. Rigid steering properties, on the other hand, are defined as character parameters" (Mazur, 1999), the source of which are the energetic properties of the human body. Character, in the colloquial sense, is explained as the cause of one's conduct. Character, therefore, determines the success of teamwork in a fundamental way.

In psychology, "character" is rarely used, and in addition, in different meanings - "some understand by "character" innate mental characteristics, others main features, and still others identify it with "personality" (Mazur, 1999). What's more, psychologists use the term "personality" in various meanings (PWN Encyclopaedia; Institute of Health Psychology of the Polish Psychological Society; Horzyk, 2012). This multitude of definitions is sometimes put forward as an argument for how difficult the concept of "personality" is, since no one has managed to define it unambiguously so far. Meanwhile, it is just sticking to the word "personality" and making assumptions. "The authors of these definitions, however, do not notice that instead of science they practice lexicography" (Mazur, 1999), because it is not the word "character" that is important, but the control properties of a human being (Mazur, 1999; Wilsz, 2005; Pawlak, 2020).

As it has already been stated: character in cybernetic terms is a set of rigid control features. One of such rigid control properties is dynamism, defined as an algorithm of behaviors that a person strives for, because when they freely manifest, he feels best, he is most fully self-realized. The dynamism of character determines the way information and energy are processed by individual classes of character. M. Mazur defined 5 classes of character, which are presented in Table 1.

Table 1: Manifestations of Character Dynamism in the Cybernetic Approach

No.	the domain of character	Characteristics
1	endodynamism	very pronounced negative dynamism
2	endostatism	quite pronounced negative dynamism
3	statism	dynamism close to zero
4	exostatism	quite clear positive dynamism
5	exodynamism	Very clear positive dynamism

Source: Mazur 1999.

For the diagnosis of character dynamism, one test is enough, which additionally allows you to determine other parameters, which include:

- tolerance - a range of naturally accepted situations,
- susceptibility - the range of situations accepted only under the influence of external pressure.

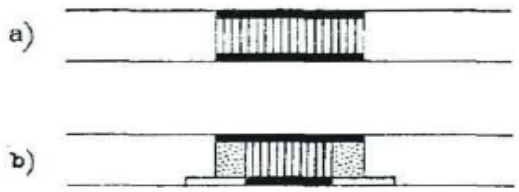
The above-mentioned parameters indicate the range of situation variability that is acceptable to a human being.

Referring dynamism to the problem of character configurations of project team members, it is known that a person with a specific dynamism has a better chance of creating a situation consistent with his character when he cooperates with people of the same dynamism, and thus striving for the same situation. The chances are greater because allied people striving for the same goal have the sum of their powers, so it is easier for them to overcome common obstacles than if they wanted to do it individually (Mazur, 1999).

The selection of team members will therefore consist in selecting the class, tolerance, susceptibility of character. On this basis, we can talk about selection and matching, which should be understood as:

- the selection of characters, i.e. the configuration of characters in which there is an appropriateness of partners' tolerance,
- character matching, i.e. a character configuration in which deficiencies in the selection of characters are filled by vulnerabilities of partners.

Selection and matching of characters can be complete or only partial, or even none (mismatch, mismatch). This is illustrated in Figure 1., where the range of character matching is highlighted by hatching and the range of character matching by dotting.



Source: Mazur (1999).

Figure 1: The Range of Selection and Matching of Characters

Fig. 1a shows a character configuration in which the full range of tolerance of one partner corresponds to the full range of tolerance of the other partner. It's a complete match of characters. The vulnerabilities of the partners do not play a role here, because everything that one partner does meets with the other's approval without exerting any pressure. In other words, neither partner has to give in to the other partner's likes and dislikes, because those likes correspond to his own.

Fig. 1b shows a character configuration in which part of the tolerance of one partner corresponds to the tolerance of the other partner, and the remaining part corresponds to his vulnerability. So it's a partial matching of characters with a complete match. In other words, it is a case when one partner likes certain preferences of the other partner, and is compliant towards the others (Mazur,1999).

4. Research Metodology

The study of character dynamism was carried out on a group of 19 students implementing social projects. The study was based on a questionnaire containing 35 detailed manifestations of character dynamism, referring to Mazur's theory. These theories result in detailed statements about the relationship of individual characters to various situations and phenomena. Their knowledge allows for proper management of representatives of each character. Examples of character manifestations are presented in Table 2.

Table 2: Detailed Manifestations of Character Dynamism (Selected Examples)

	Type of dynamism	**Exdynamism**	**Exostatism**	**Statism**	**Endostatism**	**Endodynamism**
No.	**Class of character**	**C**	**BC**	**B**	**AB**	**A**
1	Orientation life (a way of processing information	Dissipating information and energy, not accumulating anything	Advantage dissipation of information and energy over their	Maintaining balance in all manifestations of life, balance of accumulation	Advantage dissipation of information and energy over their	Advantage gathering information and energy over dissipation Gathering information and energy (gathers

	and energy)		collection	and dissipation of information and energy.	accumulation	everything, dissipates nothing)
	Intensity life	Spontaneity, seeking pleasure in life regardless of the possible consequences of such an attitude	Versatility, seeking pleasure in life, but not at any price	Regularity (for pleasure, he is ready for moderate pain))	Comfort (for pleasure, he is willing to expose himself to only minor pain , likes to live comfortably)	Calmness (I don't want to expose myself to any pleasures annoyances, wants to live peacefully, safely)
3	ratio to rules	Capriciousness (lack of adherence to rules, does not bend his behavior to nobody's requirements)	Individualism (follows general rules but rejects those that don't suit it)	Principle (adheres to specific rules)	Flexibility (recognizes general rules with deviations depending on needs)	Arbitrary (makes rules for its own benefit, but makes them itself) does not hold)
…		…				…
35		…	…	….	…	…

Source: Author own's elaborations upon Mazur, 1999.

Table 3: A Summary Table of the Results of Character Dynamism Research in Numerical Form

	Character class				
Student code	**C**	**BC**	**B**	**AB**	**A**
7	8	5	15	5	2
8	8	17	6	3	1
18	1	8	11	15	0
1	8	7	5	9	6
13	8	8	9	6	4
14	6	12	6	5	6
0	1	10	17	7	0
19	7	10	7	6	5
5	7	11	10	5	2
6	7	8	12	6	2
20	5	10	15	4	1
21	5	11	13	4	2
12	5	12	11	5	2
2	3	7	18	5	2
0	0	14	14	6	1
15	1	8	14	10	2
4	1	2	23	8	1
3	1	6	18	10	1
10	5	11	12	4	3

Source: Author own's elaborations

The concept of entropy adopted in the study makes it possible to examine the information gap in the research data and to rank the dynamism of character according to the priority of the studied quantities. On this basis, the assessment of autonomous features such as breadth of character, dynamism, susceptibility and tolerance was carried out. These listed features are the basis for the selection of members of the task forces. This is an innovative approach, because in today's organizational practice, rigid character traits are not taken into account as an important element in the selection of team members. Next, the characterological characteristics of the examined group of students were determined and the entropy distribution for all character traits was determined (Table 4). Below is C.Shannon's information entropy formula:

$$H = -\sum_{i=1}^{n} p_i log(p_i)$$

where: :

$P_i = \frac{p_i}{\sum}$ *- the probability of the intensities of all traits that make up a given class character*

At this stage of considerations, only the mathematical distribution of assigned numerical values for individual character parameters is analyzed. From now on, we do not compare the numerical values assigned to individual character classes, but the probability of their occurrence. This will allow them to be assessed in terms of the likelihood of their occurrence.

Table 4 shows the entropy calculations for the reduced number of character classes from 5 to 3.

Table 4: Reduced Entropy Calculations

	Character Class		
Student code	**C**	**B**	**A**
7	0,207	0,278	0,131
8	0,223	0,253	0,090
18	0,117	0,310	0,079
1	0,216	0,266	0,207
13	0,220	0,291	0,173
14	0,211	0,271	0,192
0	0,122	0,300	0,070
19	0,218	0,283	0,186
5	0,219	0,295	0,131
6	0,213	0,298	0,137
20	0,198	0,289	0,098
21	0,200	0,293	0,125
12	0,200	0,298	0,131
2	0,161	0,279	0,131
0	0,080	0,304	0,110
15	0,117	0,310	0,149
4	0,080	0,229	0,117
3	0,110	0,292	0,122
10	0,200	0,292	0,145

Source: Author own's elaborations

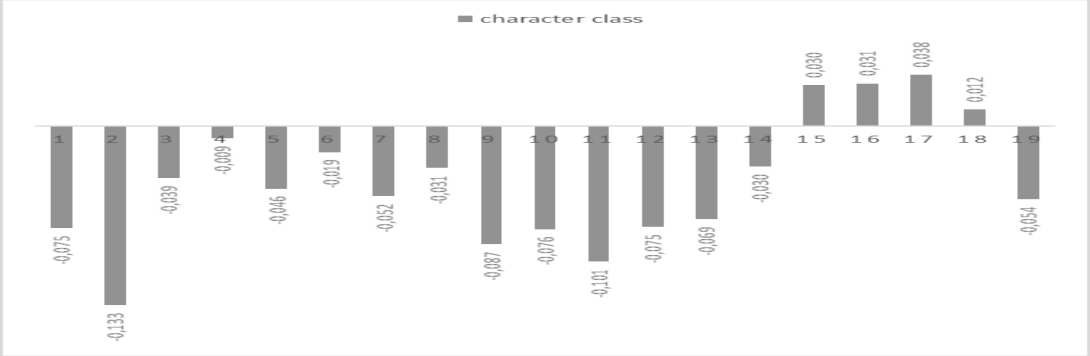
Based on the character dynamism determined on the basis of the study, character width (L) and tolerance (T) were determined, and then compliance (M), according to the formula: L=T+M, as independent variables. The calculation results are presented in Table 5.

Table 5: Character Parameters in the Form of Calculated Entropy

Student code	character parameters				Character class	Description
	Susceptibility (M)	Dynamism [log C/A)	width (L)	Tolerance (T)		
1	0,279	-0,075	0,617	0,338	endodynamism	tolerant character, not susceptible
2	0,253	-0,133	0,566	0,313	endodynamism	tolerant character, not susceptible
3	0,31	-0,039	0,506	0,196	endodynamism	tolerant character, not susceptible
4	0,266	-0,009	0,690	0,424	endodynamism	tolerant character, not susceptible
5	0,291	-0,046	0,684	0,393	endodynamism	tolerant character, not susceptible
6	0,271	-0,019	0,674	0,403	endodynamism	tolerant character, not susceptible
7	0,3	-0,052	0,492	0,192	endodynamism	tolerant character, not susceptible
8	0,283	-0,031	0,687	0,404	endodynamism	tolerant character, not susceptible
9	0,295	-0,087	0,645	0,350	endodynamism	tolerant character, not susceptible
10	0,298	-0,076	0,648	0,350	endodynamism	tolerant character, not susceptible
11	0,29	-0,101	0,586	0,296	endodynamism	tolerant character, not susceptible
12	0,292	-0,075	0,617	0,325	endodynamism	tolerant character, not susceptible
13	0,298	-0,069	0,630	0,332	endodynamism	tolerant character, not susceptible

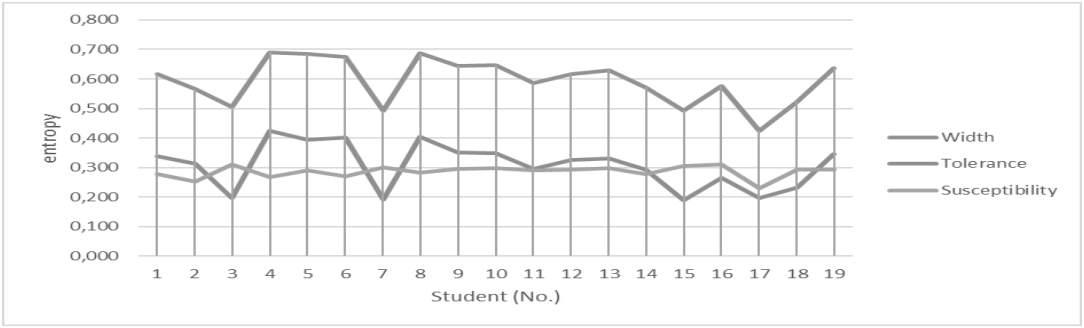
Student code		character parameters			Character class	Description
	Susceptibility (M)	Dynamism [log C/A)	width (L)	Tolerance (T)		
14	0,279	-0,030	0,572	0,293	endodynamism	tolerant character, not susceptible
15	0,305	0,030	0,494	0,189	exodynamism	susceptible, intolerant character
16	0,31	0,031	0,576	0,266	exodynamism	susceptible, intolerant character
17	0,229	0,038	0,426	0,197	exodynamism	susceptible, intolerant character
18	0,292	0,012	0,524	0,232	exodynamism	susceptible, intolerant character
19	0,292	-0,054	0,637	0,345	endodynamism	tolerant character, not susceptible

Source: Author own's elaborations



Source: Author own's elaborations

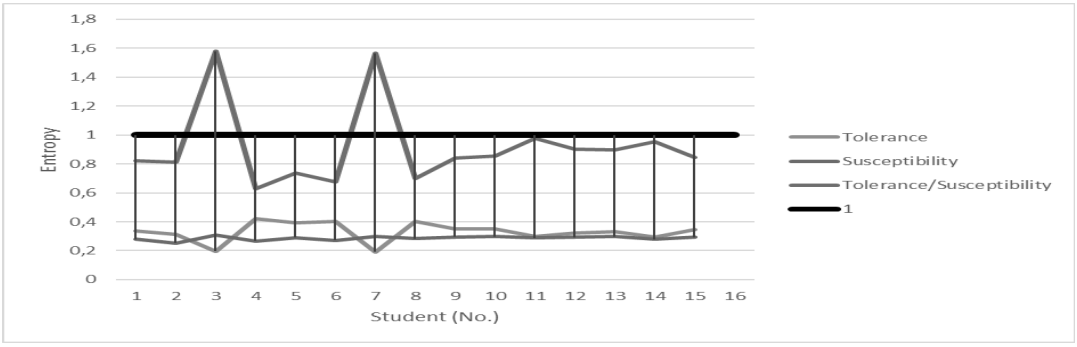
Figure 1: Distribution of the Dynamism of the Character of the Examined Group of Students (19 People)



Source: Author own's elaborations

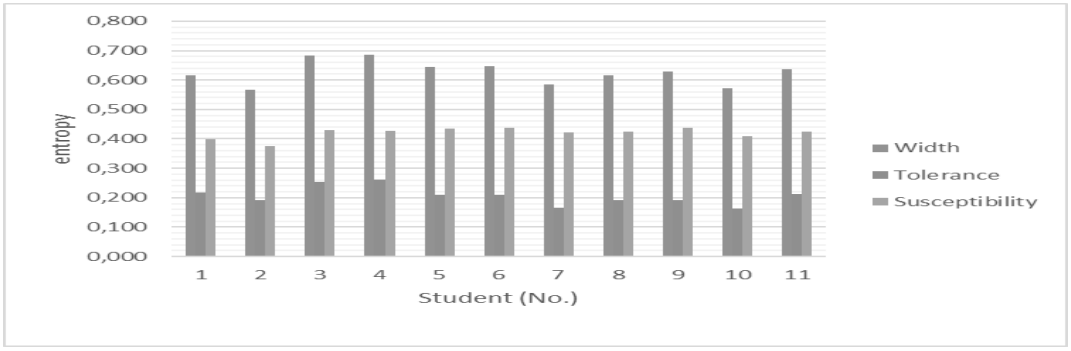
Figure 2: Width, Tolerance, Susceptibility and Dynamism of Character

Further research was carried out on the most numerous group - the group of endodynamics - resources of 15 people. The distribution of parameters for these character classes is presented in Figure 3.



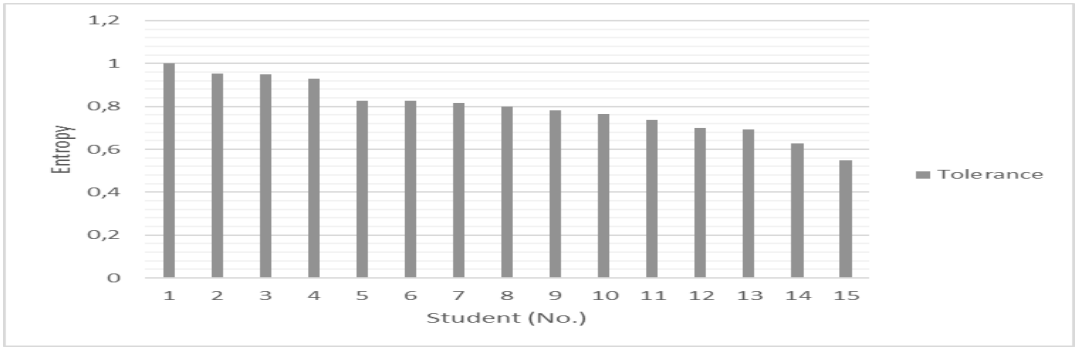
Source: Author own's elaborations

Figure 3: Distribution of Parameters for These Classes of Character - Endodynamism



Source: Author own's elaborations

Figure 4: Endodynamism - Valuable Personalized



Source: Author own's elaborations

Figure 5: Ranking of Tolerances

Based on the presented analysis of students' characters in cybernetic terms, we can indicate the most suitable team configurations according to the most important character parameter, which is tolerance, within a given class (character). Matching consists in selecting people for the project team who have the most similar character tolerance fields. Based on the conducted and presented study (Table 6), the greatest correspondence of the configuration of team members will apply to students with codes: 7,8,18–etc. for a team of 3 people, and for a team of 2 people: 7, etc. The selection is based on the size of the tolerance with the same character.

Table 6: Study

Student No.	**1**	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**
student code corresponding to the number	7	8	18	1	13	14	0	19	5	6	10

5. Discussion

Ignorance of the concept of the breadth of character, and especially the failure to distinguish between tolerance and compliance, and selection from matching, is a source of conflicts arising from the belief that man is made of rubber, which can be freely stretched and shaped, striving to force positive tendencies.

The lower the correspondence of the dynamisms and the lower the tolerance of one partner to the tolerance of the other partner, the smaller the matching of partners. The lower the vulnerabilities of the partners, the lower the possibility of character matching. Unlike character matching that always pleases partners, character matching is tolerable the greater the proportion of compliance needed to ensure character matching. The character mismatch is unbearable. The matching of characters, therefore, consists in the selection of characters, which consists in the appropriateness of the partners' tolerance and the matching of their characters, i.e. a character configuration in which the deficiencies in the selection of characters are filled by the vulnerability of the partners. In this context, a character configuration is a set of character classes of individuals between which there is a coupling.

6. Conclusion

Studying the nature of individuals in terms of psychocybernetics is particularly important in relation to members of project teams. Knowledge of the rules governing human behavior based on the study of his character allows you to predict his potential behavior in various situations of a project organization. This is all the more important in the light of the problems of improper knowledge management between project team members, manifested by low efficiency of its use and, above all, poor ability to accumulate it. The currently used methods of selecting team members do not take into account individual personal characteristics. Team members selected without this characteristic cannot work efficiently due to internal friction, short circuits, different preferences, etc. For this reason, it is important to select project team members based on the characterological characteristics of individuals in cybernetic terms. Knowledge management in didactic projects should absolutely refer to the individual team member, not the team as a whole, and be individualized and related to the character of the individual in cybernetic terms. This approach fits in with the concept of team work knowledge management, in which everyone shares their knowledge and are determined to achieve results through the group. As a consequence, the process of knowledge sharing and its transfer to the entire task force is improved.

The proposed research method should be tested in real conditions, and the results of the teams' work should be verified on a control group for various organizational groups. It is important to explore the relationship between behavior and character in the cybernetic sense and to improve the method of selecting members for various task teams or for assigning individual tasks.

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An Initial Standardized Knowledge Management Framework Formed from Learning During a Humanitarian Crisis

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Abstract: The paper presents some aspects of knowledge management theory. This underpins a research methodology designed to expose knowledge transfer in voluntary not-for-profit groups. The paper aims are to make recommendations which, supported by a knowledge management strategy and good practices, provide the basis for the development of a future model of knowledge management in crisis situations. A hypothesis has been established: During emergencies that arise suddenly, a variety of information and knowledge is dispersed, widely disseminated, and belongs to many different organizations. A coherent information system is needed for the dissemination and sharing of knowledge for effective assistance to people affected by the crisis. The main challenge in managing knowledge in such humanitarian emergencies, is the fact that a wide variety of information and knowledge is dispersed, disseminated, and originally belongs to many different organizations. These information resources may not be organized and used effectively during a crisis situation. Over time, preliminary and non-standardized rules are developed. The authors of this paper took part in a humanitarian action - both independently and in cooperation with non-governmental organizations. This allowed for the collection of extensive research material. During the research, the methodology of participatory observation and surveys was used. The aim of the study was to develop knowledge management standards, for use in the event of other humanitarian crises. The final research technique used is given, from participant selection to outcome analysis. It was found that processes of organizational learning and active knowledge management occurred in many forms. Knowledge was transferred in and out of the organizations. Expertise from earlier experiences was applied, and transferred, becoming explicit. Managerial skills and methods were applied in new organizational contexts. Many similarities and some differences were found, despite clear differences in the type of organisations and country of origin. The research allowed the authors to research extensively into people's motivations, priorities, and forms of information transfer. Knowledge acquisition, transfer and sharing were clearly identifiable, as was organizational learning and subsequent usage of it. Future implementation of standardized, coherent knowledge management rules, used in crisis situations will facilitate the sharing of knowledge and its reuse. The framework can also be applied to other situations of emergency decision making, such as crisis management and emergency medical assistance.

Keywords: Knowledge management, Social organizations, Humanitarian crisis

1. Introduction

A crisis situation is an aspect of the functioning of societies, organizations and enterprises that particularly destabilizes their functioning. An important feature of the crisis is that it usually involves "unacceptable consequences", at least for part of society, and is accompanied by a variety of contexts: political, military, economic, humanitarian, social, technological, environmental or health (Jia et al., 2012). A crisis disrupts the normal course of events in an individual's life, requiring them to reassess their ways of thinking and acting (Reber et al., 2009).

A special case is a humanitarian crisis, which usually affects wide sections of society and has far-reaching consequences. In many humanitarian crises, the primary need for crisis management is useful cooperation of the public and non-governmental sectors (Schwartz, 2016), wherein non-governmental organizations (NGOs) play an important role in mitigating the negative effects of the humanitarian crisis. NGOs, being close to people and acting directly in the environment, may correctly recognize the issues. They often have more appropriate means and methods to deal with the problems that have arisen than other bodies.

Their functioning is based on their own independent decisions, and better recognition of a crisis situation, by which they can reach the affected people more effectively and faster. This leads to a more effective reduction of the negative impact of the crisis on individual stakeholders, and better protection of society. Thus the scope of humanitarian activities offered by non-governmental organizations does not only focus on material aid. Non-governmental organizations are characterized by a diverse approach to crisis situations, which may aid the building of social trust in each other and contribute to the development of interpersonal relations in particularly difficult times (Egger and Schopper, 2022). In a large-scale humanitarian crisis, with a huge number of people in need, the actions of governmental and non-governmental organizations may be insufficient. This gap is filled by ordinary citizens, who are not organized (Haaland and Wallevik, 2019).

The subject material of this paper is an analysis of management of the humanitarian crisis at the PL/UA border, in the first weeks of the armed conflict in the Ukraine. At that time, the Ukrainian authorities asked the refugees remaining abroad not to return to the country until the situation stabilized (Forsal, 2022). The example of this crisis showed that it was NGOs, and above all ordinary people, who flocked to the border from all over the country, that constituted an important aid force, but also a major organizational challenge, inter alia from the point of view of the knowledge management system.

2. Crisis Management at Various Stages of a Crisis Situation

Crisis management is important for effective assistance activities. This requires the application of strategies designed to help the organizations and society cope with a sudden and significant negative event (Maniatis, 2018). A crisis most often occurs as a result of an unforeseeable event or an unforeseen consequence of an event or its consequences (Morell, 2005). In both cases, a crisis almost always requires quick decisions to limit its damage. The nature of the potential damage varies, but in most cases may have an impact on health, safety, finances and, in the case of organizational crises, on the reputation of the entity or a combination of them. Crisis management aims to minimize the damage caused. It is thus not just responding to a crisis, it is a comprehensive process that may be prepared for and implemented in practice before a crisis occurs. In both cases, a crisis almost always requires quick decisions to limit its damage (Tokakis et al., 2019).

Almost every crisis situation is preceded by certain symptoms. Correct identification of threats and their interpretation allows for taking certain pre-emptive actions that will help mitigate the effects of a later crisis. It is important to establish monitoring systems (mechanical, electronic, databases) that can provide early warning signals of any foreseeable crisis (Ramesh et al., 2015; Dijkzeul et al., 2013). Many stakeholders should be involved in pre-crisis activities (Alpaslan et al. 2009). In the case of organizations, these will be representatives of individual departments, e.g. HR, financial, legal or operational. A crisis manager should be appointed to coordinate the analysis of crisis symptoms and manage the crisis recovery process if one arises.

The next stage of crisis management is the reaction to it (Coombs, 2006). The crisis manager is responsible for leading the response in accordance with the established management plan. An important role is knowledge management, overseeing the flow of information and communicating with the public (Coombs et al., 2008; Jin et al. 2014). In the post-crisis stage, when it subsides, management is focused on determining corrective actions to minimize the negative effects. An important aspect of the actions taken is also feedback, which leads to the development of improvements in the crisis management system, in order to better prepare the organization and society for future crisis situations (Coombs and Laufer, 2018). The crisis management team should review the management plans to assess whether the plan worked properly and what aspects need improvement (Moon et al., 2020).

3. Knowledge Management in a Crisis Situation

Knowledge management in a crisis situation compasses all activities aimed at improving preparatory and executive actions in the event of emerging crises. So it involves capturing the knowledge generated within the organization and in the inter-organizational environment, and making it available to those who need it to make decisions (Jennex and Raman, 2009). Knowledge management determines the effectiveness of the organisation in strategic planning, decision-making, problems solving, administrative management and reaction in crisis. (Jia et al., 2012).

One of the key elements of knowledge management, which determines its success, is the acquisition and delivery of information to the relevant organizations involved. Without an efficient flow of information, counteracting a crisis situation is practically impossible. The role of information handling is essential to the efficiency and quality of response of individual organizations, whether at the level of local government or national non-profit organizations. The effectiveness of crisis management depends on the speed and precision of information exchange between stakeholders (i.e. organizations, people involved in cooperation). The effectiveness of crisis management therefor depends not only on ICT systems, but also on such dimensions as strategy, processes, services and roles that guide the coordination of the entities involved (Jia et al., 2012).

Opportunities resulting from modern technologies mean that units responsible for solving crises are looking there for solutions to improve crisis management. The increased interest in these solutions is also due to the increased participation of citizens. Thanks to the use of communication technologies, people are more willing to cooperate in times of crisis, and on the other hand - they carefully monitor the actions taken (Barthe-Delanoë et al., 2012).

Knowledge management is thus the systematic process of searching, collecting, filtering and presenting data, information and knowledge for a specific purpose and to serve a specific organization or community. In complex situations of humanitarian crises, there is usually information overload, a large number of chaotic reports and a lack of systematic collection of standardized data. It is also difficult to store structured, filterable database data (Andreeva and Kianto, 2012; Gao et al., 2018).

Knowledge management within the NGO organization, is more open to external contacts and exchange of experience than in the commercial sector. This characteristics is of particular importance in a crisis situation, when it attaches great importance to cooperation as a means of acquiring and sharing knowledge. In the case of longer-functioning organizations, cooperation mechanisms have already been developed, which clearly facilitates building a knowledge management system. The exchange of information is of key importance in crisis situations related to humanitarian aid, because individual, selective aid does not make it possible to meet all the rapidly emerging needs.

Extensive cooperation within the knowledge and experience management system generates many benefits: it reduces unnecessary duplication of activities and waste of resources, improves coordination and provides a common knowledge base (Jakubik and Müürsepp, 2018). It is important to be able to use modern communication tools, but it is important to use diversified solutions (analogue-digital, Internet and non-Internet) due to possible disruptions to access.

An essential aspect of preparing for crisis situations is to develop an appropriate knowledge management model. McGill et al. (2023) have made a broad review of approaches to knowledge exchange in crisis settings. Ramalingam (2006) proposed a model demonstrating the importance of using knowledge and learning tools as part of a holistic approach to organisational change. This approach to knowledge management is based on the search for relationships between: organisational contexts (e.g. strategic alignment, management behaviours), relationships and collaborations within and across organisation (e.g. using ICT technologies) and organisational knowledge (forms and locations; creation, sharing, storage etc.) - in relation with external factors (partners, donors and networks). Safran (2003) proposed a disaster management cycle, in in a broader context, where three phases have been distinguished: prevention, transition (disaster and emergency) and recovery. Onyango (2016) indicated some main knowledge management capabilities, which affected the performance of international humanitarian in Kenya: technological advancement, organization structure, organization culture and human resource. Dumitriu (2016) indicated the need to distinguish three categories: data, information and knowledge - during building a knowledge management model. Yahya et al. (2015) suggested simplification of the knowledge management model in crisis situations. They proposed a knowledge transfer model ACIS based on four stages: Acquisition, Conversion, Implementation and Storage. Finally, a big challenge that should be taken into account when building a knowledge management model is improving civil–military coordination in humanitarian logistics (Heaslip and Barber, 2016).

4. The Scale Of the Humanitarian Crisis Studied in the Light of Statistical Data

In the analysed period, in the first quarter of 2022, during the initial aggression of Russia, over 4.2 million citizens crossed the Polish-Ukrainian border, according to the Border Guard (2022). Over 3.1 million were refugees from Ukraine. The number of people crossing the border with Ukraine (in both directions) provided by the Border Guard is the number of entries to Poland and departures to Ukraine. It should be noted that this number is not the same as the number of refugees and helpers during this period. This number varies due to the fact that some people have crossed the border two or more times.

Data on border crossings provided by the Border Guard (2022, 2023) include “foreigners”. The vast majority of them are, of course, Ukrainian citizens, but among those fleeing the war, especially at the beginning, there were, for example, students from India and Africa who studied in the Ukraine. According to the data of the Ministry of Education of Ukraine (ONET 2022), in 2020, 80,000 people from abroad studied there. According to information from the Polish Ministry of Foreign Affairs from March 2022, among the first group of refugees to Poland, apart from Ukrainian citizens, there were: 5,300 people from Poland, 3,000 from India, 2,300 from Nigeria, 1,400 from Algeria and 1,300 each from Morocco and Pakistan (OKOPRESS 2023).

Table 1: Section of the Border with Poland/Ukraine. Passenger Border Traffic in the First Quarter of 2021, 2022, 2023 - number of Crossings, Including Foreigners

Specification	1st quarter 2021	1st quarter 2022	1st quarter 2023
Total	1 555 269	4 233 617	3 846 939
- including from Poland	626 038	974 864	1 882 719
- including to Poland	929 231	3 255 753	1 964 220
Foreigners	1 493 473	4 109 210	3 737 411
- including from Poland	596 590	916 456	1 828 278
- including to Poland	896 883	3 192 754	1 909 754

Source: Border Guard (2021), Informacja Statystyczna za I kwartał 2021 r. Warszawa, Informacja_statystyczna_za_I_kwartal_2021_r_.pdf; Border Guard (2022), Informacja Statystyczna za I kwartał 2022 r. Warszawa, Informacja_statystyczna_za_I_kwartal_2022_r_.pdf; Border Guard (2023), Informacja Statystyczna za I kwartał 2023 r. Warszawa, Informacja_statystyczna_za_I_kwartal_2023_r_.pdf

According to OKOPRESS data (2023) and data provided by the Polish authorities to UNHCR (Office of the United Nations High Commissioner for Refugees), currently (as of February 21, 2023) 1,563,386 people are registered as “refugees under the care of the state” (Temporary Protection). This number in practice means that these people in Poland received a Polish identification number (PESEL).

Table 2: Section of the Border with Poland/Ukraine. Passenger Border Traffic in the First Quarter of 2021, 2022, 2023 - Percentage Change

Specification	Percentage difference between Q1 2022/Q1 2021	Percentage difference between Q1 2023/Q1 2022
Total	172%	-9%
- including from Poland	56%	+93%
- including to Poland	251%	-40%
Foreigners	175%	-9%
- including from Poland	54%	+99%
- including to Poland	256%	-40%

Source: Border Guard (2021), Informacja Statystyczna za I kwartał 2021 r. Warszawa, Informacja_statystyczna_za_I_kwartal_2021_r_.pdf; Border Guard (2022), Informacja Statystyczna za I kwartał 2022 r. Warszawa, Informacja_statystyczna_za_I_kwartal_2022_r_.pdf; Border Guard (2023), Informacja Statystyczna za I kwartał 2023 r. Warszawa, Informacja_statystyczna_za_I_kwartal_2023_r_.pdf

According to UNHCR (2023) data, 6.3 million refugees from Ukraine were recorded globally. Apart from Poland and Germany, the largest number is in the Czech Republic (491,000). Italy (170,000) and Spain (168,000). In terms of the number of inhabitants of a given country, the greatest effort is made by: Estonia (the number of refugees is 5% of the population), the Czech Republic (4.7%), Moldova (4.2%) and Poland (4.1%) and Germany (1.3%).

5. Methods of Knowledge Management in the Process of Disseminating and Sharing it During a Humanitarian Crisis

The subject of the study was the community of charity organizations involved in helping refugees during the humanitarian crisis on the PL/UA border, in the first weeks of the armed conflict in Ukraine. Due to the escalation of the war in Ukraine after February 24, 2022, new challenges and reactions appeared in Polish society and aid organizations to the emerging humanitarian crisis.

As earlier stated, a hypothesis has been established: During emergencies that arise suddenly, a variety of information and knowledge is dispersed, widely disseminated, and belongs to many different organizations. A coherent information system is needed for the dissemination and sharing of knowledge for effective assistance to people affected by the crisis.

The authors of this study took part in the then humanitarian action - independently and in cooperation with non-governmental organizations. The study used the methodology of participatory observation and a diagnostic survey. The research technique used was a questionnaire. The aim of the study was to indicate the possibility of developing knowledge management standards in the event of a humanitarian crisis. The research tool was a questionnaire as direct research in places where humanitarian actions are carried out. The sampling method was purposive. Volunteers from organizations that actively participated in helping on the Polish-Ukrainian border were invited to participate in the study. The study was conducted at the turn of February and March 2022. 200 surveys have been made available. The return rate was 61.5%. 123 correctly completed questionnaires were received. This study presents the results of two questions out of nine survey questions. Other work will follow.

Table 3: The use of Benchmarking in the Dissemination and Sharing of Knowledge (in %)

No.	Specification	Yes	No
1.	Tracking the activities / information of the institution / organization on successes	56.9	43.1
2.	Tracking activities/information announced by volunteers about successes	53.6	46.4
3.	Documenting and publicizing your activities in the media	35.7	64.2
4.	Using solutions from other organizations	56.1	43.9
5.	Using the solutions of other volunteers	58.5	41.5
6.	Using multiple solutions to find the best one	32.5	67.5
7.	Personal contact with organizations to find the best solution	65.8	34.2
8.	Personal contact with other volunteers in order to find the best solution / face to face meeting	78.1	21.9
9.	Encouraging others to imitate effective aid methods	27.6	72.4
10.	Information obtained from other organizations was helpful	64.2	35.7
11.	The information gleaned from other volunteers was helpful	80.5	19.5

Source: Own elaboration based on a survey

One of the useful methods included in the group of comprehensive methods at this stage is benchmarking. It is a relatively simple and cheap method of disseminating and sharing knowledge. However, for this to happen, there must be an appropriate motivation system so that participants express their willingness to share knowledge. In the case of the respondents, the motivation was the willingness to help refugees selflessly, as well as the statutory assumptions of the organizations in which the volunteers worked. This method does not evaluate people as better or worse, but strives to make the success of an individual become the success of the entire enterprise, so that the experience of one person becomes an inspiration for another.

Despite the undoubted advantages of benchmarking, this method was used to a limited extent during the assistance activities on the Polish-Ukrainian border. Organizations and volunteers, however, exchanged information and, as they indicated, willingly shared their knowledge. During the aid campaigns, cooperation could be observed in the internal relations between the volunteers. Information about the successes of the actions taken was provided. The exchange of information was based on informal, friendly contacts between the volunteers. At the same time, a significant group of respondents assess the information received from organizations (64.2%) and directly from volunteers (80.5%) as useful in action.

In the group of improvement methods, helpful tools in knowledge sharing and knowledge management were face to face meetings (78.1%), tracking activities/information of other organizations (56.9%) and individual volunteers (53.6%) about successes. Documenting and announcing their activities in the media was used less frequently (35.7%). It should be noted that the surveyed respondents used the solutions of other organizations in their assistance activities (56.1%), slightly more often than the solutions of other volunteers (58.5%). Relatively rarely, decisions on the implemented solutions were based on the analysis of many solutions in order to select the best one (32.5%).

It is worth noting that for each of the analysed benchmarking categories, respondents more often used contact directly with volunteers than with organizations. The results of the answers to the second question concerned the need to use the information system in knowledge management. Various information systems, including IT, are useful in the dissemination and sharing of knowledge. The need for their use was indicated by the majority of respondents (for 82.1% of respondents this need was very high). An equally high percentage of respondents indicated the need to use a database of good practices. Respondents see the need to introduce coherent information systems because, in their opinion, their use leads to greater effectiveness of aid in situations of humanitarian crises (74.8% strongly agreed with this statement. The respondents pointed to the need to build nationwide information portals where one can find various information on topics bothering both refugees (83.7%) and volunteers (88.6%).

Table 4: The Need to use the Information System in the Dissemination and Sharing of Knowledge (in %)

No.	Specification	0	1	2	3
1.	It is necessary to use an IT system to manage knowledge.	0	3.3	14.6	82.1
2.	The introduction and use of an information system increases the effectiveness of assistance.	0	12.2	13	74.8
3.	It is necessary to introduce a database of good practices.	0	0.8	16.3	82.9
4.	A coherent system of recording current activities of charitable organizations is needed.	34.2	35.7	17.1	13
5.	A coherent information system for the exchange of experiences (forums and discussion groups) is needed.	0	47.2	47.9	4.8
6.	A coherent information exchange system for the group of experts is needed.	24.4	55.3	18.7	1.6
7.	A coherent nationwide portal is needed where refugees from Ukraine can find various forms of support.	0	1.6	14.7	83.7
8.	A coherent nationwide portal is needed where helpers (volunteers and charities) can find a variety of information.	0	8.2	3.3	88.6

Where: 0 - disagree 1 - slightly agree 2 - moderately agree 3 - strongly agree

Source: Own elaboration based on a survey

Critical reflections may be aroused by the fact that in the process of knowledge dissemination and sharing, volunteers to a small extent indicated the need for a coherent system of recording current activities of charitable organizations (34.2% of respondents disagreed with this need, and 35.7% supported it to a small extent). Similarly, low support was declared for the need for a coherent information exchange system of the expert group.

In turn, the results of participant observation indicated that the effectiveness of acquiring knowledge from institutions and organizations was relatively limited. It should be added, however, that during the period of conducting the research, the situation on the Polish-Ukrainian border was very dynamic, and the information did not appear on an ongoing basis on information pages on the Internet. Participants in aid activities, however, expressed their willingness to acquire such knowledge. However, it is difficult to assess whether their expectations resulted from limited independence and a lowered assessment of their own competences, or whether they consciously perceived the important role of organizations which, by virtue of their activity, should take over the role of leadership in sharing knowledge.

The results of the observations clearly indicated that an important method of knowledge management, which enabled its transfer in an informal way, was the formation of informal groups. Their effectiveness was conditioned by the existence of solutions in organizations that favour and motivate the formation of such groups and encourage knowledge sharing. Information provided in an informal way was often the only knowledge available, more up-to-date, reliable and tailored to the needs of recipients. In general, a high level of readiness of volunteers and others to share knowledge during the crisis could be observed in the analysed period.

6. Conclusions

The results of the research and the review of available source materials made it possible to indicate recommendations for selected aspects of knowledge management in humanitarian crisis situations: 1) At least minimum basic sets of knowledge management guidelines should be developed by aid organizations based on the best practices and experiences of individual organizations and volunteers; 2) Gradual steps should be taken to embed knowledge management and knowledge sharing skills in the appropriate assessment systems of service providers; 3) Job descriptions and core organizational competencies should be provided. It is necessary to establish standards and procedures for retaining and transferring knowledge at the end of aid work and/or termination of work of individual volunteers, transferring them to another area of activity; 4) Efforts should be made to optimize the capacity of all organizations involved in humanitarian aid during a crisis, identify a place and space for joint design of aid activities and run knowledge management training programs adapted to holistic principles; 5) Those responsible for organizing the activities should have a long and comprehensive experience in knowledge management and should be at the forefront of implementation in identifying priority actions dedicated to knowledge management; 6) Good practices and lessons learned should be indicated, which will cover the entire knowledge management system in a crisis situation.

The results allowed verification of the hypothesis positively, because the knowledge available during the analysed humanitarian crisis was highly dispersed and widely disseminated in many different organisations. The need for an efficient knowledge management system was clearly visible, and some promising initiatives were founded. Summing up, in the knowledge management process studied here, methods of obtaining information focused on benchmarking were used. Acquiring information and its implementation as well as sharing knowledge with others are key elements of success.

During the crisis it is necessary to quickly identify knowledge gaps in conjunction with the ongoing assessment of information needs. It is important that the accumulated tacit knowledge is transformed into knowledge available and understandable to other people involved in the assistance. Visualization is also very important. Appropriate maps, signposts, graphics, and knowledge maps facilitate communication, especially when the assistance is of an international nature (eliminating language barriers). These activities shorten and simplify communication, which is of great importance during time pressure. An important element of knowledge management in a crisis situation is to organize an efficient Q&A system (questions and answers) to respond to identified information needs. A system of rapid, almost instant training on knowledge management procedures, communication systems, virtual cooperation networks, and technology tools is necessary for the quick deployment of volunteers for routine and effective assistance to the victims.

This paper is the result of preliminary work and is intended to indicate the basic recommendations, which would provide the basis for the development of the knowledge management model in crisis situations. The authors undertake further, extended research on the basis of which they will propose such a model.

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PhD Research Papers

A Meta-Data-Analysis of Knowledge Creation Pattern of Small Businesses in Africa: Exploring the Past to Predict the Future

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Abstract: Small businesses continue to be highly supportive of global economies, particularly in emerging nations. It is projected that by 2050, Africa might face a rapid rate of urbanisation in the world, which poses a significant development challenge, requiring innovative and African-led solutions. However, African countries, with institutional weaknesses and inadequate government support, are yet to harness the rich potentials of small businesses, particularly due to inadequate knowledge-creation strategies. The study adopted a postpositivist meta-data analysis approach and study interrogated past research findings from other scientific research to gain a more integrative understanding of what has been discovered about the knowledge creation (KC) pattern of African small businesses. However, the study revealed a very insufficient number of studies that explored the KC processes of African small businesses but found best practices of multi-sectoral oragnisations from different countries that African small businesses can learn from. We identified that most of the KC activities revolve around both formal and social interactions, such as dialoguing, reflections, storytelling, and collaborative activities. Additionally, we note, among others, the role of the culture of mistake acceptance and proximity that removes social, organisational, and institutional distances. The following recommendations were made: the empirical testing of the application of the KC theory of small businesses, particularly in Africa, should be done; more studies should be done on KC processes of organisations so that best practices can be shared; there is a need for small businesses to be systematic in their approach to KC; and knowledge officers should be engaged to ensure the effectiveness of knowledge-creation initiatives in small businesses.

Keywords: KC, Knowledge management, Small businesses, Africa, Rayyan, Socialisation, Proximity, Mistake acceptance, Interactions

1. Introduction

Knowledge has become a critical source of the sustainability of organisations' competitive advantage (Arsawan, 2022). Firms that develop and leverage knowledge resources succeed more than those that depend more on tangible resources (Cooper et al, 2023). Although scholars acknowledge the fundamental role of knowledge creation (KC) for sustainable competitive advantage, few studies have thoroughly investigated the distinctive knowledge-creation processes of small businesses. Understanding KC processes is critical for small businesses to make optimum use of explicit and tacit knowledge flowing within their organisations. Nonaka and Takeuchi (1995) drew upon Polanyi's (1967) work to distinguish between knowledge that is tacit (internalised) and knowledge that is explicit (externalised). By observing the interactions between tacit and explicit knowledge, Nonaka, and Takeuchi's (1995) theory of KC proposes four modes of knowledge. They opined that to have continual KC, the four modes: socialisation, externalisation, combination, and internalisation, must be followed systematically and sequentially.

KC can be depicted as a series of activities (processes) (Styhre, Roth and Ingelgard, 2002), or the output of such processes, such as a value-adding outcome, or a new product or service (Johnson, 2002). As a process, KC refers to the initiatives and activities undertaken to generate new ideas or objects, that is, the methods or means through which knowledge is created. Conversely, KC as an output can be described as the development of innovative ideas that enrich existing knowledge (the difference between what is known and what must be known for project success. Mitchell and Boyle (2010:69) substantiate KC as new knowledge that is "diffused, adopted and embedded as new products, services and systems." The current study was interested in exploring KC as a process, rather than as an output.

Academics and executives mostly agree that organisations where KC is strong are more adaptable, flexible, innovative, competitive, and productive (Sin et al, 2015). However, preceding research on KM in small businesses reveals that they tend to have a more mechanistic approach and rely less on social interactions (Durst and Edvisson, 2012). Organisations need to adequately manage knowledge, which is challenging for small businesses because they usually lack the appropriate resources to fully utilise their knowledge stock. Another significant feature of small businesses is that they are particularly at risk of regular staff turnover (Bell, 2022).

Small businesses continue to be highly supportive of global economies, particularly in emerging nations, where they contribute towards employment generation because they utilise more labour-intensive production

processes than large enterprises (Ayandibu and Houghton, 2017). It is projected that by 2050, Africa might face a rapid rate of urbanisation in the world (OECD/SWAC, 2020), which poses a significant development challenge, and requires innovative and African-led solutions. However, African countries, with institutional weaknesses and inadequate government support, might not be harnessing the rich potential of small businesses due to inadequate knowledge-creation strategies. Studies suggest that some African nations focus on knowledge acquisition more than context-based KC, which underutilises knowledge for increased productivity, innovation, and competitive advantage. This is because while knowledge acquisition has the tendency to be static by replicating rules, KC induces new insights, discoveries, and innovations appropriate for different contexts. While a lot of research on small businesses has been carried out on knowledge in management, relatively less has focused on how knowledge is created and how the knowledge-creation process can be managed, particularly among small businesses in emerging economies. It is recognised that knowledge can originate from not only revolutionary progress but also through a backward-oriented approach, such as learning from the research output of previous studies. Hence, the current study interrogates past scientific research findings to gain a more integrative understanding of what has been discovered about the KC pattern of African small businesses. We sought to answer the following research questions: what are the demographic characteristics of included studies? What are the trends of KC activities of small businesses in Africa? Can the past predict the future knowledge-creation landscape for African small businesses? To explore these research questions, we assumed there would be a considerable number of knowledge-creation research that:

- Focus on SMEs
- Have Africa as the study location.
- Describe KC as a process based on the applicability of the KC theory (KCT) postulated by Nonaka and Takeuchi (1995)

The next section describes the theory that informed the study.

2. Theoretical Framework

The KC theory (KCT) came into the limelight in 1995 (Nonaka and Takeuchi, 1995). Central to KCT is the process of socialisation, externalisation, combination, and internalisation, described as the SECI model, which describes a cyclical conversion of tacit knowledge to explicit knowledge and finally to new tacit knowledge to increase organisational knowledge. Over time, the application of the KCT/SECI model has been challenged. For example, we noted the argument that the SECI model ignores the context of use (Sarayreh, Mardawi, and Dmour, 2012), discountenances cultural differences, and may be too sequential to be practicable in real-life situations (Sian Lee and Kelkar 2013). However, despite the criticism, the SECI model has been applied successfully in several disciplines (Li, Liu, and Zhou, 2018; Astorga-Vargas et al, 2017) and geographical locations worldwide (Scully et al, 2013). To address some elements of the criticism, some scholars suggest considering the role of context and cultural background (Brundrett and Lungka, 2019), which provides a basis for the motivation to study KC from the lens of SMEs as a peculiar sectorial context and Africa, with its cultural differences. Premised on the findings of Adesina and Ocholla (2019); Li et al (2018); Astorga-Vargas et al (2017), the current study rests on the assumption that in exploring KC, the study's included studies might have employed the KCT approach. A critical analysis of the SECI model, its application, limitations, and implications are covered in a recent study (Adesina and Ocholla, 2019)

3. Methodology

This is a methodologically inclusive research synthesis meta-study, aimed at synthesising primary research. Therefore, the study explored the EBSCO Host database for peer-reviewed empirical studies on KC. The choice of this database was to make it possible to locate a substantial number of relevant studies on knowledge management across various disciplines. Additionally, restricting the search to a single database was to remove many potential duplication problems characteristic of using multiple data sources. The meta-synthesis was built on a systematic review of the literature. The Rayyan software was used to screen articles for the purpose of conducting a knowledge synthesis study, being a checklist for controlling the quality of studies (Johnson and Phillips, 2018).

3.1 Search Strategy

When the initial search terms were stringed to include "KC" AND SMEs OR "small business*" AND Africa, it is notable that this yielded no result, but when SMEs OR "small business*" was removed to reduce the KC to African studies, two results were found. Therefore, we decided to make the search broader by examining "KC"

studies over a 27-year period, regardless of study location or organisational sector. Thus, "KC" was used for the final search limited to open-access peer-reviewed papers published in the English language from 1995 – 2022 in academic Journals. These keywords were used as a selection criterion in titles, keywords, and abstracts. The year 1995 was the year the theory of KC was established (Nonaka and Takeuchi 1995).

3.2 Inclusion and Exclusion Criteria

373 articles were exported from Mendeley into Rayyan, out of which 115 duplicates were removed. Some articles did not include Abstract in Rayyan and were manually searched as a complementary attempt. It is worth noting here that when analysing the search results using the Rayyan software, some studies that did not explicitly address "KC" but discuss other knowledge management components that could have KC processes embedded (Figure 1) were initially considered eligible. The reason for this was to ensure rigour and that the study did not miss out on knowledge-creation processes that could be embedded in such papers due to the use of synonyms. The reasons for excluding studies are presented in Figure 1 below.

Reasons for the eligibility of certain studies	Reasons for Exclusion (100 studies)
• Knowledge accumulation • Knowledge circulation • Knowledge diffusion • Knowledge flows • Knowledge interaction • Knowledge management • Knowledge processes • Knowledge production • Knowledge spillovers • Knowledge transfer • Knowledge translation	• Bibliometric analysis • Blog papers • Cohort studies • Editorial reviews • Foreign language • Full text is not open access • Incomplete articles • Knowledge creation is missing in-text • Literature/systematic literature review • KC not in abstract or keywords • Study's focus is not relevant to our research question. • Opinion papers • Randomised control trial • Sentiment analysis

Figure 1: Reasons for the Eligibility and Exclusion of Certain Studies

To obtain the data necessary for the meta-synthesis, a coding form was developed according to the question of interest (Duriau, Reger, and Pfarrer, 2007). Fourteen (14) coding items were used: Author, title, year of publication, type of study, study location, study context, study's research question, intended contribution, methodology, data collection techniques, data analysis method, key findings, existing study's relevance to the current study, and further comments notes.

4. Results and Discussion

The search result yielded 373 articles. First, the titles and abstracts of selected articles were screened based on the inclusion criteria. Specifically, 26.8% of the papers were irrelevant, 4.8% were duplicates, and 59% were eventually discarded from the eligible studies. Remarkably, despite delimiting the language of the search results to English, three (3) papers still emerged in other languages. Summarily, while 254 papers met the inclusion criteria after the initial screening for relevant and duplicate fulltext publications, only thirty-two (32) papers were included in the review, representing 8.6% of the overall search results, and 12.6% of the eligible studies. Notably, over 80% of the retrieved results treated knowledge as an output, rather than as a process, which was the original intention of the current research (Styhre, Roth and Ingelgard, 2002; Johnson, 2002).

4.1 What are the Demographic Characteristics of Included Studies?

The search results were published in ninety-seven journals from various fields of specialisation, buttressing the widespread of knowledge management research. Most of the studies were located within Europe, followed by the USA, and the least being Africa (Figure 1). This implies the scarcity of KC studies in the African continent.

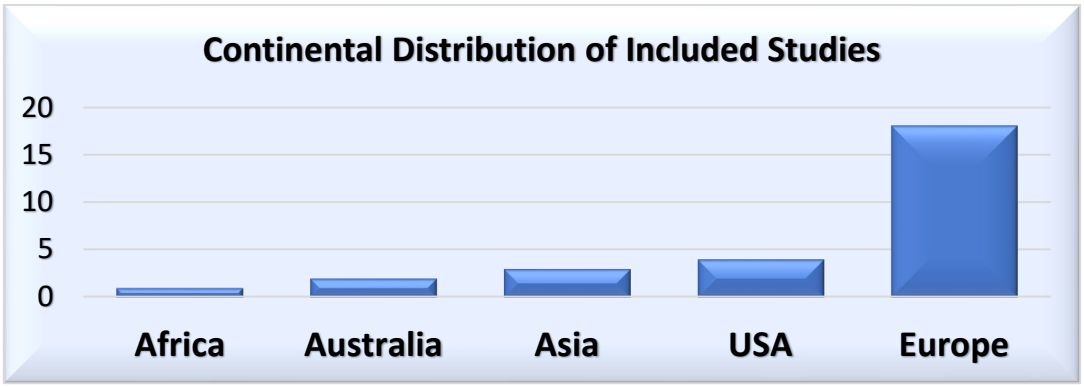


Figure 2: Continental Distribution of Included Studies

It was noted that only one (1) study originated from a small business (SME) perspective, while most were large organisations (Figure 3). This finding buttresses the need for more studies on the knowledge-creation activities of SMEs, an organisational sector that is as knowledge-intensive as HEIs and STEM (Grimsdottir, Edvardsson and Durst, 2019).

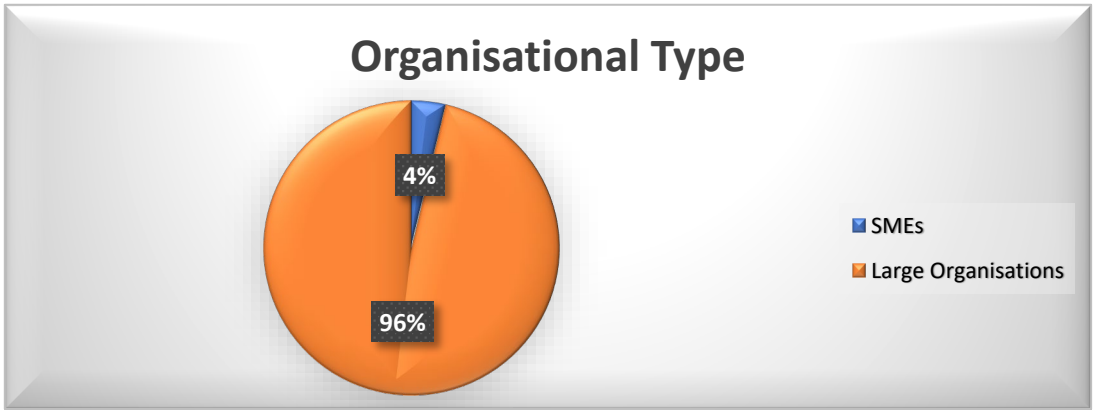


Figure 3: Organisational Distribution of Included Studies

4.2 What are the Trends of KC Activities of Small Businesses in Africa?

Notably, six (6) studies (Sales de Aguiar and Paterson, 2018; Sołek-Borowska, 2017; Heskestad, Aase and Storm, 2016; Baloian and Zurita, 2012; Travaille and Hendriks, 2010; Poissant et al, 2010) explored the SECI modes to demonstrate their KC processes, while one study (Seitamaa-Hakkarainen and Hakkarainen, 2010) utilised only the externalisation mode. Most of the studies focused on knowledge as an output rather than as a process; therefore, we settled on extracting the themes that lead to KC (Table 1) and those that enable the process, which we called facilitating conditions (Table 2). The themes from the studies are presented, not in an order of importance, but in alphabetical order, just for ease of reference.

Table 1: KC Process Themes

Methods Employed for KC Process	Author
Brainstorming; brainwriting/brainsketching/ Visual representations	Baloian and Zurita (2012); Travaille and Hendriks (2010); Poissant et al (2010); Moodysson (2008); Fong, Hills and Hayles (2007)
Collaborative analysis, collaborative learning, collaborative social efforts to solve a problem, novice-expert collaborative solutions analysis.	Shan, Ayers, and Kiley (2020); Muukkonen et al (2020); Levy et al (2016); Niemi, Nevgi and Aksit (2016); Andjelković et al (2016); Tsai et al (2013); Deken et al (2012); Travaille and Hendriks (2010)

Methods Employed for KC Process	**Author**
Data visualizations	Tilak and Glassman (2020)
Dialogues	Rambe and Bere (2013)
Face-to-face social interaction, brainwriting (knowledge externalisation using freehand writing), brainsketching (idea generation techniques using sketching); visual representations	Tanner (2018); Baloian and Zurita (2012); Duin and van den Besselaar (2011); Poissant et al (2010)
Mentoring	Collins and Winnips (2002)
problem-solving (complex problem-oriented situations in a cross-disciplinary way) deep reasoning questions and answers/discussions/feedback/interactions, project/group meetings, and contextual information sharing (novices share information about their task, and experts share information about their expertise)	Manniche, Moodysson and Testa (2017); Heskestad, Aase and Storm (2016); Andjelković et al (2016) Deken et al (2012); Baloian and Zurita (2012); Travaille and Hendriks (2010); Poissant et al (2010); Moodysson (2008)
Reflection activities	Tilak and Glassman (2020) Starodub (2019); Tsai et al (2013); Cooper (2000)
Storytelling	De Quattro (2019)

Significantly, most of the KC activities revolve around interactions, from brainstorming, brainwriting, brain sketching, to data/visual representations. Organisations engage in both formal and social interactions: dialoguing, reflections, storytelling, and collaborative activities, which can be face-to-face or virtual teams and groups, to solve organisational problems and create new knowledge.

We note, among other conditions highlighted below, the following: the role of the culture of mistake acceptance, which is not to promote mistakes but to encourage employees to share the lessons learned in order to limit the repetition of the same mistakes (Kucharska, 2022); the need to reduce distance, for instance, cognitive distance (the extent to which actors differ in their knowledge bases), social distance (the extent of relationships between actors, generally built on familiarity, friendship, and kinship. Such close relationships encourage empathy, communication, and coordination, organisational distance (such as the separation of individuals by hierarchical structures), and institutional distance (norms, rules, and values that influence how actors behave. Large institutional distances may impose serious impediments to fruitful interactions if interacting actors respond to different, even potentially conflicting, sets of incentives or values. It is also crucial that we recognize the role of digital technologies in reducing physical, social, and organizational proximities, in addition to organizing meetings to take place at locations different from employees' work surroundings, such as through shared meals in a different setting and learning arena.

Table 2: KC Facilitating Conditions Themes

Facilitating condition	**Author**
Archive for social and collective memory	Peters and Besley (2019)
Better top-down communication	Travaille and Hendriks (2010); Shan, Ayers, and Kiley (2020); Muukkonen et al (2020); Tsai et al (2013)
Collaboration networks	Hazır, LeSage and Autant-Bernard (2018)
Knowledge Communities: Communities of practice (CoPs) or Epistemic Communities	Kim (2015) ; Rambe and Bere (2013) ; Poissant et al (2010); Moodysoon (2008)
Cooperative relationships with other enterprises	Qiu, Wang and Chen (2019)
Cartography and counter-mapping tools	Starodub (2019)
Digital tools, such as clouds, online networks, social web, online instruction videos, and Web 2.0 tools	Muukkonen et al (2020); Tilak and Glassman (2020); Peters and Besley (2019); Duin and van den Besselaar (2011);
Expert-mentee relationships	Sołek-Borowska (2017)

Facilitating condition	**Author**
Face-to-face meetings.	Baloian and Zurita (2012); Duin and van den Besselaar (2011); Tanner (2018); Poissant et al (2010)
Flipcharts/adhesive post-its to record all concepts and ideas suggested	Fong et al (2007); Shan, Ayers, and Kiley (2020)
Identifying knowledge agents	Sołek-Borowska (2017)
Interdepartmental teams	Sołek-Borowska (2017)
Interdisciplinary teamwork	Muukkonen et al (2020)
Knowledge forum	Seitamaa-Hakkarainen and Hakkarainen (2010)
Learning communities	Rambe and Bere (2013); Stein (2002)
Meeting locations different workplace surroundings	Heskestad, Aase and Storm (2016)
Mistake acceptance.	Sołek-Borowska (2017)
Novice–expert consultation meetings	Deken et al (2012)
Open projects	Sołek-Borowska (2017)
Open, multichannel communication	Tilak and Glassman (2020)
Organising activities around shared "objects," such as reports, concepts, products, or services	Muukkonen et al (2020)
Podcasting exercise promotes collaborative knowledge	Tanner (2018)
Project/group meetings	Travaille and Hendriks (2010); Shan, Ayers, and Kiley (2020); Muukkonen et al (2020); Tsai et al (2013); Poissant et al (2010)
Proximity: social, cultural, and organisational	Bone et al (2020); Tanner (2018); Manniche, Moodysson and Testa (2017);
Spaces that facilitate dialogues and promote interactions	Sales de Aguiar and Paterson (2018)
Supportive cultures	Sołek-Borowska (2017)
Teamwork	Sołek-Borowska (2017)
Training and workshops	Sołek-Borowska (2017)
Trust relationships	Sołek-Borowska (2017)
Web 2.0 technologies	Lee, McLoughlin, and Chan (2008)

4.3 Can the Past Predict the Future Knowledge-Creation Landscape of Small Businesses in Africa?

Essentially, this study reflects on the best practices of other organisations and suggests that small businesses adopt the methods of KC and facilitating conditions supportive of their budget, size, and sector to enhance their KC processes. Therefore, this paper adds to ongoing discussions on the knowledge-creation strategies of organisations, particularly African small businesses.

5. Conclusion

We set out to explore the pattern of KC processes of African SMEs by assuming the existence of a substantial number of studies on KC with a focus on African SMEs/small businesses, and studies where KC is described as a process through the lens of the KC theory postulated by Nonaka and Takeuchi (1995). The initial search revealed only sixteen studies on Africa, out of which only one was eligible to be included in the final stage of the screening process. It is also notable that only one of the included studies emanated from a small business. We were aware that the KCT of Nonaka and Takeuchi has been challenged by several scholars as described in the theoretical framework assumed to guide the current study, but we went ahead to assume its usefulness to the current study because of its attested wide acceptance and usage (Adesina and Ocholla, 2019). However, we found out that out of the thirty-three included studies, only six (6) studies adopted the modes of the KCT postulated by Nonaka and Takeuchi (1995).

We acknowledge that our assumptions were not upheld, which implies an insufficient status of KC studies on African SMEs, particularly those that originate from Africans. However, the study has highlighted best practices from other industrial sectors and study locations that can be considered by African SMEs/small businesses to plan and develop their knowledge-creation activities. We were delighted to identify several facilitating conditions for such plans and development. Again, the socialisation mode of the SECI model remains relevant to almost all the research articles (Miranda and Borges, 2019; Adesina and Ocholla 2019). We observe the overlapping relationship between the methods of socialisation and externalisation. We believe this may be the reason for describing the SECI model as a continuous process, but we query the sequential nature as observed by Sian Lee and Kelkar (2013). We opine that both socialisation and externalisation take place simultaneously and that externalisation becomes distinguished only at the point of making deliberate and systematic efforts to capture the tacit knowledge for organisational use. This suggests that organisations need to pay more attention to this mode to facilitate KC and sharing, and foster innovations in line with sustainable development goal (SDG) 9. The danger of concentrating on only certain modes of the KC cycle, especially socialisation and externalisation,' was acknowledged by Nonaka (1994), so it is important that SMEs explore all modes of the KC theory.

- Recommendation
- We call for empirical testing of the application of the KC theory of small businesses, particularly in Africa.
- More studies should be done on KC processes of organisations so that best practices can be shared.
- We suggest that small businesses should be systematic in their approach to KC, as the creation of new organisational knowledge is becoming a managerial priority.
- Therefore, engaging knowledge officers to ensure effective knowledge-creation initiatives in SMEs will be an essential organisational asset.

6. Limitation

The choice of a single database host may appear insufficient. Nonetheless, it provides agenda for further research.

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Impact of Knowledge Management Process on Business Model Innovation: The Moderating Role of Wise Leadership

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Abstract: This research examines the impact of the knowledge management (KM) process on Business model innovation (BMI) via Leadership styles. The perspective of knowledge management suggests a knowledge process architecture of acquisition, conversion, application, and protection. This study also proposes to examine the moderating role of wise leadership in the relationship between the KM process and BMI. We empirically analyze a sample of 200 managers in Tunisian banks, the hypothesized relationships were tested through the maximum likelihood method (LISERL). The findings of the study reveal that wise leadership has a positive effect on the KM process. The authors encourage organizations to use this style to maximize the effect of leadership on KM. Moreover, wise leadership has been evidenced in this research as having part moderating effect between KM process and BMI. The authors also recommend financial companies increase their innovation activities through the BMI.

Keywords: Wise leadership, Knowledge management process, Business model Innovation performance, North African context

1. Introduction

The business world is becoming more complex due to innovation and the accelerating digital transformation. The best way to keep up with this constant change effectively is not by expecting training to upgrade the right tools, but to cope by improving our knowledge (Castro & Moreira, 2023). To do this, companies have to access effective innovations and acquire further knowledge. They also have to identify the required knowledge and effectively manage it to successfully achieve their goals in such a market (Qandah et al. 2020; Zheng et al. 2011). In this sense, Sreenevas et al. (2018) argue that successful firms are those that constantly create new knowledge, disseminate it widely throughout the organization, and rapidly incorporate it into new technologies and products.

To grow, firms have to further work on their resources in an innovative way (Kaur, 2019) bydeveloping specific knowledge that ensures evolution and performance in an increasingly changing market. Therefore, the company needs to nurture its innovation potential (Lei et al. 2019; Sengphet et al. 2019). Innovation must be viewed in these different technical, social, and managerial dimensions to extend to business models as well. For this purpose, some enterprises have started to explore new strategies to gain competitive advantage (Schneider and Spieth, 2013), and this is achieved through business reconfiguration by either innovating one or more components of their business model (BM), or the whole model (Lambert and Davidson, 2013; Clauss et al., 2019). Thus, the new "BusinessModel Innovation (BMI)" approach has emerged which demonstrates the company's innovative actions by simultaneously considering all internal and external factors (Schneider and Spieth, 2013).

Leadership has been regarded as a key factor to impact innovation (Rosing et al. 2011; Ding et al. 2019). Earlier research has shown that successful innovation requires the leader's permission and support (Elenkov et al. 2005).While Phronesis ("wisdom practices") is a complex philosophical concept, management researchers have begun to restudy it (Küpers, 2016; Ding et al. 2019). Nonaka et al. (2011) have identified six capabilities of the Phronesis leader (wise leadership): 1) to make a judgment based on the organization's social value; 2) to have a keen perception; 3) to create the opportunity to share (create a context for sharing); 4) to have communication skills; 5) to exercise political power; and 6) to cultivate others. Therefore, this article would use these characteristics to test the impact of this wise leader type on the relationship between the KM process and BMI.

At the organizational level, some knowledge is useful for problem-solving (Leonard and Sensiper, 1998). Theoretical and empirical methods have revealed that knowledge management (KM) capabilities positively affect innovation (Chen and Huang, 2009; Du Plessis, 2007). Some researchers, however, argue that the lack of a sharing culture can impede the practice of knowledge management in organizations (Weir and Hutchings, 2005). Based on Nonaka's theory, wise leadership has been illustrated to address the practical process of KM (Nonaka & Toyama, 2007).

Given that Ding et al. (2019) use empirical methods to prove that the KM process has a positive impact on innovation performance, according to the logic derivation, this study proposes the hypothesis that the wise leadership of organizational members has a significant relationship on organizational innovation performance and the KM process. Thus, this research will test the relationship between the KM process and BMI as well as the moderating role of the wise leader.

2. Theoretical Background

2.1 KM Process

To adapt to the ever-changing environment, the organization must develop dynamic capabilities allowing it to capture and reconfigure itself through transformational activities (Eriksson, 2013). Dynamic capabilities have been defined as "*the ability to integrate, build, and reconfigure internal and external competencies to cope with rapidly changing environments*" (Teece & al. 1997). According to Zheng et al. (2011), the term dynamic knowledge-based capabilities is used to provide organizations with the ability to acquire, generate, and combine knowledge resources to detect and explore changes in the environment and to cope with changes. Using this definition, dynamic knowledge-based capabilities have multiple dimensions which are knowledge acquisition capabilities, knowledge generation capabilities, knowledge sharing capabilities, and knowledge combination capabilities (Patrick & Dotsika, 2007; Zheng & al. 2011; Cao & Xiang, 2012). In other words, these capabilities allow the organization to acquire knowledge from the external environment (market, competitors, partners, etc.) create and share knowledge within the organization, based on the skills and experience of its employees and finally combine and apply external knowledge (Quintane & al. 2011; Zheng & al. 2011; Cao and Xiang, 2012; Al-Debei & al. 2013;Denford, 2013; Qandeh & al. 2020). In this research, we have opted to work with thecategorization of Gold et al. (2001):

- Knowledge acquisition: this step can refer to knowledge creation, knowledge exploration, knowledge production, knowledge generation, knowledge derivation, knowledge construction, knowledge discovery, knowledge collaboration, knowledge storage, and knowledge brokerage (Ouyang 2015; Pavlou and El Sawy 2006; Wu and Hu 2012; kaur, 2019). Knowledge acquisition capability reflects an organization's ability to introduce new knowledge into the organization either by facilitating knowledge flow from outside to a firm's internal stocks (obtaining knowledge from various sources) or by using existing knowledge ininnovative ways (Alrubaiee and al. 2015; Kaur and Mehta 2016; Malkawi and Rumman 2016)
- Knowledge conversion: To truly use knowledge to capture innovative opportunities, firms need to further convert and apply acquired knowledge (Cohen and Levinthal, 1990). This processing step involves the filtering of new knowledge (Gold et al. 2001). The effectiveness of these conversion-oriented processes depends on a firm's internal management capabilities and the firm's ability to value new external knowledge (Lane and Lubatkin, 1998). The conversion of new knowledge into organizational knowledge terms and knowledge stores makes external knowledge use-ready (Lane and Lubatkin, 1998);
- Knowledge translation: The process is known by several names and also refers to various concepts: transfer, diffusion, sharing, dissemination, exchange, implementation, integration, knowledge mobilization, etc. (Djikers & al. 2012; Oborn, 2012; Joseph, 2013; Ruest, 2019). It includes all the stages of knowledge production, synthesis, exchange, dissemination and sharing (Goyet, 2014; Davenport, 2019). It also refers to the firm's ability to use knowledge for problem-solving, monitoring decisions and directed actions (Waribugo, Ofoegbu, & Akpan, 2016; Maedche et al. 2019) ;
- Knowledge protection: this stage is designed to protect knowledge within an organization from illegal or inappropriate use or theft (Dehghani & al. 2014; Gold & al. 2001; Kaur and Mehta 2016a; Kimaiyo & al. 2015; Lai 2013; Nguyen 2010; Nguyen and Neck 2008; Patil and Bamnote 2015; Kaur, 2019). For a firm to generate and maintain a competitive advantage,its knowledge needs to be protected (Liebskind, 1996; Gold & al. 2001).

2.2 Business Model Innovation

The rapidly developing digital technologies have changed the business environment and have led to new means for firms to conduct innovation activities (Amit and Han, 2017; Paiola and al. 2021). Some new business models have significantly changed the rules of the game in various sectors (e.g. Uber in the cab industry,

Netflix in film, and Airbnb in lodging) (Teece, 2018). As a result, companies are compelled to regularly change and innovate their innovationstrategies (Amit & Zott, 2015).

Generally, the term innovation is associated with products and services, technology, processes, and management (Visnjic Kastalli & al. 2016). Business model innovation (BMI) differs from the other forms of innovation owing to its multi-dimensionality (Christensen & al. 2016). In terms of breadth, BMI (Business Model Innovation) can be explained at both macro (i.e., the novelty of the innovation in the market or industry) and micro (i.e., the novelty of the innovation to the firm) levels (Taran & al. 2015). In terms of depth, BMI involves a transformational change in the company's business logic and organizational culture (Hock et al. 2015).

The BMI functions as a key driver to improve a firm's innovation capability. However, it should be noted that, unlike product and service innovation, BMI is about the various innovative activities of a company such as processes, structure, delivery, and interaction performed to achieve sustainable competitive advantage and higher performance. Firms creating unique BMI can achieve higher returns four times than firms that focus innovation only on products and services (Anwar, 2018) since according to Bashir and Verma (2017) BMI is a significant predictor of competitive advantage. So BMI enables firms to create new activities that go beyond product and process innovation (Osiyevskyy and Dewald, 2015) and has been identified as a source of sustainable competitive advantage (Tallman, Luo, and Buckley, 2018).

2.3 Wise Leadership

The leadership concept is one of the most studied concepts by management researchers (Al Amiri & al. 2020). Winston and Patterson (2006) propose an integrative leadership definition –*A leader is one or more people who select, equips, trains, and influences one or more follower(s) who have diverse gifts, abilities, and skills and focuses the follower(s) on the organization's mission and objectives, causing the follower(s) to willingly and enthusiastically expend their spiritual, emotional, and physical energy in a concerted coordinated effort to achieve the organization's mission and objectives."*

Thus, leadership enables management teams to collaborate effectively to drive change and execute strategy, develop processes, skills, mindsets, and tools to jointly navigate change, trigger innovation throughout the organization, manage talent, and create the right culture. In 1978, Burns classified leadership into two types: transactional and transformational leadership (Elenkov & al. 2005). Kuhnert and Lewis (1987) simply explain that transactional leaders practice trading with workers based on their performance, and transformational leaders impact staff by changing their objectives. Additionally, transformational leadership approaches can guide followers to sacrifice personal profits for collective organizational advantages, and this method demonstrates high-performance achievement (Kuhnert & Lewis, 1987). Yet, some researchers suspend the roles of leaders in organizational outcomes, as outcomes may depend on several conditions that simply rely on leadership (Elenkov & al. 2005). Upper echelon theory argues that organizational outcomes sometimes depend on leaders' level of discretion (Davies & Davies, 2004; Hambrick & Finkelstein,

Modern researchers in the field of wisdom (e.g. Bachmann and al. 2018; Gibson 2008; Holliday and al. 2007; Jeannot 1989; Korac-Kakabadse and al. 2001; Küpers and Statler 2008; Sasse-Werhahn et al. 2020; Yang 2011) argue that wisdom practices can open up new paths of exploration for academics and practitioners, particularly in the field of management and leadership. Practically wise leadership refers to the optimal integration of the conflicting demands of ethics and effectiveness in organizations facing complexity and uncertainty (Holliday and al. 2007; Küpers and Statler 2008) and requires the ability to foster practical wisdom in others and inspire them into action (Rowley and Gibbs 2008).

In contrast to strategic leadership theory, which mainly focuses on the organization top managers (Vera & Crossan, 2004), the wise leadership is a type of leadership that comprises middle and senior managers (Nonaka, Hirose, & Takeda, 2016). Nonaka et al. (2016) point out that senior management cannot detect all the changes and opportunities that frontline workers can. Promoting employees' managerial awareness strengthens the collective awareness of the individual to participate in organizational management and practice the concept of "management by all" (Adler and Hiromoto, 2012). Therefore, wise leadership is not limited to top management, with most focus on mid-level managers (Nonaka et al. 2016).

3. Research Hypotheses

3.1 KM Process and BMI

The BMI literature has been mainly related to the dynamic capabilities of KM (Yun &t al. 2015; Teece, 2018; Rayees and Makhmoor, 2019; HockDoepgen & al. 2021). KM permits the identification, formalizing, sharing, enriching, and value of knowledge within the organization, especially critical and strategic knowledge. All this occurs to foster the capacity for innovation through better productivity of new knowledge (Boboughazala and Ermine, 2007; Christian Elongé, 2019). Indeed, the continuous acquisition of new knowledge is essential to identify innovative opportunities and to guide the strategic positioning of the company. In addition, the acquisition of external knowledge can be used to find new partners, suppliers, distribution channels, and new customer relationships (Zott and Amit, 2010; Miroshnychenko et al. 2021). The knowledge conversion process is also important for BMI (HockDoepgen et al. 2021). Indeed, firms with knowledge integration capability can link external and internal knowledge (Grant, 1996; Kleinschmidt & al. 2007). The more advanced this capability, the better firms are at coordinating and integrating knowledge from various sources into their BM (Kraaijenbrink, 2012; Subramaniam, 2006). In this sense, Makhmoor and Rayees (2019) find a positive link between the knowledge conversion process and BMI. For them, knowledge conversion is the main condition for innovative BMs.

The BMI also depends on the nature of the knowledge, i.e., on how tacit knowledge contributes to the construction of the BM and how explicit knowledge facilitates the creation of successful BMs. Each company should consider what type of knowledge assets would be essential to implement an innovative business model (Lee & al., 2004). In this sense, Malhotra (2001), state that companies operating in an ever-changing business environment must be able to apply new knowledge, and continuously renew existing archived knowledgeto improve their BM and keep up with dynamic changes in the business environment (Makhmoor and Rayees, 2019). In other words, the application process implements andadjusts the operational and strategic activities of the current BM to solve problems and develop new technologies and innovations in the BM (Valentim & al. 2015).

The protection process guards against imitating innovations and inappropriate use of knowledge. In this regard, Schweizer (2005) explains that "dynamic capability can be seen as the ability to seize new opportunities and change the existing business model by reconfiguring the Value Chain constellation and protecting knowledge and skill assets". Based on these arguments we propose the following hypothesis:

Hypothesis 1: The KM process positively impacts BMI.

3.2 Wise Leadership and KM Process

Since the 1990s, KM has become an emerging discipline in business and academic fields (Donate & de Pablo, 2015). Leaders manage, practice organizational KM and monitor progress effectiveness (Donate and de Pablo, 2015; Nguyen and Mohamed, 2011). Dynamic capability acts as an innovative value for organizations to create a development plan (Nonaka et al. 2016).

Some scholars find that the lack of a sharing culture impedes knowledge sharing and transfer in organizations (Guaderrama, 2016; Weir & Hutchings, 2005). Connelly et al, (2012) indicate that the organizational knowledge dissimulation phenomenon is present, and they also show that interpersonal distrust is related to dissimulation behaviors. Wise leaders acquire contextual and universal knowledge via experience and training (Nonaka & Toyama, 2007). Wise (phronesis) leadership, in the distribution model, flexibly adapts the context to create a place for sharing and emphasizes that knowledge creation may require cooperation (Nonaka et al. 2016; Nonaka and Toyama, 2007). In other words, the distribution model of wise leadership emphasizes the sense of participation of organizational members, which can increase their opportunities for interaction. Therefore, after comparing the KM dilemma practice and the characteristic of wise leadership, this article assumes that wise leadership can have the positive function of creating a space for organizational knowledge sharing, encouraging employee participation, and increasing team spirit to improve the effectiveness of knowledge transfer. Thus, we propose this second sub-hypothesis:

Hypothesis 2: Wise leadership positively impacts the KM process.

3.3 Wise Leadership and BMI

Previous academic contributions summarize two types of organizational innovation, one is product innovation and another is business mechanism innovation (Elenkov et al. 2005; Huffman and Hegarty, 1993). While

leaders are not required to manage all business details, innovative leaders can excel in creativity and discipline, and they could perfectly identify and seize opportunities (Bel, 2010; Shotter & Tsoukas, 2014).

In the same vein, organizational theories have been widely discussed regarding firms' approaches to adapting to environmental and technological change (Fageberg, Mowery, & Nelson, 2004; Tushman & Nelson, 1990). Damanpour (1991) states that the use of innovation creates changes in organizational structure and function. Eco-innovation, similarly, addresses the sustainability of three types of changes such as social, institutional, and technological innovation (Rennings, 2000). To adapt to changes, if leadership is flexible, action would become fast and effective (Nonaka and Toyama, 2002). Considering comprehensively the benefit of wise leadership on organizational effectiveness, this research asserts that wise leadership can play a positive role in improving organizational innovation performance (Elenkov et al. 2005; Nonaka and Toyama, 2007). Accordingly, we propose the following hypothesis:

Hypothesis 3: Wise leadership positively impacts BMI.

3.4 The Moderator

The previous hypotheses present the links between the KM process, wise leadership and BMI. Hypothesis 1 proposes that the KM process has a positive effect on BMI. Hypotheses 2 and 3 state that wise leadership positively relates to the KM process and BMI. Specifically, wise leadership accelerates KM practice (Donate & de Pablo, 2015; Nguyen & Mohamed, 2011), and impacts organizational technical and administrative innovation (Chen & Huang, 2009). We argue that wise leadership has a moderating effect on the relationship between the KM process and BMI. Accordingly, we propose the following hypothesis:

Hypothesis 4: Wise leadership acts as a moderator between the KM process and the BMI.

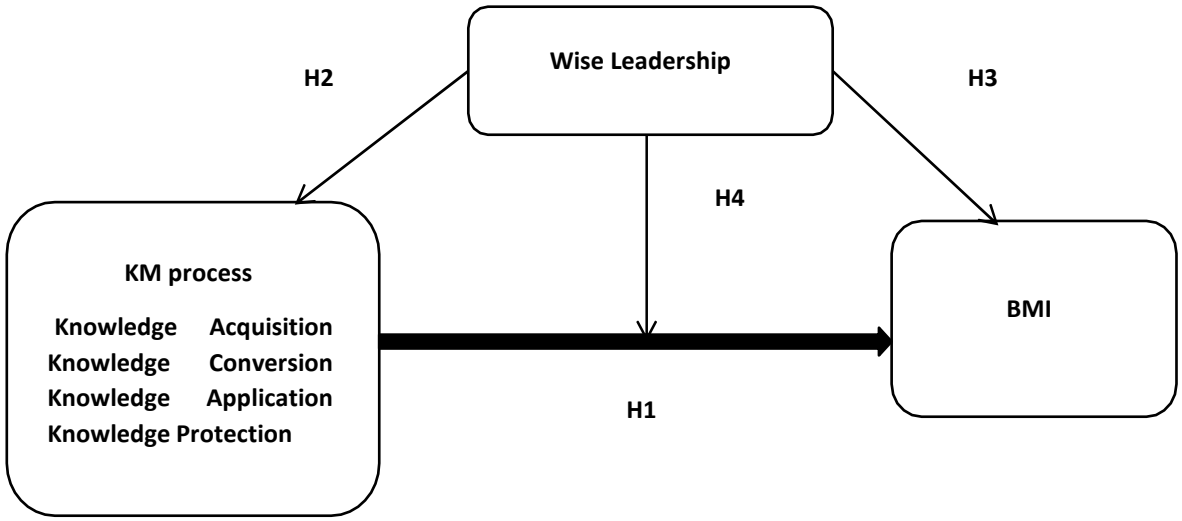


Figure 1: Research Framework

4. Research Methodologies

4.1 Sampling

A questionnaire is utilized, and we examine the questions before issuing. After discussion andmodification, the survey is distributed to the managers of Tunisian Bank. 283 people are requested and informed for the survey, while the total amount of respondents is 200.

4.2 Measures

The four KM dynamic capabilities constructs are knowledge acquisition capabilities (9 items), knowledge conversion capabilities (5 items), knowledge application capabilities (6 items) and knowledge protection capabilities (4 items). This dynamic KM capabilities construct is developed by Gold et al. (2001) and reused by Heisig, (2009), Liebowitz and Megbolugbe (2003), Smith (2006), Jasimuddin and Naqshbandi (2019) and Hock-Doepgen, et al. (2021).

The BMI measurement scale is derived from the work of these researchers George and Bock (2011), Karimi and Walter (2016), Anwar (2018), Anwar and Shah (2020), and Al-Nimer et al. (2021). It includes questions

about whether the firm focuses on existing or new activities ineach of the eight components of the business model.

Wise leadership is considered the moderating variable in this research. Nonaka et al. (2016) state that there are 6 items on wise leadership (Nonaka et al. 2016; Nonaka & Takeuchi, 2011).

We use the five-point Likert-type scale because based on the literature review a five-point scale increases the response rates and the quality of responses, which makes it easier for respondents to complete the questionnaire (Guo et al. 2015; Suqin Liao et al. 2018; Anwar, 2018; Karimi and Walter, 2016; Al-Nimer et al. 2021). Table 1 illustrates the details of the question numbers, which are designed to measure the variables in this research.

Table 1: Reliability Statistics

Items	N of Questions	Cronbach's Alpha
Knowledge Acquisition	9	.896
Knowledge Conversion	5	.920
Knowledge Application	6	.915
Knowledge Protection	4	.869
BMI	8	.946
Judge goodness	2	.747
Create shared context	4	.862
Grasp the essence	2	.831
Communicate arts	2	.873
Exercise political power	3	.896
Foster phronesis	2	.855

4.3 Data Analysis and Results Presentation

51 questions are designed for the questionnaire, 4 of which deal with respondents' backgroundinformation. The Cronbach's alpha value of the 47 residual subjective questions is above 0.8. In social science studies, 0.600 of Cronbach's alpha value is the acceptable line (Liao et 8al. 2007). Therefore, it means that the situation of data reliability is acceptable as the usual cases. Table 1 displays the results of the item tests. The minimum Cronbach's alpha value is 0.747, which is above the acceptable line (0.600), so the reliability of the data meets the requirement of general social science research.

This article uses the Kaiser-Meyer-Olkin and Bartlett test to examine the data set. The standard level of acceptance requires a KMO value of at least .600, and "Bartlett's test of sphericity" requires significant testimony (Ismail, Mohamad, Mohamed, Rafiuddin, & Zhen, 2010). The results of the KMO value are greater than 0.8 in this research, and "Bartlett's sphericity test" is significant ($p < 0.001$). Thus, the data set in this study is also satisfactory for factor analysis.

5. Hypothesis Test

Our model is evaluated using structural equation modeling (SEM), which is a diverse set of algorithmic and statistical models and methods that allow for equivalences and relationships between concepts (latent or dependent variables) and quantitative data (observables or explanatory variables). This capacity to make concepts resemble data has made SEM modeling a privileged tool in the social sciences (sociology, psychology, marketing, etc.) (Steenkamp and Bau4.3. mgartner, 2000).

Indeed, this tool can be used to analyze the effect of KM processes on BMI as it adjusts the types of factor analysis and regression, helping the researcher to examine the relationships between measured variables and latent variables as well as between latent variables simultaneously (Hair et al. 2014; Zhou et al. 2016). In this regard, two models constitute the structural equation model (SEM) according to Al-Emran et al. (2018): the MeasurementModel "refers to the outer measure of the model representing the relationship between the latent construct (i.e., variable or factor) and its relevant indicators (i.e., items or measures)" and the Structural Model "refers to the inner model specifically the assessment of the internal structure of the model where the

relationships between the constructs themselves are measured." To examine the causal relationships of the model, the measurement model and structural models can be used as descriptive or explanatory methods (Roussel et al. 2002). In our study, we identify only one type of measurement model, namely reflexive measurement, which means that all indicator items are caused by the same construct.

Table 2: Testing of Direct Effects

Hypothesis	Estimation	S.E	C.R	P	Signification
H1. The KM process has a positive impact on BMI.	.573	.074	7,789	0,000	Significant
H2. Wise leadership has a positive impact on the KM process	.648	.080	7,773	0,000	Significant
H3. Wise leadership has a positive impact on BMI.	.663	.067	7,743	0.000	Significant

This table reveals that all direct effects have a statistical value T (C.R) greater than the threshold of 2 and significant at a P error of 5% (Joreskog and Surbom, 1996). Thus, these results help to confirm the hypotheses (H1, H2, H3). In other words, if organizational members are endowed with a strong ability to create knowledge-sharing opportunities in a wise leadership context, this would significantly improve the organization's BM innovation performance.

Table 3: Testing of Indirect Effects

Hypothesis	Estimation	S.E	C.R	P	Signification
H4. Wise leadership actsas a moderator between the KM process and BMI.	.558	-	-	0,003	Significant

Based on Tables 3 and 4, the moderation effect hypothesis is significant with a p<0.05. Therefore, wise leadership plays a moderating role in the relationship between the KMprocess and BMI.

Table 4: Confirmatory Factor Analysis

Model	χ2	*df*	Δχ2	Δ df	RMSEA	CFI	SRMR
Factor Model	841.65	421	.074	-	0.05	0.92	0.06
Factor Model [a]	1487.98	433	.080	423.55*	0.1	0.82	0.09
[a]Combining all items *p<0.001							

6. Discussion

Based on our empirical study, the relationship between dynamic KM abilities and BMI is significant (H1). We find that knowledge application, conversion, application, and protection capabilities positively impact BMI. This found positive impact does not align with the results of Zott and Amit (2010) who note that the knowledge acquisition process identifies new KM opportunities that introduce new activities, connect partners in innovative ways, and change the governance of activities along the supply chain. That is, for these, new knowledge acquisition capabilities are critical for BMI (Von Delft et al. 2019; Hock-Doepgen et al. 2021; Miroshnychenko et al. 2021).

Our results also suggest that Tunisian banks have a process to convert knowledge into new product or service design, which promotes their ability to integrate important knowledge into WB innovation agreeing with

Makhmoor and Rayees (2019) who find a positive link between the knowledge conversion process and BMI. In their view, knowledge conversion is the main condition for innovative BMs. For the knowledge application process, we also find a positive link between it and BMI. Indeed, the banks studied, use knowledge in the development of new products and services and the adjustments of their strategic orientation. This process also implements and adjusts the operational and strategic activities of the current WB to solve problems and develop new technologies and innovations in the WB (Valentim et al. 2015; Farooq, 2016; Makhmoor and Rayees 2019).The last dimension of dynamic KM capabilities is related to knowledge protection. According to our results, the knowledge protection process proved to have a positive effect on BMI. Thisresult is reflected in the fact that banks provide good incentives for knowledge protection.

Additionally, this research proves that wise leadership has a positive relationship with BMI and according to the illustration by Nonaka et al. (2016), wise leadership has a positive relationship with organizational innovation performance. Wise leadership focuses on middle- level managers; hence the research results indicate that the middle managers' leadership has positive relations with organizational performance. Both top managers and middle managers have formal positions in organizations, however, the employees' status competition theory illustrates that some informal status corresponds to people's prestige and reputation (Van Leeuwen & Täuber, 2011). Therefore, in future studies, if the researcher hopes to explore the human factors in innovation or knowledge management, both formal and informal organizational members' status is suggested for further study.

7. Contributions, Limitations, and Suggestions for the Future Studies

Firstly, the findings indicate the relationship between wise leadership and BMI. While the empirical research results of this paper show the 6 abilities of the wise leadership of Nonaka's theory, only the ability to create the sharing context has been proved to have a significant positive impact on BMI. Wise leaders encourage organizational members' sharing and exchanging of their knowledge and experience via creating places and opportunities. According to our research results, this collective wisdom may promote the enterprise's innovation ability.

Secondly, the research contributions indicate that the KM capabilities including knowledge acquiring, conversion, application and protection have been evidenced to have a significant positive function on BMI. In other words, these conclusions fully demonstrate the role of KM capability in the corporation's innovation. Not only does the technical innovation require efficient KM to support the breakthrough of the existing technology, but also the organizational administration expects new ideas for sustainable development.

Thirdly, the existence of the moderating effect of wise leadership has been evidenced in this research, and the KM process may need to impact BMI via the leadership channel. If we metaphorize the wise leader as a warrior fighting and competing for organizational innovationand development, the ability of knowledge management would be their military hardware. Hence, the KM capability's bridgework cannot be ignored.

However, several limitations cannot be ignored in this paper. First, our data are cross- sectional, and therefore causality cannot be guaranteed. Yet, our theoretical arguments support the ordering of our variables as shown in our theoretical model. Still, future research would benefit from the use of longitudinal and/or experimental study designs. Second, we tested our hypotheses with a specific sample of financial service employees, which limits the generalizability of our findings. Although we believe this sample is an interesting and important context to study wise leadership, future research would benefit from replicating our findings using a sample of participants from a variety of contexts. Third, same-source bias could be a concern in that our antecedent and moderator variables are rated by the same source. Finally, we encourage employees to participate in our research by offering incentives. Although past research suggests that financial incentives improve response rates, without biasing results (Singer and Ye 2013), this may not be true in all contexts. Future research could consider replicating our results within the financial services, without the use of incentives, to determine whether results vary.

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Appropriately Managing Knowledge in Romanian Entreprenuerial Businesses: Finding Balance in Restructuring Companies

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Abstract: In light of the global economy transformation and the several crises affecting the world, streamlining and reorganization of companies' activities is a priority. We posit that concentration of knowledge and its use in companies for short term gains can lead to misguided economic behavior, crisis and insolvencies coupled with low probability of successful restructuring. In turn the success of restructuring is dependent on cohesive knowledge management while dispersed knowledge management can, at most, prolong the economic life of a company and not save it from demise. We analyze the impact and lack of impact that knowledge and its guided/misguided management can have on Romanian companies, ex ante and ex post insolvency procedures. We chose both an exploratory and explanatory case study approach of Romanian companies affected by economic crisis that underwent various insolvency stages, tracing the use of knowledge and its different practical deployment to the decision-making processes and their outcomes. We review the causes that lead to the economic crisis and subsequent insolvency contexts. We compare the use of knowledge by the companies' leadership against similar cases in other jurisdictions and we identify patterns of successful and unsuccessful application of knowledge management. Next, we investigate the effects of dispersed knowledge management in the early insolvency stages, focusing on the reorganization phase identifying gaps and discussing potential solutions. The results suggest, as they apply to the researched case studies, that both concentrated and dispersed knowledge management within distressed companies do not lead to positive outcomes and a balanced approach to knowledge management is more prone to provide effective and viable restructuring. The article explores several knowledge management theories and various academic research as they relate to the decision-making process for Romanian companies in distress and expands the academic universe as it relates to knowledge treatment in economic crisis. The results of our research and the potential solutions discussed can be further developed into a best practice guidance or a practical model to be used both by academics and practitioners as well.

Keywords: Knowledge management, Restructuring, Insolvency, Reorganization, Crisis management

1. Introduction

The use of Knowledge Management in the context of transformations/reorganization of companies, due to numerous crises, is increasingly important. Despite this importance, it is noted that this area is still little explored and there are many possibilities for academic research. From the point of view of companies' reorganization process and management of knowledge, there are opportunities related to the analysis of case studies in companies in Romania.

The financial crisis that started out in the US in 2007 found its way to Romania at the end of 2008 and began really causing major disruptions in the domestic economy in early 2009. The real economy which, in Romania is primarily driven by industry sectors and consumption took a severe hit. Businesses involved in tourism, construction, agriculture, food processing, manufacturing and other industrial products suffered cash shortages, problems with the supply chain and acquiring raw materials as well as the need to optimise costs. This macro-economic event took many business owners by surprise although the crisis was unfolding overseas for almost two years. The information, was there but few chose to transform it into knowledge and act accordingly to steer the direction of their business to safer grounds.

Moreover, organisations such as the ones that we are going to discuss subsequently, have chosen to take major risks in ignoring the signs of distress, in handling knowledge in an ineffective way and choosing to use the available knowledge to elude their business partners, financiers and other stakeholders involved.

The researched cases discussed below are all insolvency cases. We explore how knowledge was managed and argue whether knowledge could have been used more effectively. We also explore whether

Our research is structured in 7 parts, the first part includes the literature review, secondly the case background, thirdly, the methodology used, fourthly, the findings our our research, then the conclusions drawn, practical implications, limitations and further research.

2. Literature Review

We've investigated the academia discussion on types of knowledge and the classifications done by Nonaka, Boisot, Chase and Roos (1997) and Demarest (1997)

In their paper entitled "A critical review of knowledge management models" Rodney Mc Adam and Sandra McCreedy discuss three primary Knowledge Management Models: "Knowledge Category Model" (a concept developed by Nonaka and Takeuchi, 1995), "Intelectual Capital Model" (Chase R.L. (1997), Socially Constructed Models , initially developed by Clark and Staunton's (1989) and later on perfected by Demarest (1997).

The "Knowledge Management Category Model" developed by Nonaka(1997) maintains that knowledge consists of tacit and explicit elements. The model postulates the existence of transformation processes: Socialization (everyday comradeship), externalization (formalising a body of knowledge), internalization (translating theory into practice) and combination (combining existing theories) (Mc Adam, R., McCreedy, S, 1999).

Boisot's model, cited by McAdam R. and Mc Creedy S. (1999) in their paper, considers knowledge within an organization as either codified and uncodified and as diffused or undiffused, Boisot uses the term "codified" to refer to knowledge that can be readily prepared for transmission purposes (e.g. financial data). The term "uncodified" refers to knowledge that cannot be easily prepared for transmission purposes (e.g. experiences). If knowledge is categorized as both codified and undiffused, then the knowledge is referred to as proprietary knowledge. In this case knowledge is prepared for transmission but is deliberately restricted to a selectively small population, on a need-to-know basis (e.g.projected profits, share price issues) (McAdam R., McCreedy S., 1999).

In our research paper, we explore via the 3 case studies, this type of knowledge element which becomes proprietary not because of its intrinsic characteristics but because the organizational leadership makes it so. We reveal similar patterns in handling knowledge and in lacking knowledge and business acumen.

McAdam and McCreedy purport that the "Socially Constructed Model of Knowledge Management" ("SCMKM") views knowledge as intrinsically linked within the social and learning processes of the organization (McAdam R., McCreedy S., 1999). These model predicates on the social construction of the knowledge concept Demerest (1997), an adaptation of Clark and Staunton's (1989) model. Demerest sees knowledge management as an iterative process that begins with "knowledge creation", follows with "knowledge dissemination", "use" and and finally it culminates with "knowledge embodiment" (McAdam R., McCreedy S., 1999).

The iterative characteristic of the "social model" highlights the importance of multiple-way- interaction in the process of knowledge formation, knowledge transfer and its use. In all its practicality, knowledge management is not a sequential, unidirectional process, but rather a recursive phenomenon.

Further, we review and explore through our case studies, starting from the initial Nonaka model (Nonaka 1997) the knowledge classifications present in the academic literature and its reverberations in the business world. We analyze the definitions and traits of the tacit and explicit knowledge as they are present in the academic literature, and subsequently we trace

The *tacit* type of knowledge was originally defined by Polanyi in 1966. It is sometimes referred to as know-how (Brown & Duguid 1998) and refers to intuitive, hard to define knowledge that is largely experience based. Because of this, tacit knowledge is often context dependent and personal in nature. It is hard to communicate and deeply rooted in action, commitment, and involvement (Nonaka 1994).Tacit knowledge is also regarded as being the most valuable source of knowledge, and the most likely to lead to breakthroughs in the organization (Wellman 2009). Gamble & Blackwell (2001) link the lack of focus on tacit knowledge directly to the reduced capability for innovation and sustained competitiveness.

In regards to Tacit Knowledge, management practices and leveraging of tacit knowledge from employees and top managers is fundamental for the organization's competitive success (Cheryl Marie Cordeiro-Nilsson and Suliman Hawamdeh, 2010). Knowledge sharing transforms the culture of

> *''You're the boss you should decide'' to one that ''No we have to talk about it and we have to decide together'' (Cheryl Marie Cordeiro-Nilsson and Suliman Hawamdeh, 2010).*

The *"explicit"* type of knowledge is formalized and codified and is sometimes referred to as "know-what" (Brown & Duguid 1998). It is therefore fairly easy to identify, store, and retrieve (Wellman 2009). This is the type of knowledge most easily handled by KMS, which are very effective at facilitating the storage, retrieval, and

modification of documents and texts. Explicit knowledge is found in: databases, memos, notes, documents, etc. (Botha et al. 2008)

Perusing the academic literature, we've identified that in restructuring cases, certain authors are focused on analyzing the transformation of tacit into explicit knowledge. In his article entitled "Innovative application of knowledge management in organizational restructuring of academic libraries: A case study of Peking University Library", author Long Xiao ascertains that in restructuring cases, management emphasizes work on user knowledge and less on internal knowledge management (Xiao, 2020). Knowledge management design should be approached in a wholistic manner, maintains the author, considering the human orientation and the knowledge stream system based on a knowledge lifecycle (Xiao, 2020).

3. Case-Study Background

The below developed case-study research discussion is divided into two main areas:

Area 1: Company's Brief Activity Description;

Area 2: Information and Knowledge Architecture.

Area 2 further addresses the following sub sections: "Knowledge Management Process in Review", "Types of Knowledge" (Explicit and Tacit) based on the classifications identified during the literature review.

CASE 1- BEYLER SA – A METAL DOOR MANUFACTURER:

Brief Activity Description:

The first case subject to our research is *Beyler S.A. a metal-door manufacturer*, ranked number two in 2008 in Romania owned by Turkish entrepreneurs. We delve into understanding what deterministic role, if any, knowledge handling played as strategic causes of insolvency.

Based on existing judicial evidence, Beyler's causes of insolvency were: lack of financial control, engagement in large projects, decrease in demand for metal doors as a consequence of the financial crisis; in short a series of unfortunate strategic and tactical decisions.

Chronologically, it took a year for a reorganisation plan to be approved and two years until the causes for insolvency were finally clarified. Meanwhile, sales decreased by 89% y-o-y and demand could not be satisfied given the lack of cash flows necessary to acquire raw and auxiliary materials. The company found itself unable to service the existing debt and pay off its critical suppliers. Given the precarious financial state, Beyler filed for insolvency protection in April of 2009.

In the following paragraphs we briefly discuss Case 1 knowledge management context and its implications for the organization.

While overseas, the real estate bubble burst caused immense damage to the US economy also affecting other parts of the world.

In Galati, Romania the company's owners decide to invest in developing a real estate ensemble of apartment buildings. The overall investment value amounted to 70 million EUR, a large project that took up a significant amount of financial resources. On top of the contracted loans, the owners decide to re-direct, through various financial schemes the cash available from the manufacturing business to the real estate business.

Insufficient knowledge about the rippling effects of a financial crisis and its implications, the lack of knowledge sharing culture to ensure proper control of operations, finance and accounting functions lead also to the lack of solvency.

Through our research we have identified that *information was hardly turned into knowledge* and applied to steering the company's direction to avoid financial distress and eventually insolvency.

Beyler's Information and Knowledge Architecture:

Data Storage and Management:

Except for financial and accounting data which was centrally stored and processed on a rudimentary accounting software platform, the commercially sensitive data and other data was significantly scattered (i.e., stored on computers, external drives etc).

For the financial and operational data, the company lacked an Enterprise Resource Planning ("ERP") software whereby the operational activity (sales, production, and distribution) is integrated with the financial function (budget analysis, various profitability and other KPIs reports) and with other business areas (e.g., payroll and personnel management).

Information circulated on a "need to know" basis. For example, production orders were created based on weekly schedules that were prepared upon reception of the purchase orders from the distribution network.

Beyler's KM Process in review

Explicit Knowledge Handling:

Explicit knowledge was not readily available to all the implicated stakeholders. For example, the Finance Manager was hardly aware of any strategic deviations from the budgetary planning. Strategic knowledge management was concentrated in the hands of the owners and the Sales Manager. Explicit knowledge was also stored on individual hard drives with little to no back-up support.

The existing explicit knowledge rudimentary handling has put additional stress on the decision-making process which deepened the effects of the financial pressure that in turn lead to the company's state of insolvency.

Types of Explicit Knowledge:

The primary focus of the company's leadership was towards local scale commercial knowledge (metal doors market evolution in Romania, pricing strategies, promotional campaigns for customers etc).

If business was thriving, and sales were increasing little attention was directed towards building explicit knowledge in times of crisis.

The company lacked formal internal control procedures and hence inefficiencies and misrepresentations were present more and more often.

Tacit Knowledge Handling:

The company had no system in place to handle tacit knowledge. However, tacit knowledge as applied in all the principal business areas such as: sales, marketing, operations, production, personnel etc.

The top executives (i.e. business owners) did not set into place a knowledge management system to address the explicit knowledge and tacit knowledge content. Moreover, the existing knowledge was highly concentrated and less visible, being primarily controlled by the owners of the business.

Company's category of existing explicit knowledge:

<u>Highlights of verifiable Pre-existing explicit knowledge in the organization:</u>

Design Patents for various metal doors and other interior type doors;

Production equipment line up and flow;

Commercial Doors' Market Knowledge in Romania.

Technical knowledge on operation of heavy production equipment.

Machinery maintenance and support.

<u>Highlights of non-verifiable "should-have-been foreseen" explicit knowledge conditions:</u>

Construction knowledge with regards to the development of large real estate projects;

Financial Restructuring of distress companies;

Negotiation with creditors and other vested stakeholders;

Business continuity plan.

The above evidenced lists of explicit knowledge stand proof of the incongruencies between the backbone of the organization's core operations and the 2008 initiative undertaken by Beyler's owners to invest in large real estate projects.

Lacking financial acumen in understanding the rippling effects of a large scale worldwide financial crisis (with direct impact on the real estate market), having little grounded knowledge of the real estate development

business model and its workings, ineffectively handling cash flows to support the construction of large apartment buildings, having a low-level internal control environment, these are all solid factors that contributed to the company's demise.

Concentrated, undistributed information and limited knowledge in the hands of few led to poor decision making, elusive economic behavior and misguided allocation of financial resources.

Case 2- PIC S.A. FIRST AND ONLY ROMANIAN HYPERMARKET

Brief Activity Description:

PIC S.A. began operating in 1991 in Pitești and is a privately held company with a share cap valued historically at 20 million EUR. PIC was the first and only large size Romanian fast moving consumers goods (FMCG) retailer with stores in five important cities (Craiova, Pitesti, Oradea, Calarasi, Braila). The majority owners of the company were two local entrepreneurs. The company had multiple related parties that performed ancillary activities such as distribution or transportation.

As discussed in the above Case 1 situation, the financial crisis has affected entire industries and the retail sector was no exception. When the Romanian retail sector was impacted by the crisis, PIC SA had just completed its last investments opening three large retail stores in Oradea, Calarasi and Braila. People were already hired on the stores' roasters and stores just began selling their items.

2004 to 2007 was a period of strong growth for the Romanian retail market. Managers and owners that had little experience with crisis situations were irrationally confident in the strength of their businesses and showed no concern for controlling the generated costs or considering potential business risks.

Therefore, knowledge sharing was limited while knowledge and information storage was dispersed.

PIC's Information and Knowledge Architecture:

Data Storage and Management

One of the remarks made by PwC, the Judicial Administrator appointed by the Insolvency Court was that data and information was significantly scarce in the company. Information and knowledge was unreliable and managerial reporting was often unreconcilable with the financial reporting.

Accounting data was stored separately from sales and inventory and manual accounting entries were performed based on printed reports provided by operational SAP software and Receivables Management app.

Although the company has invested a large sum of money to implement a digital solution (SAP) that would assist management in

Moreover, the Judicial Administrator Team found that primarily accounting entries had no corresponding supporting documentation, no information, no additional data. The Physical archive was not organized, and many documents were missing.

PIC's KM Process in review

Explicit Knowledge Handling

In terms of explicit knowledge, we also found that in this case, relevant knowledge was fragmentary, or it was even missing.

We found no evidence of formal managerial reporting or other type of governance. The SAP application, which could have been easily developed into a solid ERP, was solely used for integration and reporting on hypermarket sales information. There was no integration between the SAP application and the Accounting Application. Management was clearly focused on monitoring the top line of the business performance and put less weigh on other indicators such as gross or net margins, operational gearing etc.

We could not identify evidence of cash-flow governance or efficient working capital management. In fact, we found signs of misguided working capital decisions as small term financial instruments such as suppliers' credit, short-term leasing and bank debt were used to finance investments in the construction and equipment of three new hypermarkets in the cities of Oradea, Braila and Calarasi.

Major discrepancies totaling more than 20 million EUR between the book value and actual value of existing current assets were identified. Salaries were distributed in cash without any existing nominal evidence of their

designated employees. Large amounts of money more than 400.000 EUR were distributed in advance without any justifying proof of their destination.

Types of Explicit Knowledge:

We found similarities in terms of explicit knowledge types with Case 1. Management turned to commercial knowledge (sales) with little propensity towards cost optimization knowledge or profitability.

In terms of business continuity and business sustainability (including control procedures and corporate governance), we couldn't identify any such elements during our research. Explicit knowledge on handling economic crisis was not available.

Tacit Knowledge Handling:

Tacit knowledge was the prerogative of the owners' family. Prior to commencing the retail business, the company's owners studied the business models of European market leaders such as Carrefour, Rewe Group to understand the mechanisms and implications of such models. These aspects were partially replicated in developing the PIC SA business. Nevertheless, efforts were concentrated in ensuring viability of commercial day to day operations that generate top line growth while control processes, contingency planning, cost optimization practices were not given sufficient attention.

Tacit knowledge was concentrated in the hands of a few, and little sharing was done. The high degree of knowledge concentration led to a "telling and do" type of culture, whereby even top managers were executioners and decision making was non-consensual.

Tacit knowledge was primarily oriented toward business development and less towards business continuity.

Case 3- Terra Vision

Brief Activity Description:

Terra Vision started out in Bucharest in 2004 as a television, video producing company. In 2005, the company decides to go into real estate development as its main activity.

The residential project was built over 25.000 sqm piece of property and envisages 7 residential buildings, out of which three were finalized and the others were still in progress at the beginning of the insolvency procedure.

The company filed for insolvency in 2009, as it became clear that it could not service the existing debt. The state of financial distress was primarily the result of capital tied-up into immovable investments and poor management foresight. Also, the investigation undertaken by the judicial administrator went on to reveal that certain illicit practices were carried on by the former owner.

Terra Vision's KM Process in review

Explicit Knowledge Handling

Based on the "Causes of Insolvency Report" published by PwC BRS SPRL Romania in the Insolvency Gazette No. 4087 from 31st of August, 2009, the financial and accounting records found were scattered and inconsistent.

Morever, upon appointment of the Judicial Administrator, a large volume of records went missing, reported as stolen, making it hard to ascertain the formal stand of the company's patrimony.

Explicit knowledge was very limited in nature and was for the most part inconsistent.

Tacit Knowledge Handling

Similar to what we discussed above, knowledge was concentrated in the hands of one person, the majority owner of the business. He was the one who oversaw all sales transactions. The owner was in charge with negotiating with banks, suppliers and other stakeholders.

4. Methodology

We have based our findings on three qualitative studies of knowledge management and knowledge culture in distress Romanian companies that were subject to insolvency procedures. To produce meaningful results, our focus was on organizations activating in retail, production, and real estate to explore similarities and disparities in knowledge handling and behavior.

We used an exploratory, partly inductive partly deductive approach to draw our findings and conclusions. The chosen organizations were large and medium size, all privately held, being owned by both local and foreign individuals. We have intentionally selected different organizational sizes and ownership demographics to ascertain characteristics of knowledge behavior and knowledge management as well as the dynamics or inertia associated with the identified processes.

We have designed the research objectives as follows. First, we wanted to enhance hypothetical distinctions and consequently we have chosen a heterogenic industry base for our case studies (real estate development, metal doors manufacturing and retail FMCG). Secondly, we considered the socio-demographics of the ownership (Romanian and foreign) to see whether cultural background influences knowledge management and the architecture of knowledge (knowledge types, knowledge repositories, knowledge transfer, knowledge sharing).

We established the underlying pervasive organizational behavior by building data clouds using a specialized software called Worldle. An illustrative example of the constructed data cloud is shown in Figure 1 below:



Figure 1: Example of Data Cloud Showing Underlying Economic Culture and Insolvency Causes

4.1 Data Collection

Firsthand data was collected based on discussions with members of the organizations of different tenure and seniority, including, were applicable, company owners. We also had unconstrained access to the companies' intranet and correspondence. Through these sources, we were able to obtain useful background information and utilize it in our research. We corroborated various field notes and documentation to obtain our research findings.

Access to the organizations' resources was available at different moments in time. Data on knowledge management was collected over several months.

The documentation and information used was either proprietary for the organizations or was included in the public records publicized in the Romanian Insolvency Gazette ("Buletinul Procedurilor de Insolventa").

The collected data was reviewed for consistencies and organized accordingly using a relevant categorization technique.

4.2 Data Analysis

First and foremost, based on the literature review we've identified the different types of knowledge used in the organizations, the knowledge model and framework theories. In turn we determined the different company individuals and their positions in the organizations, and we initiated discussions to obtain adequate data. We've also reviewed the public reports on the causes of insolvency and the possibility of restructuring. We've assessed the internal knowledge structure and where applicable the knowledge base. We've looked into whether certain patterns emerge in relation to how the studied organizations treat and use knowledge; We've identified and charted the common characteristics in handling knowledge. We looked for patterns emerging in our case studies, and we compared them across the case study universe.

We defined and coded by categories the relevant data as shown in Table 1.

Table 1: Illustrative Example Showing Analysis Coding

Coding	Case 1	Case 2	Case 3
Knowledge Instances	Metal Door Design and Manufacturing Pattents	Sales and Inventory Reports held in SAP Software	Technical Construction Book
Knowledge Architecture	Scattered comercial data, centralized accounting repository. No system to handle tacit knowledge (only verbal transference)	Unreliable data and information; scarcity of knowledge structure. No evidence of corporate governance (reporting process and sharing of knowledge).	Large volume of data and information were missing. Little top down knowledge sharing
Ownership behavior in handling knowledge	Ownership decided to invest in building an appartment complex and finance it with short term inflows from the manufacturing business based on limited opportunity analysis	Preference to transfer knowledge on a need to know basis	Owner performs commercial activities and negotiations with creditors.
Organizational Culture	Family business of foreign origin- autocratic leadership style. Formal structure informal processes	Family business- different members of the family hired in key management position. All major operational decisions taken by the owners	Focus on sales and cash in and less on controlling the business.
Knowledge Transference	Knowledge clustered based on the functional organization chart. Difficulty in sharing inter departmental knowledge	Knowledge concentrated in the hands of owners and commercial manager (transferred on a need to know basis).	Lacking Critical control knowledge and basis for transfer relevant knowledge

Coded instances were subjected to team scrutiny, differences in interpretation were reconciled until agreed upon by the team.

5. Findings

Based on the research and the applied methodology, we have identified several pervasive knowledge handling patterns within the studied organizations.

First, knowledge management, generally accepted in the academic literature, as a formal, fully integrated concept with all its components (creation, storage, transfer, and iterations) was not present in the studied organizations. Knowledge repositories were scattered, and transfer of top down or horizontal knowledge transfer was scarce.

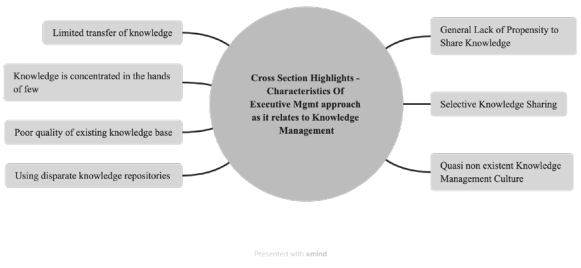
Second, in terms of structure, knowledge repositories and knowledge storage in general were highly clustered lacking integration. For example, knowledge related to operational activities was stored in one application while the resulting interrelated financial knowledge was stored and accessed on a different platform.

Third, based upon the above discussed classification, when present, tacit knowledge was pervasive, and its transfer was deficient among the organizations' members. Explicit knowledge was only present to satisfy the operational prerequisites and was used to execute the daily specific activities for each department within the organization.

Forth, organizational culture and ownership behavior was conducive to free-form knowledge handling, that set the grounds for poor monitoring controls of the operations and eventually to financial distress.

Knowledge that should have been shared was in the hands of ownership, kept away or not thoroughly distributed to other important stakeholders.

A cross section analysis of the principal top executive characteristics as they relate to knowledge management is shown in the below pictogram:



6. Conclusions

We conclude that for the three studied organization knowledge management in all its different subprocesses was precarious and knowledge was for the most part handled informally. Selective knowledge sharing and concentrating important knowledge in the hands of the few were present in all the three case studies. Ineffective knowledge handling shaped a context that hindered the development of viable restructuring initiatives. None of the three studied organizations took a balanced and structured approach towards knowledge management and as a result they set the stage for insolvency.

We provide below an identified list of critical knowledge that should have been appropriately managed by these organizations.

Critical Knowledge that should have been managed: Market Knowledge, Customer Base and CRM, Debt Finance, Cash Flow Management, Adequate Asset Allocation

7. Practical Implications

The three case studies reveal real business circumstances as they relate to knowledge handling for Romanian organizations under distress in need of restructuring. The research shows that organizational culture, understanding of knowledge use, lack of knowledge transference, impede on the development of sound restructuring actions and deepen the knowledge gap so desperately needed in the insolvency context.

8. Limitations and Further Research

Given that this is both an exploratory and an explanatory research study, the analysis focused on the qualitative aspects of understanding the knowledge environment and knowledge management in the researched organizations. Quantitative analysis could reveal aspects related to causality elements and the resulting effects that both the lack of, or the mishandling of knowledge may have on the restructuring process.

Further analysis could be conducted envisaging the deterministic relationship between management of certain types of knowledge and the success of restructuring undertakings. Also, understanding the way effective knowledge can improve the rate of success is also a subject matter worth to be further researched.

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Exploring Knowledge Management From a Software Engineering Perspective

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Abstract: *Context:* The knowledge domain of software engineering (SE) gradually expands due to fast emerging technologies and complex organisational processes. The software industry represents a special focus of interest from a Knowledge Management (KM) perspective, as it is characterized by high employee turnover, a high level of outsourced projects, and an accelerated pace of technology innovations. Knowledge management can substantially influence SE knowledge's life cycle, contributing to better structuring of organisational processes of knowledge creation, knowledge transfer, and knowledge sharing. Reflecting on the trends for SE automation with artificial intelligence tools, KM approaches can enable companies and professionals to reconsider the future of SE work. *Purpose:* The present research aims to identify and investigate how implementing knowledge management principles and processes within the software engineering domain can facilitate the future transformation of software-related jobs. Based on a conceptual model, built upon the literature review, the paper analyses the quantitative data, collected from 91 software experts. Evaluating the impact of both organizational and domain types of SE knowledge, the discussion evaluates the unique value-adding SE processes along with models of how to explore AI applications to automate the SE domain. *Results:* The outcomes of the analysis identify the models of structuring knowledge management processes in SE both within the technological domain and organisational layers. The discussion section establishes suitable KM methods and approaches for supporting SE job transformation. It identifies the main knowledge management integration practices, demonstrating how combining KM with AI-based innovations may change the SE knowledge flow, improving substantially SE activities like onboarding new team members, monitoring software documentation, version control, and error tracking.

Keywords: Software engineering, Knowledge management, Software process improvement, Knowledge sharing, AI, software industry

1. Introduction

The knowledge domain of Software engineering (SE) is fast enlarging, influenced by various dynamic factors due to technological novelties, organisational and management practices. Responding to the need to build reliable, efficient, and scalable software systems, software companies have adopted a variety of SE methodologies, tools, and techniques (Kiv et al., 2018). The software engineering work is reflected often as a “meta-industry” supporting the digitalization and digital transformation of all other economic sectors and activities. It is investigated from various knowledge management perspectives, recognized as “knowledge-intensive processes” (Bjørnson et al, 2008), both on individual and organizational level. Knowledge management can substantially support the SE knowledge's life cycle, contributing to better structuring of organisational processes of knowledge creation, knowledge transfer, and knowledge sharing. SE professionals are expected to access and use knowledge from various sources, including design patterns, programming languages, software architecture, and best practices. Further, the process of software development generates enormous volumes of data and knowledge, that must be further captured, codified, and re-used within the organisation. However, the recent advancements in Artificial Intelligence (AI), have the potential to revolutionize many aspects of modern society, including software development processes and the software engineering profession.

The rapid pace of technological advances requires software companies to adopt emerging approaches, applications, and tools for preserving their competitiveness and market position. This process of aligning to the latest technology developments is time-consuming and demanding, both for organizations and SE professionals, who must stay up-to-date and deliver high-quality software. Moreover, the SE is a highly collaborative process and teams need to cooperate while managing real-time large volumes of data and knowledge, sharing code libraries, documentation, and analysing user feedback. At the same time, software development is highly specialized, and every employee can develop unique knowledge and expertise, which can be hardly captured and codified by teams or by companies. In principle, this expertise is processed within various Information Systems (IS), making a "clear distinction between data, information, and knowledge” (Baydoun et al, 2021), and applying customisations approaches. Specific knowledge-sharing activities are designed to capture and retain knowledge and to prevent the loss of valuable expertise, and companies recognize that “knowledge sharing influences team performance, creativity, and climate” (Ahmad et al, 2019). At the same time, the fast-emerging Artificial intelligence tools promise to revolutionize the SE processes in organisations and to further automate the process of software development. Therefore, companies need to better understand the specific and unique

SE expertise and knowledge management practices, that can be assisted by AI. It is already admitted that AI tools can be used to improve knowledge sharing in various ways, including enhancing search capabilities, enabling personalized content delivery, and automating knowledge-intensive tasks.

The present research aims to identify and investigate how implementing knowledge management principles and processes within the software engineering (SE) domain can facilitate further software-related job transformation.

The paper is structured as follows. Based on a preliminary background analysis, a conceptual model is defined, combining organizational and domain types of SE knowledge. It serves as a starting point for evaluating unique value-adding SE processes and knowledge. Next, the analysis of the responses, provided by 91 software experts, examine the trends and actual expectation between different companies and software professionals. The obtained results help to illustrate the need for structuring knowledge management processes within the technological domain and between organisational layers. In the end, the discussion part evaluates the suitable KM methods and approaches for supporting SE job transformation and identifies the main aspects that AI technologies can support knowledge management integration in SE practices.

2. Background

Software development is a knowledge-intensive domain, thoroughly investigated from a KM perspective in several diverse systematic reviews (Bjørnson & Dingsøyr, 2008; Ouriques et al., 2019, Mora et al., 2019 and others). The software development process along with the SE life cycle is context-dependent, the application of knowledge requires additional preparation, and stakeholders need to be aware of the available explicit and tacit knowledge (Ouriques et al, 2019). Agile concepts are a means of tailoring software development to draw the development team's attention, strengthen the decision-making process, increase inter-team coordination, and build collective-code ownership (Kiv et al, 2018). To generate new ideas that could support the product, expand its scope, and implement its functionalities according to stakeholders' expectations, creation, storage, transfer, and retrieval activities must be introduced. To ensure product quality and simplify and expedite integration processes with the production environment, frameworks such as DevOps (Development and Operations) are available for the product delivery (Céspedes et al, 2017). These goals align with customer expectations of building trust, bringing satisfaction, and establishing the belief that "working software is the primary measure of progress" (Mora et al, 2019).

A preliminary research (Georgiev, 2023) analyses 16 systematic reviews of different knowledge domains, outlining the key topics between SE and KM. To define the SE Knowledge domain, thorough research is made, which summarises the reviews and their main topics. Thus, by comparing the main concepts, a joint knowledge domain emerges, where subdomains are identified and highlighted. Those subdomains include Software Process Improvement, KM in large projects on a global scale, and KM factors regarding Agile methodologies and Knowledge Management Systems.

Based on the thorough analysis of the literature, there are identified four main knowledge domains in software companies, critical for their success. These knowledge domains include technocratic, behavioural, product, and process types of knowledge:

- *Technocratic knowledge* - several studies highlight the necessity of adopting a more technocratic approach to knowledge management (KM). This approach involves utilizing cognitive analysis, closely examining communication within virtual reality, employing event modelling, and clustering data based on common features (Osorio et al, 2020). In project management, this is crucial as codification and documentation play a vital role in monitoring (Ayarza et al, 2020). Knowledge modelling, which focuses on applying conceptual and computational models to extract functions or process clustered data, also plays a significant role. Managing perceived complexity and risks is essential in utilizing knowledge artifacts. Therefore, many aspects of knowledge management can be classified under this technocratic approach.
- *Behavioural knowledge* is a critical domain in software companies that involves team modelling to identify specific behaviour types within a team and patterns in larger projects. This approach prioritizes human factors, which are introduced effectively in the software engineering process to improve it via education and motivation. Agile frameworks such as Large-Scale Scrum (LeSS) (Steghöfer et al, 2019) and Scaled Agile Framework (SAFe) (Putta et al, 2018) have been successful in building compact and effective teams that quickly deliver value to clients' expectations. However, the main driver of the agile transformation is the agile coach who builds teams, creates guidelines, sets

goals and roadmaps, and leads the team toward self-organization. The success of the agile transformation is evaluated based on shared product vision, shared responsibilities, shared knowledge, feedback, and ownership, while failure factors include lack of middle management support, barriers to the production environment, excessive control by higher management, and lack of understanding from stakeholders.

- *Product knowledge* is used to transform software systems "into easily accessible, well described, and interoperable, modular services" (Huang et al, 2008). Descriptive languages provide a machine-readable domain specification that can be enhanced by introducing metadata and conflict-detecting mechanisms through a three-step analytic process for validation, verification, and performance metrics. This approach is used to transform legacy systems into easily accessible, well-described, and interoperable modular services. Languages like UML, VEL, (Bagnato et al, 2019), and WADL support different development designs, including Quality-driven Architecture Design (QDAD) (Franch et al, 2019), Quality-Aware Rapid Software Development Design (Q-Rapids), Transformation models in dynamic environments (Trieflinger et al, 2021), and older pipeline development models like Product Line Use case modelling for Systems and Software engineering, described by Ahmed et al (2008).
- *Process knowledge* refers to the knowledge of the internal processes and procedures that a software company uses to deliver its products or services. These solutions vary, with some focusing on data handling, while others concentrate on monitoring changes and product engineering. In the initial stages of product development, the main goal is to clarify requirements and develop a solution based on past experiences. The portfolio-driven development model, an advanced model of Agile Product Line Engineering (APLE), demands a more agile and rapid approach that involves "a collection of projects, programs, and other operations for achieving the business goals." (Hayashi et al, 2020). With this, collection managers can provide more precise estimations, especially when working with fixed resources.

Each of these knowledge domains can be critical for employees learning and growth. However, the relative importance of each domain may vary depending on the company's size, structure, and experience. For example, a start-up software company may prioritize technocratic knowledge to develop a new product. In contrast, a large IT services company may prioritize process knowledge to ensure efficient development procedures.

3. Study Design and Implementation

To investigate the current situation in the SE knowledge domain, a short survey is prepared and shared among SE professionals in Bulgaria. The survey is divided into four parts, each representing questions that aim to gather information about employees' approaches to software processes, team methodologies and established traditions, organizational culture, and solutions they are working on. The questions are classified into the four knowledge domains mentioned above. The first part of the survey gathers information about employees' work such as workload, activities within the working process, and overall job satisfaction. The second part focuses on teamwork, collaboration, communication, and group effectiveness. The third part gathers information about organizational culture, exploring leadership, innovation, and employee engagement. The fourth and final part focuses on solutions the employees are working on, including questions related to the product and process domains, and their familiarity with the product, their involvement in the software lifecycle, and the efficiency of the development process.

The survey is circulated in the months of January and February 2023, collecting 91 responses among SE professionals. The analysis of the results considers employee experience, company size, and organizational structure. Average values are calculated and compared to the overall ones. This process helps to identify trends and potential problems.

3.1 The Respondent's Profiles and Expertise

The analysis of the respondents' profiles is presented in Figure 1, exploring their general SE expertise. It is important to mention that almost 90% of the respondents work in full-time job positions. Considering the SE job expertise, about 73% of the respondents work as software developers, more than 25% have some management background as product/project management, scrum master or team lead and 13% are software architects, 11% are quality assurance (QA). Business and marketing positions (7%) and HR/Recruitment experts are 5%. It should be mentioned that almost 42% share two or more job positions.

Considering the experience in the SE domain, more than 53% of the respondents have substantial experience and SE expertise (20% more than 10 years, and 33% more than 5 years). It is important to mention that only 14%

are in junior positions with less than 1 year of experience. About 51% of the respondents work in big companies with more than 100 employees. About 26% work in small companies (less than 20 employees).

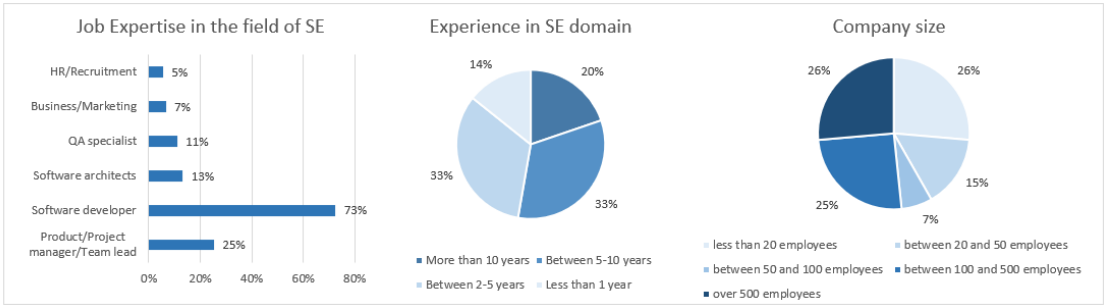


Figure 1: Respondents' Profile

The general analysis shows that the survey gathered various expertise and experiences which provides a diverse data sample. This allows critical points to be identified in terms of what motivates respondents' growth, how they react to changes within their work, and how companies can support their work. It is essential to consider the following factors when investigating further the results:

- company size – the number of employees, volumes of data, and knowledge infrastructure contribute to the KM solutions;
- project complexity – how the scope of product knowledge and architectural solutions influence technological progress;
- team size – how the bonding experiences and teamwork are introduced in organisational culture;
- experience – how different professional backgrounds could diversify the knowledge base;
- organizational structure – how different structure types correspond to the communication channels within the company.

These factors impact knowledge types and necessitate strategies to mitigate information noise and redundant procedures and improve the accessibility and efficiency of KM processes.

4. Discussion

4.1 Analysis of the Quantitative Results

The main part of the survey explores the four main knowledge domains, focusing on SE products and processes and SE organizational aspects from technocratic and behavioural styles. Using a Likert scale (1- definitively not, 5 – definitively yes, 3 -neutral), four groups of questions are formulated.

Figure 2 presents the questions about Domain knowledge, divided into the following groups:

SE Domain – Product, exploring how requirements engineering (RE) and quality assurance (QA) affect the product's evolution and how employees react to those processes (Figure 02). Most SE professionals value the importance of a high-level quality of the software products, as well as the influence of how functionalities are described in their work as programmers.

SE Domain – Process, exploring how Continuous Integration (CI) provides a flexible approach to effective value delivery. They also analyse the communication within the processes of development and management. Experts value the adoption of different concepts to have a better knowledge base and efficient value-generating process.

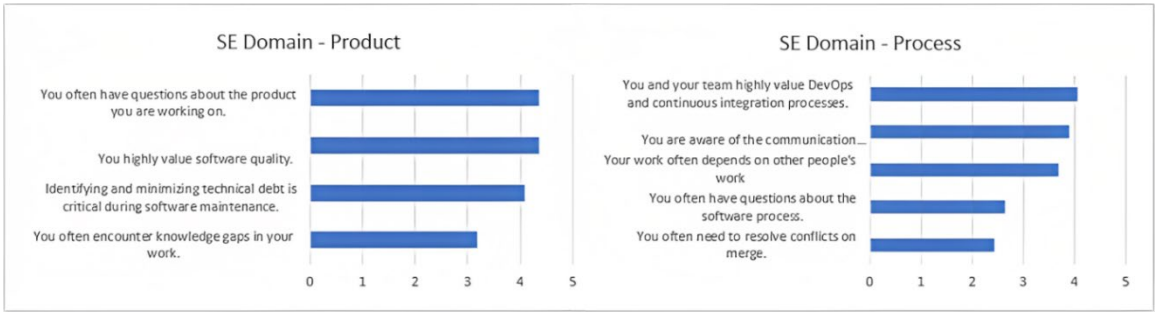


Figure 2: Product and Process Questions Quantitative Results

Figure 3 presents the questions about Organisational knowledge, also divided as follows:

SE Organisational - Technocratic, exploring product quality in terms of how respondents' colleagues perceive it as a critical process for their success. Then the relationship between organisational structure and the product is also included – experts are supportive of the paradigm which states that communications through the organisation follow the architectural style the project defines.

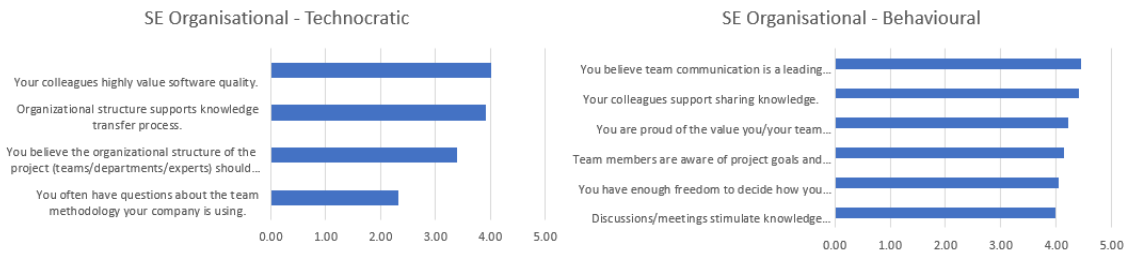


Figure 3: Technocratic and Behavioural Questions Qualitative Results

SE Organisational – Behavioural, exploring two perspectives - the first one covers trends on a local scale within the team – employees are quite supportive in terms of sharing knowledge and generating ideas for boosting efficiency. The second one measures the overall acceptance and procedures that support organisational culture – employees are rather positive about their career growth and are expecting effective approaches like mentoring and onboarding for bigger projects.

4.2 Knowledge gap Analysis

Process knowledge gaps

Most issues about the process knowledge domain stem from the software development life cycle. When aiming to create value, it is crucial to possess a clear understanding of the functionalities under development and align them with previous versions of the software. This establishes a strong interdependence among teams and team members. Over 60% of experts highlight this interdependence, which escalates the risk of conflicts, particularly in larger projects. Hence, it becomes necessary to control knowledge generation by implementing collaborative methods and groupware, while also incorporating automated procedures that synchronize not only with Version Control Systems but also with methodologies that facilitate effective value creation and modelling.

Product knowledge gaps

The problem associated with product knowledge primarily stems from its accessibility and availability. According to half of the respondents, they frequently encounter questions about the software they develop. This issue has a significant impact on the entire lifecycle from three different perspectives: software quality, technical debt, and legacy software.

Firstly, it affects software quality as it hinders the thorough testing of basic cases, edge cases, and complex end-to-end scenarios. Without adequate product knowledge, developers may struggle to identify and address potential issues effectively.

Secondly, insufficient product knowledge often results in technical debt, causing performance issues and decreased motivation among the development team. When developers lack a deep understanding of the software, they may resort to quick fixes or suboptimal solutions, leading to bad quality and low flexibility.

Lastly, legacy software often fails to provide adequate support and sufficient opportunities for professional growth. Knowledge gaps regarding such software can arise due to outdated technologies, the absence of a codification strategy, and a lack of investments.

Technocratic knowledge gaps

The three main problems addressed by questions related to technocratic knowledge are as follows:

- lack of mentoring (70%) is closely linked to Creative Organizational Learning (Sahibzada et al., 2020), which is crucial for fostering the growth of intellectual capital. Mentoring plays a vital role in guiding individuals and nurturing their skills and knowledge within an organization.

- lack of new technology knowledge (42%). Staying updated with the latest technological advancements is essential for organizations to remain competitive and adapt to changing market trends. Acquiring and integrating new technology knowledge is crucial for their success.
- lack of adequate documentation (29%). While considered a secondary knowledge source, documentation serves as a solid foundation for initiating new projects, facilitating hiring processes, and managing employee terminations. Having well-documented information ensures continuity and knowledge transfer within an organization.

In response to these challenges, the majority of respondents agree or strongly agree that organizational structures should facilitate knowledge sharing both horizontally (70%) across management layers and vertically among team members (58%). To promote effective knowledge exchange and utilize knowledge artifacts, organizations implement various methods such as brainstorming sessions, discussions, team-building activities, and mentoring-focused onboarding programs. By prioritizing mentoring over documentation, organizations recognize the value of experiential learning and interpersonal knowledge transfer.

Given the rapid increase in information volumes and overall data dynamics, knowledge management emerges as a critical supporting process, particularly for fast-growing companies. It enables efficient handling of information, facilitates knowledge sharing, and helps organizations navigate the ever-changing landscape of information and data.

Behavioural knowledge gaps

Upon analysing the results, a significant observation emerges regarding the reliance of the behavioural domain on tacit knowledge. Notably, new employees heavily depend on more experienced colleagues, including team members (75%), team leaders (48%), and managers (21%), to acquire this knowledge. The key requirements for these individuals revolve around their proactivity, motivation to grow, and effective communication skills to navigate the dynamics of communication within and between teams.

Another noteworthy gap relates to communication between different management layers. Approximately 60% of the respondents express the importance of understanding the organizational structure and how knowledge flows across different departments. To address this gap, knowledge management techniques primarily focus on stimulating proactivity and idea generation. Consequently, various initiatives are implemented to foster bonding experiences and cultivate a culture of sharing within the organization. Furthermore, this corresponds to various studies stating that knowledge sharing plays a crucial role in "moderating the relationship between transformational leadership and innovative work behaviour" (Afsar et al., 2019).

4.3 Management Perspectives

Communication serves as a fundamental pillar in the construction of knowledge infrastructure. Consequently, several factors must be considered when establishing information flows and structures, including company size, which impacts the volume of data being processed and the risk of knowledge loss. A prominent approach in this regard is Business Model Innovation (BMI), which proves advantageous for companies seeking to reconfigure the delivery and capture of value from customers (Hock-Doepgen et al., 2021). This approach not only stimulates discussions about process optimization but also raises the question of how to provide customized solutions for different technological challenges. The notion of a strong interdependence between internal knowledge management and external knowledge provision introduces new requirements for employees, such as mentoring, team bonding, workshops, and opportunities for learning and growth. These initiatives effectively bridge knowledge gaps and facilitate the process of value creation.

4.4 Implications for Future Implementation of AI

Although the survey is not focused on AI, the increased interest in AI-based applications already has its influence in different directions, having several technologies introduced to facilitate the filling of knowledge gaps for employees. While internet resources serve as a static, default solution for accessing general knowledge such as code blocks, algorithms, and methods, customized standards, working solutions, and decisions that significantly impact the knowledge process are typically provided through internal knowledge infrastructure. To support knowledge generation, companies implement various software systems, including:

- Documentation software: This software utilizes different plugins for tracking, sharing, and versioning documents.
- Collaboration software: These tools employ features like whiteboards, screen sharing, and information exchange to facilitate collaboration among employees.

- DevOps and Version Control Systems (VCS): Particularly valuable for software development, VCS systems like Git enable new experts to access, update, and manage knowledge effectively.

AI-powered tools can also automate documentation and update it automatically based on code or product changes. This saves time and reduces the workload of employees responsible for documentation maintenance.

Some additional examples such as ChatGPT provides accurate search results, enabling employees to quickly find the information they need without spending excessive time searching through documents. Furthermore, AI can analyse search data to identify knowledge gaps and areas where additional information is required.

Tools like Github CoPilot suggest code snippets, reducing the time spent on code reviews and expediting deployment. Through analysis of extensive code bases, AI can detect syntax errors, performance issues, and security vulnerabilities. It can also propose solutions, including refactoring and optimization techniques.

DeepCode is another tool that aids in error identification, performance optimization, and security vulnerability detection. It can also identify patterns in code and assist in decision-making processes.

Microsoft Power BI and Google Cloud Auto ML can identify trends and provide insights that aid in informed decision-making. This is particularly beneficial for new employees who are not yet familiar with the organization's workflows and processes, thereby facilitating knowledge sharing.

5. Conclusion

In conclusion, the questionnaire results offer valuable insights into how knowledge is organised within the software industry. They clarify the existing knowledge management challenges in software engineering. One major issue identified is the difficulty in sharing knowledge, particularly when complex tasks are involved, that require significant time and effort. These challenges can lead to workflow delays and inefficiencies. Another issue is how knowledge management tools are being used to improve overall communication both on local and global scales. Lastly, organisational culture is the main driver of how team members bond and work more efficiently together. KM should support integrating employees with the company’s culture and be a major driver in establishing a creative working environment.

AI-powered tools and automated systems can enhance the productivity and efficiency of software developers. By integrating AI into their workflows, organizations can save time, reduce errors, and expedite their processes. AI can introduce practical approaches based on theoretical knowledge.

Some of the challenges mentioned above can be addressed through innovative applications. As stated in the last section, there are ideas and prototypes that have already been implemented technologically and are widely used by experts. Thus, the KM process is integrated effortlessly, and its contributions would be highly evaluated.

Finally, this research serves as a starting point for an advanced investigation process, which could identify patterns in KM from an SE perspective by adding identified factors such as company size, team size, project complexity, and experience. It is important to compare how they correspond to the organisational structure and how AI can handle different cases to optimise the common knowledge workflow.

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Examining Digital Readiness in the Era Of Industry 4.0 in Tunisia

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Abstract: Industry 4.0 is the fourth and most current industrial revolution, which refers to the integration of the digital and physical worlds in a manufacturing context. It is the current trend in organizational automation and data interchange. It denotes intelligent manufacturing processes that combine cyber and physical systems via a collection of technologies such as the Internet of Things, big data, and cloud computing. The transition to Industry 4.0 is predicted to result in significant structural changes, productivity increases, and increased competitiveness in the global manufacturing industry. The use of such technology enables businesses to identify solutions capable of transforming rising complexity into possibilities for assuring long-term competitiveness and profitable growth. Organizations must self-assess their Industry 4.0 readiness in order to survive and prosper in the Fourth Industrial Revolution. Digital readiness enables the workforce to be able to use digital tools consciously, productively for a given purpose, and to adapt quickly to the ever-changing work environment. Following that, the conception or construction of an Industry 4.0-ready model with the basic model parameters is required. The business environment is changing as a result of digitalization, and companies are facing new hurdles in order to advance. The first step in supporting companies is checking their digital readiness and capabilities, as well as setting clear progress goals. The purpose of this paper is to identify the primary aspects for measuring companies' preparation for Industry 4.0, the relationships between these readiness criteria, and how future Ph.D. research should proceed based on the findings. This paper focuses on the literature analysis identifying the reasons, challenges, barriers, and facilitators of digitalization. The research applies triangulation, by combining qualitative and quantitative methodology. The qualitative approach will be applied initially by conducting open interviews, and then, for the quantitative part, with a questionnaire aimed at Tunisian companies and their workforces.

Keywords: Digital readiness, Digitalization, Industry 4.0, Digital technologies, Tunisian companies

1. Introduction

Since the 18th century's industrial revolution, modern industry has undergone several advances. Industrial of items, tools, clothing, and weaponry was done by hand until the end of the 18th century, when industrial methods were introduced. The progression from Industry 1.0 to the forthcoming industrial age - Industry 4.0 - was very swift. The creation of Industry 4.0 has been accompanied by rapid technological advancement on the one hand, and social issues on the other.

The Industrial Revolution was an era of significant industrialization and innovation in which the transition from an agricultural and handicraft economy to one dominated by industry and machine production began. The industrial revolution is a fundamental shift in manufacturing technology (Xifan and Yingzi, 2016). It has shaped the civilizations in which we live today. People's working circumstances and lives have altered because of new manufacturing technology. The following is an explanation of the history of the industrial revolution: The first industrial revolution, or Industry 1.0, occurred between 1760 and 1820. It signaled the move from manual manufacturing methods to machines powered by steam and water.

The period between 1870 and 1914 is known as Industry 2.0, the second industrial revolution, or the technical revolution. The invention of electrically powered machinery was a major factor to this revolution. The first assembly line was also created, expediting the process of mass production, which ultimately became normal practice. The third industrial revolution, often known as Industry 3.0, happened in the late twentieth century. Because of the substantial use of computer and communication technology in the manufacturing process, it is also known as the digital revolution. The concept of Industry 4.0, or as it was initially known - "Industry 4.0" (Shu et al., 2018), originated in Germany.

Industry 4.0 marks the end of traditional production. It led in the merger of the physical and virtual worlds to produce Cyber Physical Systems. (Alcácerac and Cruz-Machado, 2019) Industry 4.0 involves connectedness, and it will provide a chance to modify how industry reacts to societal requirements. Unlike past industrial revolutions, which were driven by breakthroughs in manufacturing processes and systems, a smart, networked, omnipresent environment drives Industry 4.0 developments.

Industry 4.0 is a phrase used to describe the fundamental change of industry that has occurred as a result of the integration of developing technologies. It means that we are on the verge of the Fourth Industrial Revolution.

Based on the study I conducted on this emerging issue, I could not discover sufficient findings in Tunisia. That is why I decided to work on this new digital preparedness problem in Tunisia to see what kind of outcomes we can obtain and how the market is attempting to integrate with this new technology. In addition, we will compare Tunisia and Hungary to discover how the two markets vary from different perspectives.

The goal of Industry 4.0 is to allow intelligent factories to provide individualized output while using greener and more efficient techniques. To do so, producers must overcome multiple obstacles, including a dearth of trained people to create and run diverse high-tech systems. This shortcoming implies that Industry 4.0 necessitates a shift in the labor market, namely requiring skilled individuals with the abilities and skills to succeed in this new environment. To what extent does the level of digital competence and attitude of employees influence a company's digital readiness in Tunisia? How are digital technologies from Industry 4.0 used to create a framework for developing employees' digital readiness in Tunisia? What are the challenges of HRM with the implementation of Industry 4.0?

2. Theoretical Background

2.1 Digitalization of Industry 4.0

Over the previous few decades, the manufacturing environment has evolved dramatically. The Fourth Industrial Revolution (I4.0) era, in which physical progress stagnated and technological advancement largely taken its place in which results the integration of numerous breakthrough innovations in various technologies, such as big-data analytics (e.g., deep learning, data-mining, virtual & augmented reality and social media), enhanced computer vision, friendly robotics, communications and the Internet of Things (IoT), smart self-aware sensors and systems, and the cloud's virtually limitless memory and computing power. (cohen et al., 2019) It also advanced their digital consumer obligations, IT-based business processes, products and services, M2M connectivity, human-machine collaboration, Digital Twin, AI-enhanced systems, high-end simulation, and so on. (Nagy, 2017)

The pervasive use of inexpensive sensors and actuators communicating through the Internet has eased manufacturing development, resulting in real-time communication between systems, machines, tools, people, consumers, and products, establishing the so-called Internet of Things. (Stankovic, 2014)

The massive amount of data (e.g., Big Data) created by these linked things is the raw material of the twenty-first century. IoT facilitates the development of a new manufacturing paradigm known as customized production, which allows for consumer interaction from the product design phase. (Bortolini, 2017) The growth of market demand over the previous few decades necessitates large quantities of items that are uniquely customized. (Nee, 2012)

This new industrial revolution is known as "Industry 4.0" (I4.0), and it signifies the full revolution of all factories via the integration of the Internet and information and communication technologies (ICT) with traditional manufacturing processes. (Davies, 2015) Smart factories of the I4.0 age are defined by greater production flexibility achieved via the use of real-time reconfigurable equipment, which enable profitable tailored manufacture of products in batches as small as the individual item.

The most often referenced qualifying technologies in the literature were evaluated to support this work in order to determine the most relevant qualifying technologies.

- IoT - Technology that connects sensors, machines, mobile and human devices, enabling internal and external interoperability of businesses and making data more accessible and pervasive (Ahuett-Garza and Kurfess, 2018).
- Big data - An environment in which a vast quantity of unstructured, structured, and semi-structured data is kept, arriving from multiple sources and connected via the IoT, in order to give accurate and timely decision-making information (Vaidya et al., 2018).
- Cloud computing - A broad phrase that refers to remote access to data kept in an external environment via the Internet of Things (Zhong et al., 2017).
- Cyber physical system - Systems that mix statistical and computational approaches with real-time data taken from physical systems in order to explore the behavior of a structure under many scenarios and choose the optimum decision. In fact, by leveraging the interconnectivity of intelligent, resilient, and self-adaptive machines, they are transforming technologies for managing systems interconnected between physical and computational resources (Ahuett-Garza and Kurfess, 2018; Alharthi et al., 2017; Mazzei and Noble, 2017; Cervone, 2016).

- Autonomous robots are intelligent, adaptable, and collaborative robots. They will eventually communicate with each other and operate securely alongside people, learning from them and making their own decisions (Guoping et al., 2017).
- Additive manufacturing - Also known as 3D printing, this technology may generate small quantities of custom items that give significant benefits, such as in the design of complicated parts (Posada et al., 2015). Caiazzo (2018) describes the method as applying a substance layer upon layer.
- Augmented reality - This technology enhances information in the environment around a person, allowing the human to interact with virtual things that coexist with a physical environment in a virtual fashion, in the same space as the real environment (Vaidya et al., 2018).
- Artificial intelligence (AI) represents, rationalizes, and manages knowledge. To be intelligent, systems must be able to recognize the context of their deployment environment and determine what to do in the current circumstance to achieve the specified objective (Matyi et al., 2020).

2.2 The Level of Digital Competence and Attitude of Employees Influence a Company's Digital Readiness in Tunisia

Autonomous robots are key to Industry 4.0. The advantages of this technology include higher productivity, reduced mistakes and rework, and the ability to handle high-risk activities. (Fitzgerald, 2017)

Soon, these robots will be able to manage (quickly and effectively) a wide range of things of diverse sizes and forms.

Furthermore, they will make informed and accurate selections (Karabegovic and Husak, 2018). Simulations are commonly used in manufacturing to develop goods or for off-line optimization; their major advantage is that they save time and resources. Simulations imitate processes in the Industry 4.0 setting to understand their behavior, make choices, and enhance performance. (Xu et al ., 2016).

Horizontal and vertical system integration entails the integration of independent production chains as well as the value-added subsystems of a single firm. (Rubmann et al., 2015) When it comes to horizontal integration, Industry 4.0 leverages connected networks of cyber-physical and commercial systems that improve automation, flexibility, and operational efficiency in manufacturing processes. Vertical integration in Industry 4.0 strives to connect all logical levels of a company, from the field layer to research and development. (Mohamed, 2018) The fundamental advantage of vertical integration is that it allows for complete corporate autonomy. Horizontal and Vertical System Integration has become the backbone of smart manufacturing because of Industry 4.0.

Industry 4.0 has several advantages. Digital manufacturing provides clients with higher quality, lower-cost goods while also protecting the environment and making businesses more competitive (Bryner, 2012). However, producers must overcome various obstacles before these benefits may be realized. The main one is a shortage of skilled people to administer the various systems (Mohamed, 2018).

The waves of developing technologies are transforming the labor market, particularly in terms of the competences and abilities required to satisfy the demands of the new environment. As a result, new professional profiles are required (Rubmann et al., 2015). Analysts expect that 3.5 million employees will be needed in the next ten years to fill particular industrial positions. However, fewer posts will be filled due to a shortage of experts with the necessary capabilities (Turcu, 2018). These qualities range from managing complicated production systems to having more creativity, strategic thinking, and coordinating abilities (Hecklau et al., 2016). However, there is no unambiguous agreement on these skills. Qualified human resources are now more important than ever. As a result, colleges are already playing a role in educating and training professionals for success in Industry 4.0.

Several studies have been conducted to explore the influence of employee digital competency and attitude on a company's digital readiness. According to a research conducted by Bahloul and Tlili (2021), workers' digital competence and attitude favorably enhance a company's digital readiness in Tunisia. According to the study, digital competency positively influences digital technology adoption and use, and a good attitude toward digital technologies increases employees' desire to learn and utilize new technologies. Similarly, Ben Othman and Bouzidi (2019) discovered that digital competency and employee attitude play an important influence in increasing a company's digital readiness in Tunisia. According to the study, firms with strong digital competency and a good attitude toward digital technologies are more likely to embrace and deploy digital technologies, resulting in better digital readiness.

Furthermore, Rahmouni and Arfaoui (2021) evaluated the influence of digital competence and employee attitude on Tunisian SMEs' digital preparedness. The study discovered that workers' digital competency has a substantial influence on SMEs' adoption and usage of digital technology. A good attitude toward digital technology also increases workers' desire to learn and apply new technologies, resulting in increased digital readiness.

2.3 The Challenges of Industry 4.0 on Human Resources Management in Tunisia

Industry 4.0 will alter community everyday routines as well as all business behaviors. This evolution must maintain pace with states, society, businesses, and employees. Those who are unable to keep up with change risk economic extinction. This transformation, which affects states, societies, businesses, and people, will have a significant impact on human resource management.

Industry 4.0 will transform all stages of manufacturing, distribution, and marketing, as well as embrace significant organizational changes. Human resources will be at the heart of these developments. Companies who are agile and have easy-to-change adapters will get ahead of the competition. Human resources will need to reinvent its goal, job definition, and duties in order for the agile process to proliferate throughout the firm (Alayoğlu 2010).

Organizations will need to connect their HRM strategies and practices with Industry 4.0, encompassing subjects such as workforce employment and skill development, according to Sivathanu and Pillai (2018). In this view, some digital abilities, such as problem-solving, non-routine activities, and the generation of digital outputs, may be required in this Industry 4.0 future (Djumalieva and Sleeman, 2018). This is due to the fact that some technologies, such as the Internet of Things, Big Data, and artificial intelligence, will automate the majority of HR activities, resulting in more efficient and smaller HR staff. Industry 4.0 will affect human-related concerns such as training, development, employment, and skill development across supply chains.

Industry 4.0 has had a tremendous influence on Tunisian firms, notably on human resource management. The incorporation of innovative technology into numerous businesses has created new problems for the country's HR specialists. While the Fourth Industrial Revolution offers tremendous benefits, it also brings with it a number of difficulties that HRM must solve in order to stay competitive. (Alouane and Sakka, 2021)

The requirement for a highly qualified labor is one of the most fundamental problems faced by Industry 4.0. Because of the transition toward automation and digital technology, human resource managers must guarantee that employees are taught in the skills necessary for these new tasks. This has resulted in a greater emphasis on training and development programs in Tunisia, with many firms investing in staff upskilling and reskilling projects. (Ben Ayed and Ben Yahia, 2020) Another issue raised by Industry 4.0 in Tunisia is the need for a more adaptive and flexible workforce. The advent of digital technology has made it easier for organizations to function remotely and manage remote staff. As a result, there is a greater emphasis on flexible work arrangements, as well as a trend toward a more results-oriented work culture. HR managers must be able to adapt to these changes and ensure that staff have the skills and tools they need to perform effectively in a remote workplace. Concerns concerning data privacy and security have arisen as a result of the rising usage of digital technology in the workplace. (Bouzidi et al., 2019) HR professionals must guarantee that personal data of workers is secured and that they are aware of the hazards connected with the use of digital technology. This has resulted in the establishment of new data privacy and cybersecurity regulations and processes in Tunisia.

Overall, Industry 4.0 has brought various obstacles for Tunisian HR experts. To meet these difficulties, HRM must adapt to the changing technology world, seizing the benefits while tackling the obstacles. HRM can effectively traverse the Fourth Industrial Revolution and prosper in the years ahead with careful planning and intelligent decision-making. (El Ouirdi et al., 2018)

3. Research Method

To address the indicated research questions, a thorough approach to the identification and analysis of studies from appropriate and reputable sources that characterize competences in the context of the development of Industry 4.0 and digitalization in general is required. To that end, we will begin with the identification and analysis of studies, followed by the extraction of data and, lastly, the research perspective. The study will be separated into two portions. The first will be a theoretical component in which we will explore the many concepts of the issue based on the preliminary investigation. The literature review will include the study's main aspects such as digital readiness models, the degree of digital competencies and attitudes among digital enterprises in the native nation, and digital technologies instruments in the industry 4.0. The literature review

will aid comprehension of the key topics based on previous research. This issue necessitates the use of two complementing procedures for the empirical portion of this research: qualitative and quantitative methods, which means a mix methodology. The qualitative approach will be used initially, followed by quantitative methods to check and interpret the data.

3.1 Research Questions

The primary literature review based on the previous research and the main methodology of our problematic were focusing on having answers to the following questions:

Q1: To what extent does the level of digital competence and attitude of employees influence a company's digital readiness in Tunisia?

O2: How are digital technologies from Industry 4.0 used to create a framework for developing employees' digital readiness in Tunisia?

Q3: What are the challenges of HRM with the implementation of Industry 4.0 in Tunisia?

3.2 Data Collection and Interview Participants

We will distribute an online questionnaire in the form of a newsletter to members of Tunisian groups and enterprises, as well as employees and students. Attempting to meet the estimated sample size. An internet connection will be used to disseminate the questionnaire. These descriptive questions will include both open-ended and multiple-choice questions. To moderate the participants' viewpoints, we will incorporate a 5-point Likert scale in this questionnaire. On a 5-point scale, we will assess the utility of the latter technologies in order to understand how they assist internal and external process improvements and business success in the field of HR. We will utilize a PwC model to try to capture the present stage of development in order to better understand how manufacturing organizations approach Industry 4.0 and digitalization, as well as the technologies they use. In this study, independent sample t-tests will be used often to emphasize discrepancies between our assessments, in addition to numerous descriptive statistics. The quantitative method will not be reflective or generalizable in this study project, so in order to explore real company cases demonstrating how companies perceive Industry 4.0, what technologies they use and how they are adjusted, as well as what concerns companies perceive, we will use a qualitative method that includes several interviews (online or face to face). These interviews are open-ended, allowing interviewees to express themselves freely, and we will examine their replies. Several expert interviews will be conducted to supplement the findings. The list of members of the National Technology Platform, which is the body representing Tunisian firms and institutions involved in Industry 4.0 innovations, will be used to aid in the selection of enterprises. We will choose firms from the membership list, and at the conclusion of each interview, we will ask the interviewee to propose additional possible interviewees whom they know and who may have interesting perspectives or practices in Industry 4.0. The interviews will be semi-structured—a list of questions will be utilized, but if interviewees wish to go into further depth, we will deviate from the list. The interviews will then be compared based on the previously established topics: interpretation of Industry 4.0, its influence on the field of human resources, problematic issues, and the development phase.

3.3 Description of the Target Group

Our participants will be members of Tunisian Associations and Companies, as well as workers of digital organizations. We will strive to get 500 people to participate. The focus will be divided into many groups: managers and staff of enterprises in Tunisia. The individuals in the groups will be between the ages of 20 and 50. We may also add students who are looking for work and are inspired by the new technological revolution and the impact of digitalization on the field of Human Resources.

3.4 Choosing the Method of Data Analysis

Following the pre-definition of our topic's literature research, we will proceed to the reduction of the questionnaire in order to distribute it to our sample. The questionnaire will have open questions with brief responses such as (number of workers, yearly revenue, etc.) as well as multiple-choice questions. For the Likert scale, we will use 5 points to reflect employee satisfaction with transformations and the influence of the phenomenal on their area, as well as to express the amount of relevance of these technologies for businesses. The questionnaire will be completed with the participants' sociodemographic information. After all, the questionnaire will be disseminated online to the estimated sample, and after collecting all of the replies, we will begin analyzing the data on SPSS and PLS using various tests. On AMOS, we will compare the various variables

to see how they are related to one another. Several tests will be utilized to extract the effective data that we require from the data that we have gathered in order to confirm it in our study. Following the quantitative approach, we will move on to the qualitative approach, which will involve open interviews. The interview will cover the essential topics of the subject. Subtitles will be extracted from the study major questions and divided into portions for the interview. The interview will consist of entirely open questions, beginning with a brief introduction of the participant and their understanding of the issue and progressing through all areas of the questions to allow them to freely discuss their experiences and expertise. We will provide a pleasant environment for the interview so that the participant feels free to express himself. We will ask the interviewees to record the session, and if they refuse, we will just take notes and record audibly so that we can understand the comments afterwards. After we have completed all of our interviews with our participants, we will proceed to the analysis and interpretation of the collected answers, unit by unit.

4. Conclusion

Finally, the Fourth Industrial Revolution, or Industry 4.0, has significantly altered the way firms function in Tunisia. The integration of digital technology has enhanced efficiency, production, and competitiveness in a variety of industries, but it has also brought a number of obstacles. Analyzing Tunisia's digital preparedness revealed a strong need for further investment in digital infrastructure and education. Many firms and individuals continue to fall behind in terms of digital adoption, which can put them at a competitive disadvantage. There are, however, possibilities for individuals who can accept modern technology and use them to their benefit. After examining the Tunisian market, this essay will give us with future outcomes.

My study topic's restriction is that it does not reach enough firms in the market. Given that I will not be presenting every time, it may be difficult to contact as many firms as we require. Perhaps, for the practical consequences, the findings of Tunisian enterprises will be shown, and they will know the areas where they need to enhance their employees' digital competency.

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The Role of Social Initiatives in Developing Front-Line Employees' Capabilities in the Service Industry: The Case of a Delivery Company

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Abstract: The response of businesses to address social issues has gone beyond the scope of traditional corporate social responsibility activities. They now include a more strategic focus on initiatives that incorporate the core business operations of the firms into solving social issues. This is perhaps coupled with heeding to Porter and Kramer's 2011 call for firms to focus on "creating a shared value." Subsequently, this new approach has attracted researchers to investigate what impacts this approach has on companies and their employees. Empirical studies have linked a firm's social initiative involvement to employee-level impacts such as motivation, retention, and identity, but its relation to employee capabilities, including skills and knowledge, has not been sufficiently investigated. Ultimately, employees' overall performance depends largely on their capabilities. Through the lens of knowledge creation theory, this study investigates the relationship between a firm's concerted involvement in social initiatives and its employee capabilities at a Japanese package delivery company by examining the case of Yamato Transport Company's delivery drivers in rural Japan. The case study was conducted at Otoyo Town in Kochi Prefecture, where a social initiative project to provide shopping support and watch-over service for elderly people has been ongoing since 2012. Data was collected primarily through project site visits, and interviews with project stakeholders, who included Yamato branch managers, delivery drivers, and local authorities involved in the initiative. Information available in the company's newsletters, annual reports, and other publicly available sources was also analyzed. Results found that social initiatives can serve as a knowledge-creation context for frontline employees as they create the opportunity for employees to socialize with customers and project partners in a collaborative manner. This rare opportunity helps employees improve on-the-job skills and other tacit capabilities such as empathy, reliability, and communication. Finally, frameworks showing the relationship, impact, and performance of social initiative involvement for a firm and its employees are presented.

Keywords: Social initiatives, Employees' capabilities, Soft capabilities, Hard capabilities, Case study

1. Introduction

While corporate social responsibility (CSR) in general is a broad term referring to companies' voluntary efforts to tackle social and environmental concerns.(Komisyonu, 2001) The social initiatives discussed in this paper are better referred to as "corporate social initiatives." (CSR) or "social initiatives," a concept described by Hess, Rogovsky and Dunfee, (2002) as projects that differ from traditional CRS activities in that they are connected to the firm's core values, based on the firm's core competencies, and have clear objectives and means of measurement. Additionally, unlike CSR, social initiatives are not pro bono projects but operate very similarly to the mainstream business of the firm and are managed like commercial projects. The main difference between social initiatives projects and commercial projects is that they have a stronger emphasis on social impact and are non-profit. (Hess, Rogovsky and Dunfee, 2002, p. 115; Bode, Singh and Rogan, 2015, p. 2)

Therefore, social initiatives can be defined as a part of corporate endeavors to address social issues based on the core business of the company through non-profit projects and programs with a social goal as their focal objective. In contemporary CSR literature, attention has been given to these social initiatives as they create value for customers, communities, and companies. At the strategic and policy level this approach is what Kramer and Porter (2011) referred to as "creating a shared value."

Furthermore, there is consensus among scholars that an important new line of inquiry is no longer whether CSR initiatives work but, rather, why companies engage in these initiatives. (Aguilera et al., 2007, p. 837; Brønn and Vidaver-Cohen, 2009, p. 91)

In response to this inquiry and to understand why companies engage in social initiatives, this research investigates what impacts social initiatives have on companies and their employees. Drawing from the perspective of knowledge creation theory, which argues that knowledge is created and converted in an enabling context through the face-to-face interaction of individuals in a process called socialization. (Wei Choo and Correa Drummond de Alvarenga Neto, 2010)

Do these social initiatives create an enabling context for socialization with players outside the organization, such as customers and other project stakeholders? And do these social initiatives enhance the knowledge and skills of the frontline workers who directly interact with customers and other stakeholders? This research examines the impacts that social initiatives have on the knowledge creation and skill development of the

employees involved, through a qualitative study of a decade-long social initiative project that provides shopping support services to elderly people. This social initiative project is conducted by Yamato Transports Co. at Otoyo Town in Kochi Prefecture, Japan. This research has two main objectives: First, to define what knowledge and skills delivery drivers (also known as sales drivers) need to effectively conduct their functions. Second, to examine how these knowledge and skills are impacted by their participation in the social initiative. The combination of this knowledge and skills is referred to as "capabilities" in this paper.

2. Theoretical Background

This section gives an academic background on knowledge creation theory, socialization, and employee capabilities. It also analyzes how these three concepts are related in the context of social initiatives.

2.1 Organizational Knowledge Creation Through Interaction With Customers

According to the theory of organizational knowledge creation, the context in which knowledge is created is known as "Ba," and there are four types: *Interacting/dialoging "Ba,"* in which knowledge is created and converted through peer-to-peer reflection. *Cyber/systemizing "Ba,"* in which knowledge is created and converted through group-to-group collaboration. *Exercising "Ba,"* in which through active participation on-site and on-the-job knowledge emerges; and *Originating "Ba,"* where individuals share feelings, emotions, experiences, and mental models through a direct encounter, leading to the emergence of care, love, trust, and commitment, and eventually tacit knowledge emerges. (Nonaka and Konno, 1998; Nonaka, Toyama and Konno, 2000; Al-Mansour and Obembe, 2021)

This research is particularly interested in the *Exercising* and *Originating "Ba",* where tacit knowledge is created, more specifically at individual level outside the organization and where skills are developed on-the-job. (Nonaka and Konno, 1998; Nonaka, Von Krogh and Voelpel, 2006; Al-Mansour and Obembe, 2021) Khodakarami and Chan (2014) studied how customer relationship management (CRM) systems support customer knowledge creation processes, and divides socialization into two: one that happens within the organization and one that happens with the customers outside the organization. Pereira, Ferreira and Alves (2012) argues that direct interpersonal contacts create tacit knowledge, which is a source of sustainable competitive advantage for the firm. And relationship marketing (RM) is particularly important for firms in the service industry, especially when the service requires high interpersonal contact with the customers.

There is a considerable consensus among scholars that knowledge is 'socially constructed' (Spender, 1996; Gibbert, Leibold and Probst, 2002). Social initiatives seem to provide an above-normal level of exposure and interactive opportunity for the employees in a context characterized by mutual collaboration of all players with positive social impact objectives and goodwill for the community.

2.2 Socialization in Social Initiatives and Employee Capabilities

In developing employee capabilities, there is no doubt that formal, structured programs of training are important, but what happens on the job is the most important element in the growth of employee capabilities in confronting problems. (Bennett, 1969, p. 45) Therefore, having discussed how knowledge creation occurs through interaction with customers and other stakeholders in an enabling context called "Ba," we could ask the following questions: Can social initiatives be an enabling context for knowledge creation for the company by serving as a "Ba" for individual employees to interact and share tacit knowledge with the project stakeholders? Can social initiatives create a conducive new environment for frontline workers to sharpen and improve their skills, thereby improving their overall capabilities? And why are employee capabilities an essential part of a firm's competitive advantage?

*"*Socialization in practice involves capturing knowledge through physical proximity, creating, and converting tacit knowledge between individuals. This process of acquiring knowledge is largely supported through direct face-to-face interaction with stakeholders such as suppliers and customers*."* (Nonaka and Konno, 1998, p. 43) Socialization can happen beyond organizational boundaries (Chou and He, 2004, p. 147). And according to Tsoukas and Vladimirou (2001, p. 983) in organization context, knowledge is the capability its members have that enable them to draw distinctions in a *concrete context* based on collective understanding and experience.

2.3 Employee Capabilities

"Employee capabilities are a measurable pattern of knowledge and skills, but also behaviors, and other characteristics that differentiate high from average performance" (Maley, 2019, p. 147) additionally, they are

knowledge-based, firm-specific, and socially complex (Maritan, 2001, p. 514). connected with decision-making, problem-solving, self-esteem, and task completion abilities (Gohar et al., 2015, p. 153).

Bontis and Serenko (2007) acknowledged that capabilities depend on training and development programs, and job satisfaction levels. Kakui and Gachunga, (2016) revealed that on-the-job training influences the performance of employees by increasing their motivation and providing additional capabilities and networking opportunities. Knowledge from formal education and skills acquired through on-the-job training increase employees' capabilities. Ultimately, interactions among various actors in an enabling context increase capabilities. (Gohar *et al.*, 2015; Dal Mas *et al.*, 2020, p. 213)

Management scholars emphasize the importance of employees' capabilities for various reasons, the main of which is that employee capabilities can serve as a critical competitive advantage for a firm (Eicker, Kochbeck and Schuler, 2008) as well as a means of sustainable productivity. (Dabić, Maley and Nedelko, 2023)

Maritan (2001) argued that investing in employee capabilities is one of the most critical type of capital investment a firm can make. Employees' capabilities can also serve as options, because they reduce the cost of adjustments when changes occur, preserve value, and create flexibilities of decision and operation according to Maley (2019), who urges firms to develop employees' capabilities proactively.

2.4 Classification of Employees' Capabilities

Capabilities can be defined as a measurable pattern of knowledge, skills, and other attributes that collectively contribute to an individual's overall ability and performance. This comprehensive definition of capabilities allows us to perceive employees' capabilities in relation to an individual's holistic abilities to perform a task or function. This way, we will be considering not only their technical skills but also their attitude, self-esteem, experience, and other characteristics that significantly impact their performance. With this dynamic definition, we can further categorize employee capabilities into two main types: *Hard and Soft capabilities.* (Laker and Powell, 2011; Robles, 2012; Voogt and Roblin, 2012; 2020; Romero *et al.*, 2022) as cited in (Dabić, Maley and Nedelko, 2023)

Table 1: Employee Capabilities

Employees Capabilities				
Soft Capabilities			Hard Capabilities	
Tacit knowledge	Relations skills	Conceptual skills	Explicit knowledge	Technical skills

The classification of skills into conceptual, technical, and relational skills is adapted from Katz, (2009) which aligns with Katz's earlier work on the *"Skills of an effective administrator"* (Katz, 1955) Additionally, the distinction between tacit and explicit knowledge follows the framework proposed by Nonaka and Takeuchi (2007). What is novel about this classification is the integration of skills and knowledge as integral components of capabilities, this approach reflects more on the productivity of frontline workers.

For instance, we can consider *Experience* as a component of capability, wherein employees gain additional knowledge (tacit or explicit) and further develop skills (conceptual, technical, or relational) through their experiences. And we can view *Attitudes* as an important component of capabilities, with attitudes towards work falling under conceptual skills and attitudes towards people falling under relational skills.

By including experience and attitudes as components of capabilities, we acknowledge their significance in shaping an individual's abilities.

Furthermore, this perspective aligns with the notion that capability development is an ongoing process. It entails a measurable pattern of knowledge, skills, and other attributes that contribute to an individual's overall ability and performance. Both attitudes and experiences change over time, further emphasizing the dynamic nature of capability development.

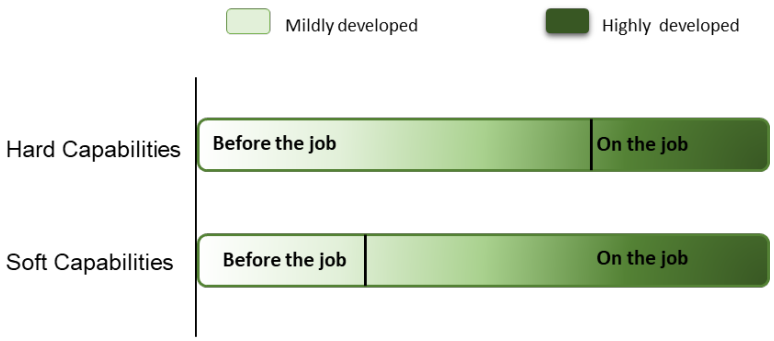


Figure 1: Development of Capabilities on the job and Before

2.4.1 Hard capabilities

These are knowledge and skills that are easily codifiable, measurable, transferable, and earned through learning and training.

Hard capabilities consist of explicit knowledge, such as familiarity with traffic rules and road regulations, knowledge of the local area map, and understanding package handling procedures. They also encompass technical skills, including driving proficiency, IT skills, and the ability to operate machines and devices on the job.

These are all foundational requirements that sales drivers must meet before they can undertake independent delivery missions, ensuring safety and operational efficiency. Employee manuals, skills training courses, and rulebooks are common sources of hard capabilities.

The absence of these hard capabilities can have operational consequences for the company. Therefore, it is crucial for employees to possess a high level of hard capabilities before they commence their job functions. Furthermore, since capability development is dynamic in nature, these capabilities are further enhanced through on-the-job training.

2.4.2 Soft capabilities

These capabilities have a significant impact on an employee's performance in sales and service-related functions. But they are hard to measure, codify, and transfer. They are primarily developed through experience, intuition, and attitudes. Soft capabilities encompass relational skills, such as effective communication and the ability to establish and maintain positive relationships. They also involve conceptual skills, such as problem-solving and the ability to handle unpredictable situations. In addition to tacit knowledge related to understanding customers' situations and emotions at a deeper level, as well as empathizing with them. Soft capabilities are acquired through experience in various situations and under different circumstances on-the-job. While they are partially developed during onboarding training, they are predominantly obtained after employees have started their job.

3. Methodology

This case study used a qualitative research method, as this provides the flexibility to explore complex concepts from the vantage point of the participants. (Webb and Mohr, 1998) This study involved going to the social initiatives project sites and having face-to-face semi-structured interviews, follow-up Zoom interviews, telephone calls, and email exchanges.

The dialogs were mainly focused on understanding the way the social initiatives were implemented, the relationships between different stakeholders, and their perspectives on the impact on all stakeholders involved. The interviews were conducted without sharing the main research objective with the interviewees.

The main interview talking points are as follows:

- What kind of knowledge and skills do sales drivers need to be better performers than average?
- How are these social initiatives conducted, and what sort of relationships does the firm have with the partners?
- How do stakeholders view their participation in these initiatives? And what are their views on their counterparts' participation?

- What does the company's participation mean for frontline employees?

However, the question of what determines employee performance was not investigated, as this may be out of the scope of this paper. And the assumption is that employee capabilities influence performance.

3.1 Research Context

Because of the aging and declining population in Japan, rural communities face numerous problems, including businesses and shops closing because of a lack of sales. Otoya Town is in the mountains; according to one of the interviewees, the town is about 80% mountainous, and this makes movement within the town hard. In April 2023, the population of the town was 3,181 residents, according to the town's official data, a decrease from 4,719 in 2010. About 60% of the population is at least 65 years old. (Marcus, 2022; Otoyo Town, 2023) With declining sales, shop-owners cannot afford to give a free delivery service to customers who struggle to come to the shops, and neither can the elderly customer with minimal income afford an extra delivery fee at the market rate.

On the other hand, Yamato Transports is a leading Japanese logistics company, with 46.6% of the domestic parcel delivery market share as of 2022. Additionally, the company uses its extensive network and human resources to partner with local authorities in resolving social issues and revitalizing local communities through social initiatives solutions. By December 2019, the company had 1075 active social initiatives projects around Japan, all aimed at addressing issues faced by local communities by collaborating with local governments and authorities. (Yamato Holdings, 2019, 2020, 2022)

Yamato Transport and Otoyo Town's authorities started a social initiative project in November 2012 with the aim of offering shopping assistance and watch-over services for the elderly people in the town. (Yamato Holdings, 2013, p. 9) Under this initiative, the elderly customer can place an order by making a call to one of the participating shops in the town, and then the shopkeepers organize the package in a container that can be up to 35 ㎝×49 ㎝ × 33 ㎝ in size with a maximum weight of up to 25 kg. The delivery price is JPY150 (about USD1.1) per container. Orders placed before 11:00 AM will be delivered on the same day by Yamato sales drivers to the customers' residence, who will collect payment of the delivery fees and price of goods upon delivery. Additionally, the local government also covers some of the project expenses.

3.2 Data Collection Method

This research involved semi-structured, one-to-one, and one-to-two interviews with social initiatives project participants between April 2022 and April 2023. It involved talking with stakeholders namely sales drivers (two interviews) managers at the Yamato Transports (two interviews), officials from the longevity and welfare division in Otoyo town and Nishiwaki city (two interviews one email questionnaire); Otoyo Chamber of Commerce (two interviews). Additional material on the company's and Otoyo town's websites and publications publicly available were also used.

Table 2: List of Interviewees

Semi-structured Interviewee	Gender
Yamato Transport Co. manager 1	Male
Yamato Transport Co. manager 2	Male
Yamato Transport Co. sales driver 1	Female
Yamato Transport Co. sales driver 2	Male
Otoyo Town Chamber of Commerce official 1	Male
Otoyo Town Chamber of Commerce official 2	Male
Otoyo Town longevity and welfare division official	Male
Nishiwaki City longevity and welfare division official 1	Female
Nishiwaki City longevity and welfare division official 2	Male

4. Findings

To examine the impact of social initiatives on employees' capabilities through knowledge creation and on-the-job training, the research focuses on how soft capabilities are potentially influenced during the social initiatives, and if the chance for socialization to create tacit knowledge is present.

4.1 Building Relationship With Customers

Social initiatives enable frontline employees to build closer relationships with the customers and partners compared to normal business operations. This is because sales drivers in these initiatives are encouraged to create a closer relationship with the customers they serve. The guiding principle behind Yamato's social initiative, as shared by one of their managers, is rooted in the belief that their sales drivers' success is tied to the success of their customers. He gave an example of instances when sales drivers would see elderly people walking around areas far from their known residence, and the sales drivers would stop to ask the elderly customers if everything was okay and confirm if they had lost their way home. This is how familiar the sales drivers can be with the customers, he explained.

He also gave an example of an instance when one of the sales drivers came to the office and asked colleagues if they knew any good honey dealers in the area. Apparently, a shop-owner participating in the social initiative had asked the sales driver to help him find a good honey supplier in the area because the sales drivers deliver in different towns, so they know more people in the neighboring area. Because of the close interpersonal relationship, the sales drivers have with the customers and shop-owners, they are able to help out with things outside of the usual business of delivering goods.

Similarly, at Nishiwaki city, welfare official 1 described to me how Yamato employees in the city have become conscious of watching over the elderly even outside their business hours, and she quoted an instance when a sales driver found an elderly person who was sick and crouching outside, called out to the elderly, and helped.

Helping customers find their way back home or when they are feeling ill and helping shop-owners find new honey suppliers all indicate how close a relationship the sales drivers have with the customers in these initiatives.

There is continuous consultation with the partners in the projects to reflect and make potential adjustments. I learned from Otoyo Chamber of Commerce officials that at the end of 2021, after consultation with Yamato and the Town Office, they concluded that one of the stores that had the largest demand at the time was to be removed from the initiative as it was able to attract enough customers even without the initiative, bringing down the total active stores in the initiative to 13 stores as of April 2023.

4.2 Spending More Time and Being Watchful

The sales drivers spend more time with the customers in the social initiative than they would in their normal day-to-day business operations. The Otoyo Town's social initiative has two main aims: To make delivery of shopping items to the customers' residents, and to check on the elderly customers' state of health. They check on their health conditions by asking them a few questions during the delivery and by observing their behavior. This is why these social initiatives are called shopping support and watch-over service, there were 150 nationwide including Otoyo Town and Nishiwaki City.

The watch-over support service is when a delivery driver makes a delivery to the household of an elderly person, usually living alone, talks to them and observes if there is any apparent health issue, then reports this to the local authorities. In Otoyo Town, reports of "serious cases" are rare. According to Otoyo Town longevity and welfare division officials, the last time a case was reported was about a year ago (2022).

Moreover, a similar watch-over initiative is underway in Nishiwaki City. Unlike Otoyo, where sales drivers are encouraged to have a casual chat with the customers, the sales drivers are given a questionnaire with three health-related questions to ask customers during delivery. These health-related questions are asked to check on customers' health status. Therefore, either through a small chat and observation of their behaviors as in Otoyo Town or a structured questionnaire as in Nishiwaki City, sales drivers spend more time with customers during their delivery missions in the watch-over service social initiatives.

4.3 Soft Capabilities on-the-Job

Regardless of location and project, all sales drivers have a similar basic onboarding training program, but soft capabilities are developed on-the-job. "There are two kinds of training. The first is the training in basic skills,

such as how to drive and how to deliver. This form of training is easily learnt from manuals. The second is training in service skills, which cannot be acquired from manuals. In Yamato, service skills are interpreted as the ability to judge what to do independently in any situation, in accordance with the guidelines established by the corporate philosophy."(Liu and Goh, 2015)

The same sentiment is confirmed by Yamato Manager 1. He explained to me that the company is mostly concerned from a risk standpoint with avoiding traffic accidents and maintaining the company's good reputation. And added that sales drivers are not only delivery drivers, but also salespeople, trained to be so.

Their training includes the necessary driving skills including traffic rules what to do in special circumstances, how to park in hilly and narrow streets, and they are given enough time to familiarize themselves with the map of the area. Additionally, they are trained on how to interact with customers and solve their issues on training courses and on the field before they can embark on independent delivery missions. One such training that sales drivers go through includes how to deal with people living with dementia.

However, it is safe to assume that those sales drivers dealing with the elderly in the watch-over support service social initiatives are more likely to in fact interact with people living with dementia, making these initiatives a unique on-the-job training for the employees to encounter more realistic situations in this sense.

Three respondents share the sentiment that soft capabilities such as communication, patience, and empathy of sales drivers have improved during their participation in social initiatives. (Yamato Manager 1, Nishiwaki city welfare official 1 and chamber of commerce official 1)

5. Discussions of Findings

This section will discuss social initiatives in more detail and their impact on the main players, and then further delve into their impact on employees' capabilities. Although the main goal of social initiatives is to have a positive social impact for the community and its members, "it is important to note that organizational benevolence does not necessarily exclude the simultaneous pursuit of self-interested objectives." (Beveridge and Höllerer, 2023, p. 4)

5.1 Impact of Social Initiatives on the Firm and Community

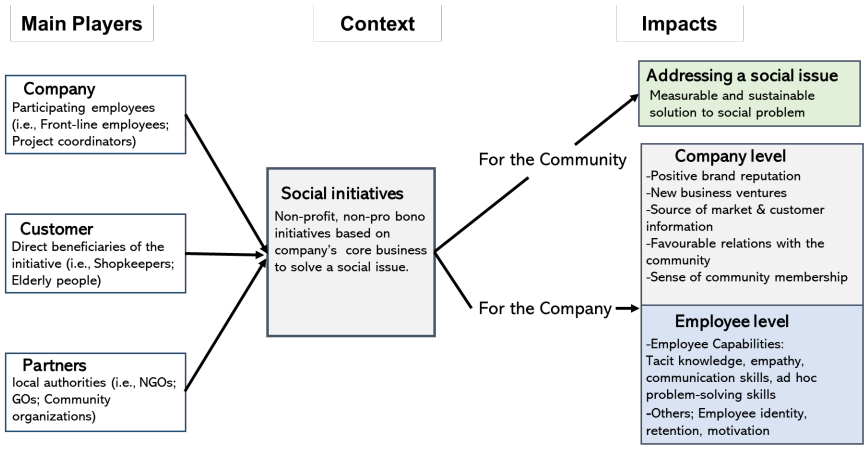


Figure 2: Impact of Social Initiatives on Stakeholders

5.1.1 Main players

(a) The *Company* provides resources, including human capital, through the participation of its employees. In this case study, this includes sales drivers who deliver items to elderly residents. A key distinction between social initiatives and other CSR initiatives is that the company offers a solution based on its core business and providing this service at a rate below the commercial market price, without compromising the quality of service. Unlike commercial projects, where profit is the goal, social impact takes precedence in social initiatives.

(b) The *Customer* represents the second player. These are typically the citizens of the community, directly benefiting from the social initiatives' intended social impact. This includes elderly people and local storeowners because the initiative addresses the issue of shops going out of business due to low revenue and a lack of buyers. Additionally, elderly individuals who face challenges walking long distances to purchase

essential items, primarily due to their age and the town's mountainous terrain, can conveniently buy their basic daily needs with a simple phone call.

(c) The *Partners* form the third group of stakeholders involved in social initiatives. These partners can be NGOs or community-based associations that collaborate with the company in implementing the social initiative projects. In the case of Otoya Town, the partners include local authorities such as the chamber of commerce and the social welfare division at the town office. The chamber of commerce is committed to revitalizing the town's economic activities, while the town office is responsible for the welfare and well-being of the town's residents, including the elderly.

5.1.2 Context

There are several distinctive features of social initiatives that provide employees with opportunities for on-the-job training to enhance their capabilities.

Firstly, the stakeholder dynamic among the major players differs from that in commercial operations. In social initiative projects, collaboration and partnership are key characteristics as the main players work together to address a common social issue. This dynamic is underpinned by mutually beneficial relationships and a shared goal among the company, customers, and government (GOs) or non-governmental partners (NGOs) involved in the initiatives. The second feature of social initiatives is that they have specific and measurable social impact goals, with the company contributing based on its core business. For instance, Yamato's contribution to this social initiative involves delivering orders from shops to the homes of elderly people. Given that Yamato holds the highest market share for home delivery in Japan, delivering packages to homes aligns perfectly with their core business competency. This means that employees participating in the social initiative will be performing tasks similar to their day-to-day operations but within a different context.

5.1.3 Impacts

On the one hand, the community can address a pressing issue it faces by collaborating with a market-leading company, which offers its services at a price below the market rate. On the other hand, impacts at the company level include a positive brand reputation, where the market perceives the participating company as an active social contributor, and the community views the company favorably, seeing it as genuinely concerned about their well-being.

Secondly, social initiatives serve as sources for new business ventures. For example, in the case of Yamato, the company has achieved 100% coverage of last-mile delivery across the country. The company can deliver packages to virtually any location, including golf courses and ski resorts. Therefore, while social initiatives may not yield immediate financial profitability, they provide an effective means for the company to utilize its existing network and manpower to expand its market share by increasing the number of packages delivered year-on-year. At the employee level, involvement in social initiatives fosters the development of employee capabilities in several ways. First, it serves as a context for organizational knowledge creation, with frontline workers actively participating and socializing with customers and partners. This knowledge eventually becomes part of the organizational knowledge base.

Second, social initiatives help employees enhance their relational skills, as they closely collaborate with other stakeholders and build close relationships. Additionally, employees' conceptual skills are also honed, as they often require ad hoc problem-solving, at a level different from regular business operations. Therefore, it is reasonable to argue that involvement in social initiatives provides the company with a competitive advantage in the long run. This advantage stems from the positive impact on brand reputation, new business ventures, customer trust, organizational capabilities, and employees' capabilities.

5.2 The Impact of Social Initiatives on Employee Capabilities and Firm's Competitive Advantage

According to Alipour, Idris and Karimi (2011) the success of a company will depend to a large extent on the capabilities of its members developed through knowledge creation. If a company has employees who can fulfil their functions and responsibilities based on their capabilities, both hard and soft, the company will gain a reputation commensurate with their performance. Moreover, what differentiates a high-performing firm in the services industry is the soft capabilities of its customer-facing employees. particularly because in the service sector, sales skills and human relations are as relevant as the service rendered. While hard capabilities contribute to the company's reputation, the human relations and emotional aspects accompanying the service are what give a company an edge over its competitors.

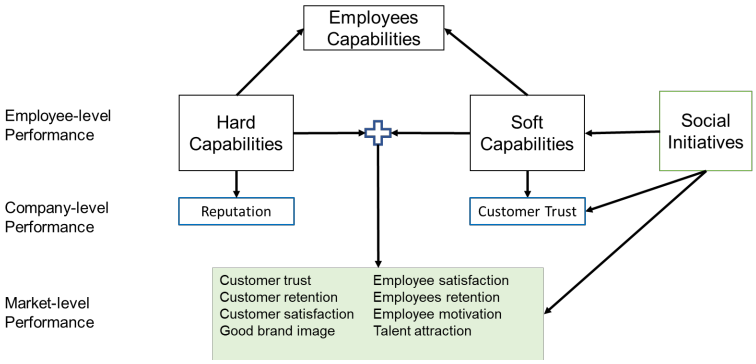


Figure 3: Social Initiatives on Employees' Capabilities and Firm Performance

6. Conclusions

In defining the knowledge and skills necessary for sales drivers to effectively carry out their functions, two main types of capabilities are identified. Although both types are improved on-the-job, hard capabilities can be developed to advance levels before the start of the job. On the other hand, soft capabilities are mostly developed on-the-job through experience, and social initiatives give employees a unique experience to enhance their soft capabilities. Additionally, soft capabilities developed through social initiatives are considered relevant for a firm's competitive advantage as they are acquired in a context different from the commercial market.

However, this research is not without limitations, this includes its focus on a rural area in Japan, which may restrict the generalizability of the findings to other regions. Nevertheless, the study contributes to academia by offering insights on how social initiatives can enhance firm performance through employee capability development. This understanding can benefit management practitioners by utilizing social initiatives as tools for employee development and organizational knowledge creation.

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Designing an Analytical Framework for Measuring Knowledge Mobilization in Higher Education Institutions in the Philippines

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Abstract: The study aims to design a framework for measuring the effectiveness of knowledge mobilization (KMb) in higher education institutions (HEIs) in the Philippines. The said design is intended to guide and strengthen the research efforts and research capability of HEIs that have been mandated by the Commission on Higher Education (CHED) to lead in the conduct of technology-directed and innovative/creative research that is locally responsive and globally competitive and to ensure that the research outputs are presented and distributed to, and utilized by, their respective internal and external stakeholders. The exploratory sequential mixed methods design was used starting with collecting and analyzing qualitative data obtained from a mini knowledge audit using open-ended questions. The instrument was given to 17 respondents from HEIs in the National Capital Region via online following health and safety protocols. These respondents were either research directors or project research leaders of their respective HEIs. A content analysis of qualitative data was used to guide the researcher in designing a framework for measuring the effectiveness of knowledge mobilization in HEIs in the Philippines.

Keywords: Exploratory sequential mixed methods, Analytical framework, Knowledge mobilization, Mini-Knowledge audit, Knowledge mapping, Measuring.

1. Introduction

Schools of higher learning are the moving force behind a knowledge-based society and are among the institutions entrusted to create, communicate, distribute, and utilize knowledge (UNESCO Asia and Pacific Regional Bureau for Education, 2002 as cited in Knight, 2014). Thus, the Commission on Higher Education (CHED), the government agency created to supervise all higher education institutions (HEIs) in the country through the passage of Republic Act 7722, introduced measures to support a knowledge-based economy, namely: (1) Identification of intervention measures to increase the quality and quantity of research outputs of HEIs; (2) Development of the National Higher Education Research Agenda (NHERA), which provides the policies, directions, priorities, and thrusts of Philippine higher education research in the medium and long term; and (3) Establishment of more partner institutions/agencies for research capability training.

HEIs are expected to produce knowledge resources to contribute to the economic growth of the country (Rodrigues, Gupta, & Carlson, 2015). The knowledge resources they create, develop, and produce through research and development have to be effectively and efficiently mobilized to serve the organization, the community, and the country and ensure that "knowledge [is] put into action; action without knowledge is dangerous" (Bennet & Bennet, 2007).

2. Statement of the Problem

The Commission on Higher Education (CHED) and the Department of Science and Technology (DOST) have worked together to provide HEIs research funding, promote a culture of research, and connect them with industry partners to solve specific problems in the community. However, it is difficult to determine the effectiveness of this effort because there is no significant measuring tool that can assess the knowledge mobilization (KMb) of HEI research results in the Philippines. Likewise, it is critical to understand the current process of KMb and the effectiveness of that process in supporting utilization of the research results. To support this need, this study focuses on designing an analytical framework for measuring the effectiveness of knowledge mobilization (KMb) in HEIs. This study aims to design an analytical framework for assessing the effectiveness of KMb in Higher Education Institutions (HEIs) in the Philippines. This research will answer the primary question and secondary question to support the discovery of the solution set for the primary question:

- How can the effectiveness of the KMb in HEIs be assessed?
    - What is the current state of the mobilization of research results in Philippine HEIs?
    - How can the mobilization of research results in HEIs be measured?

3. Scope of the Study

This analytical framework will guide in effectively mobilizing research results of HEIs. Specifically, the outcomes of the KMb analytical framework will:

- Improve research mobilization. The KMb analytical framework will guide researchers in enhancing their research mobilization capabilities.
- Value the culture of research. It will promote research habit in HEIs and encourage continuity of research not only to advance their career but also challenge them to provide solutions to existing problems.
- Support funding for research infrastructure. The framework design will assist policymakers in formulating guidelines on allocating resources for research infrastructure.
- Create a framework designed for usability and leveling up of research results. The framework design will lead to better dissemination and implementation of research results which will facilitate collaboration among stakeholders and may further lead to developing a feedback mechanism that will be useful for further studies.

4. Related Literature

Knowledge: Knowledge is the only meaningful resource today to create value and wealth in the organization (Drucker, 1993 as cited in Omotayo, 2015). Although the traditional factors of production – land, labor, capital, and entrepreneurship – remain, they have become secondary since they can be obtained easily, provided there is knowledge. It is the utmost asset of an organization, a component of intellectual capital (Constantine, 2007 as cited in Akhtar et. al, 2015). For purposes of this paper, knowledge is considered a product of human thinking, articulated through research and development to create value to the potential players such as policy-makers, decision-makers, and practitioners. It can be used to create or increase the value of other forms of capital (Brenca & Gravite, 2013).

Knowledge Audit: Knowledge audit is an investigation conducted by an institution to establish the nature of information it has produced, the identity of the person/s who discovered it, and the manner in which the institution disseminates, stores, or uses it. It goes beyond mapping of available information as it fulfils the needs of a particular institution; thus, it also includes an evaluation of the level or status of technology of the specific institution, the manner in which the institution generates, uses, and supports efficient sharing of information, and the work ethic and culture of the employees in the workplace (Bennet & Bennet, 2004; Tiwana, 2000 as cited in Mohapatra et. al., 2016).

Knowledge Mapping: Knowledge mapping is an important action in any strategy involving knowledge management and the first step in conducting a knowledge probe (Davenport & Prusak, 2000; Tiwana, 2000 as cited in Mohapatra et. al., 2016). It is an inventory of vital information the institution has gathered to help people gain access to knowledge and proficiency to perform their tasks. It gives a complete record of the nature of information found in the institution, establishing its location within the institution, and disseminating a list or pictures that reveal to users the location of the information (Davenport & Prusak, 2000 as cited in Lee, 2013).

Knowledge Economy and Knowledge Societies: Knowledge economy has become a significant element in all economic activities in most developed nations since it is a system of utilization and creation based on intellectual capital that can maximize scientific discoveries and basic and applied research (Hayes, 2020). It depends significantly on intellectual capabilities (intangible assets) such as a worker's knowledge or intellectual property (e.g., licenses, trademarks and copyrights) rather than natural resources or physical contributions (tangible assets, e.g., land, vehicles, equipment, and inventory). In a knowledge economy, products and services that rely on intellectual capability and advancements in technical and scientific fields empower development and economy (Hayes, 2020).

Academic institutions, organizations engage in innovative work, software engineers creating new programming, internet searchers for information and wellbeing, and workers utilizing advanced information to improve medicine are components of a knowledge economy (Hayes, 2020).

Knowledge society makes knowledge accessible to all towards economically and socially reliant communities confident of their capacities to generate scientific and technological knowledge (Ruser & Stehr, 2017) for the advancement of human life (Castelfranchi, 2007 as cited in Arocena et. al., 2015).

5. Higher Education Institutions (HEIs)

Higher education includes all types of studies, exacting applied work (e.g,. in medical schools and dental schools), training, or training for research at the post-secondary level provided by educational establishments that are approved as institutions of higher education by competent state authorities (UNESCO, 1993 as cited in Scott, 2016). It is "a level of education provided by universities, vocational universities, community colleges, liberal arts colleges, institutes of technology, and other collegiate level institutions that award academic degrees or professional certifications" (IGI Global, n.d., para. 1).

There are 1,871 higher education institutions (HEIs) in the Philippines offering undergraduate or Bachelor degree programs, graduate degrees like the master's diploma, and doctoral programs (and postgraduate level). Almost 88% of HEIs are privately owned and managed, the rest are state-run or managed by local governments such as city colleges and polytechnics.

*Knowledge Mobilization***:** Knowledge mobilization (KMb) includes all activities and products that help ensure research utilization and usefulness. It is an emerging field of work which draws from many disciplines and perceptions such as participatory action research, communications, sociology, knowledge theory, usability, education, and psychology (Community First, 2014).

KMb conveys existing knowledge into effective use (La Velle & Flores, 2018). It includes efforts to narrow the differences between policy research and practice to improve results. It also involves knowledge sharing among research producers such as university researchers and research users, including professionals and communities or others whose works can use the research findings and the assistance of third parties (Levesque, 2011 as cited in Greenhalgh & Fahy, 2015). KMb does not only transfer knowledge to stakeholders, but it also embeds knowledge generation and knowledge use within the core structure of communities and organizations (Bennet & Bennet, 2007).

Hence, it is necessary to measure KMb and its utilization and policy impact to ensure that knowledge is put into practice and to strengthen KMb of other educational institutions, researchers, and industry stakeholders. A research conducted on the outputs produced by HEIs sounded a call for mechanisms to monitor and evaluate research utilization (Fetalvero, 2010 as cited in Tamtekin Ayudin, 2017). This observation underscores the relevance of evidence-based practice in measuring KMb in the community.

Knowledge Mobilization Processes and Application: The KMb process involves research and education with the stakeholders as partners bound by a mutual objective. This process may apply efficiently to a specific KMb program using the appropriate approach to generate value by transporting the knowledge of an expert to a local situation (Bennet & Bennet, 2007). Several KMb models focusing on KMb process are presented in this study.

Generic KMb Process Model: Bennet and Bennet (2007), enumerated the eight generic knowledge mobilization process as follows:

- Identify the situation (problem, issue, opportunity).
- Gather information about the situation and its context.
- Understand the situation using information, experience, and related sources.
- Consider theoretical knowledge in the context of the situation.
- Apply practical knowledge learned from experiences or related situations.
- Pursue a set of actions.
- Be conscious of new situation that may emerge from the actions.
- Provide feedback to assess the effectiveness of actions made in achieving the desired goal and the opportunity to change or supplement those actions as needed.

KMb Knowledge from a Mobilization Whole-System Perspective: This model emphasizes research policy and practice. The Whole-System Perspective is composed of (1) policymaking; (2) research production; (3) research mediation; and (4) research use of online programs, social media platforms, and internet engines for innovation and engagement.

This model differentiates policy-making context from practitioner context to address the purpose, kinds of work, and time periods involved in decision making of the two groups. The KMb/WPS model incorporates Lavis' et al. (2006) research models with Levin's (2004) model, articulating the research production domains as

"producer-push efforts," the research use domain as "user-pull efforts" and the research mediation domain as "linkage and exchange efforts" (Cooper, 2015b).

Knowledge Mobilization Strategy: The KMb toolkit diagram generates an effective KMb strategy regardless of the stage you are in. The seven components of the research process are: (1) identify and connect with end-users, (2) develop research topic, (3) design and plan project, (4) manage project, (5) interpret results, (6) communicate and disseminate findings, and (7) evaluate success (Networks of Centres of Excellence of Canada, 2015).

Potential Players: Since knowledge is context-sensitive and situation dependent (Bennet & Bennet, 2007), KMb is interdisciplinary, depending on how it touches the situation or what the stakeholders' requirements are. Stakeholders are the actors with concerns on the project who can provide insight on the process while decision-makers influence the implementation process (Varvasovsky & Brugha, 2000 as cited in Boaz, 2018). They include organizations and individuals, as well as different individuals within the organizations.

The potential players model (Figure 1) shows the group of practitioners, advocates, and policy makers/decision makers at the center between the researchers and the target audience to signify their role as partners. Consequently, different levels of interaction and engagement take place between the partners – the group of practitioners, advocates, and policy makers/decision makers on one hand and the target audience on the other hand (Bennet & Bennet, 2007). Working with other stakeholders, the researchers conduct the study that underpins the needs of the community. The general public in the model is the beneficiary of the research result whose receptivity to the research determines the success of the project.

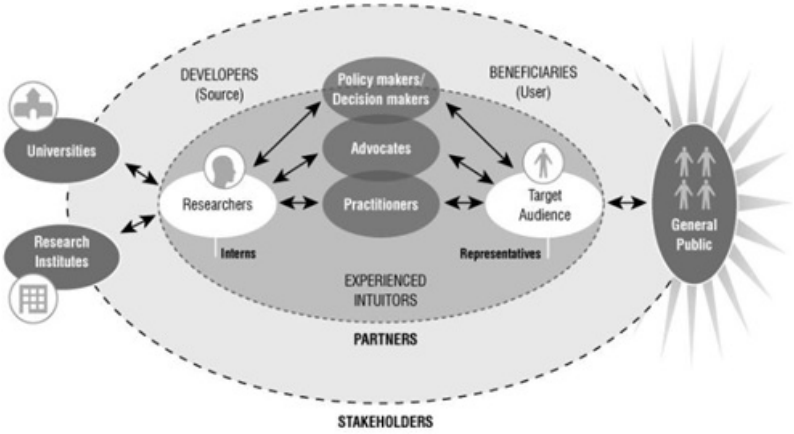


Figure 1: Potential players (Bennet & Bennet, 2007; used with permission)

Knowledge Mobilization Assessment Tools: The KMb assessment tools model (Figure 2) differs from most other models by giving equal attention to the three context/functions that are part of KMb. It also sees research use more as a function of systems and processes than of individuals. Approaches to understanding research use are often described in terms of a science push model (research producers try to circulate the results more effectively), a demand pull model (consumers look for research that may be useful), a dissemination model (research is selected because of the wide presence of different formats), and an interaction model (research is used due to chaotic collaboration between groups; thus, both groups influence the use, or lack of use, of research result) (Levin & Copper, 2012).

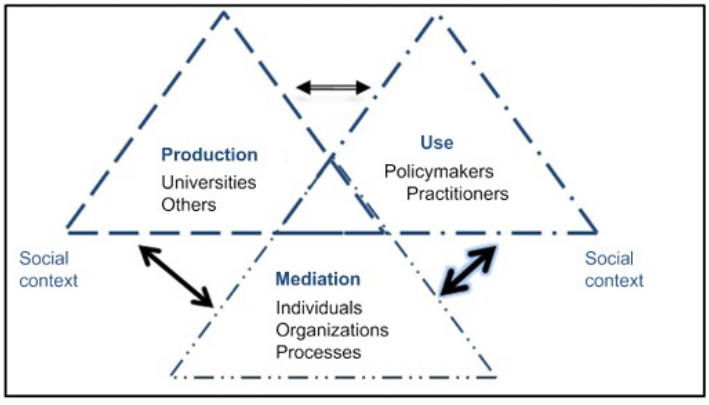


Figure 2: Knowledge Mobilization Assessment (Levin, 2012)

*Knowledge Impact Model***:** Levin's (2004) KMb model is still regarded as sensibly pragmatic as it is still being has utilized or referred to by a significant number of other researchers, including Nutley et al. (2009) and the European Commission. The knowledge impact model (Figure 3) shows the contexts of research production and use are overlapping, not separate. Similarly, the boxes in the diagram can also represent functions and processes, not necessarily structures. Arrows represent connections and relationships of varying strengths (as indicated by the two-way arrows of different thickness). KMb occurs when two or more of these contexts or functions interact as seen how people or organizations work in two or even all three of the contexts.

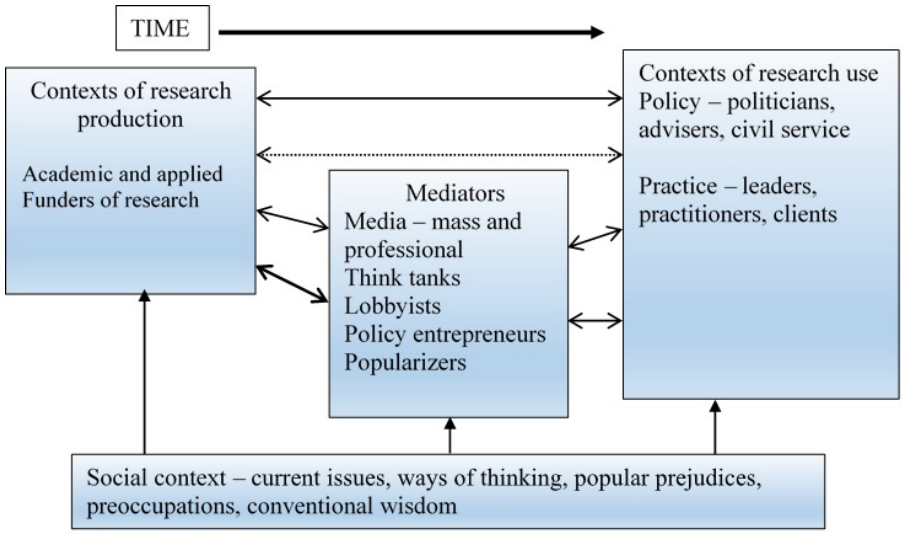


Figure 3: Model of Research Impact (Levin, 2004)

6. Knowledge Mobilization in Higher Education Institutions (HEIs)

Institutions of higher education, especially research universities, are particularly well equipped to facilitate the flow of new knowledge and to disseminate it internally. Exchanges of both faculty and advanced students need to be facilitated, along with participation in international conferences and research projects. Nations must also act to remove legal restrictions on the flow of scholars and ideas, and ensure that there is adequate funding for this important work. Publicly funded knowledge exchange also offers an international public good. Profit based research is designed to capture and commercialize the benefits it generates, not to make them universally and freely available. In large measure, academic research stands outside these commercial transactions. Internationally, higher education is an intellectual common represented by the invisible college (Task Force on Higher Education and Society, 2000 as cited in Altbach, 2013).

The academic investigations HEIs conduct and the new knowledge they produce offer high value to the name of the institution or country they represent. Thus, emerging knowledge-based societies encourage countries not only to create new knowledge but also to participate in academic and scientific collaboration with other nations (Master Business and Competitive Strategies Competitive, 2018).

*Measuring Knowledge Mobilization in Higher Education Institutions***:** In implementing research results in the social sciences discipline, research findings can be validated using assessment measures. Consequently, the outcome of the implementation may be significantly affected by the design, process, and application of assessment measures. This shows assessment is more effective than evaluation since evaluation involves forming an opinion or perception and making decisions, while assessment "is the process of defining, selecting, designing, collecting, analyzing, interpreting, and using information to increase students' learning and development" (Westminster College, n.d.).

Theoretical Framework for Research: Developing a conceptual framework inspired by the KMb Generic Model (Bennet & Bennet, 2007) with modifications (used with permission) is a starting point for developing a KMb conceptual model for this study specifically focused on KMb in HEIs. The conceptual framework developed following interviews with university research experts was used as a guide in designing an analytical framework for measuring the effectiveness of KMb in HEIs.

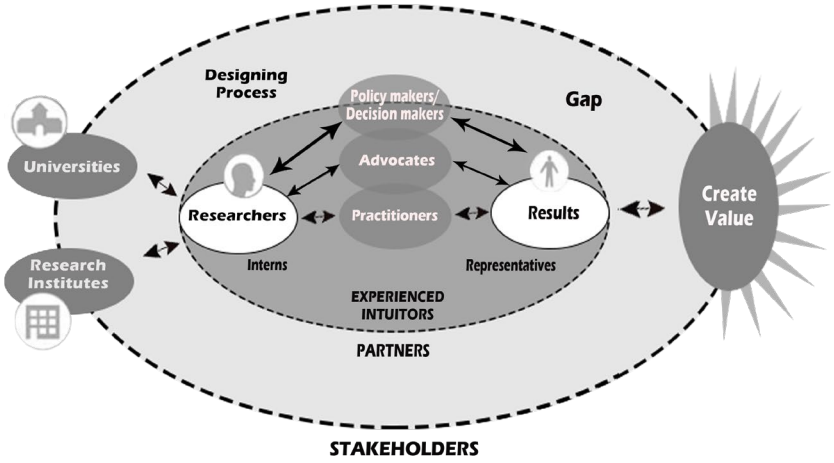


Figure 4: Conceptual framework (Adapted from Bennet and Bennet, 2007, Used with permission.)

The current state of KMb in HEIs was examined in designing the analytical framework. The policy impact of KMb is essential to improve KMb in HEIs, obtain research funding, and ensure that industry and partner stakeholders benefit from the research implementation (Levin, 2008). Research output should be disseminated to the consumers to convert it into something useful, thereby creating business value from the research, and published so knowledge circulates in the international arena and benefits other researchers. The generic KMb conceptual framework was explored in the areas of potential players, knowledge production, research output, and research utilization.

7. Methodology

This study describes the philosophical worldviews that inform the research design and data collection and analyze strategies used to attain the objectives set for the investigation. The analytical framework design for assessing KMb in HEIs is anchored on the social constructivism worldview which holds that individuals seek to understand the world where they live and work (Creswell, 2014). This explains how individuals create knowledge based on their cultural backgrounds, experiences, social interactions, and the complexity of nature. Furthermore, individual knowledge creation takes place as these individuals interact in the ecosystem of which they are a part.

8. Research Design

Following the social constructivism worldview, this research identified the current patterns and the potential of HEIs in mobilizing research to achieve effective and sustainable change in society. Although HEIs are mandated to nurture new knowledge through research and development to solve specific issues and address the concerns of the community (CHED, 2016), there is no significant tool to assess if the research results of Philippine HEIs are locally responsive and globally competitive. Thus, this study is of value in providing an assessment measure using an analytical framework.

Initially, the literature review was expanded to include a mini knowledge audit to acknowledge the substantial body of research produced by universities. The fields of knowledge of these researches were identified to understand their potential users or target audience, i.e., to help define the larger stakeholder community. The exploratory sequential mixed methods design was used to collect and analyze qualitative data. Core university stakeholders involved in the KMb process were asked open-ended questions based on the research focus, literature review, and mini knowledge audit. The qualitative data was subjected to content analysis to design a conceptual model for the KMb analytical framework. Its results guided the researcher in designing the initial KMb analytical framework.

Participants: The participants of this study were composed of 17 core university researchers from the selected HEIs involved in the KMb process. They were research directors of their respective HEIs or project research leaders whose researches were either completed or nearly completed.

Data Collection Procedure, Supporting Instruments and Data Analysis:

Building on the literature review, the researcher observed the following steps in the pre-data collection phase:

- Conduct a mini knowledge audit in the HEIs to (1) understand the knowledge domains the researches generated (2) identify potential end users of the research, i.e., the larger stakeholder group (3) identify current uses of this research, if available, and (4) explore current KMb processes related to specific identified research.
- Construct open-ended questions for the interview based on the research focus, and literature review to generate information on the HEIs' perception, knowledge, and practices on the use of research studies.

The actual data collection phase included an interview process to capture the respondents' views (qualitative in nature).

*Design of a Conceptual Model of KMb***.** A conceptual model describes the connections among the variables. It simplifies the theorized connections between the concepts in the model, helps the readers visualize the concepts easily, and provides a quick idea of the problems that need solutions (Sekaran & Bougie, 2016). The model illustrates the main participants, the components of KMb, the relationships of the variables, and ideas explored and analyzed in the study. It shows that the independent variables, namely research production, research outputs, and research utilization influence the dependent variable, which is knowledge mobilization.

External KMb Model. As shown in Figure 5 below, External KMb makes knowledge produced by HEIs useful and impactful on the community through the dissemination of research outputs to various groups of stakeholders, the availability of external research funding to make the implementation of the research run smoothly, and the stakeholders' utilization of these research outputs for better external services to meet the needs of the targets users. Knowledge mobilization is, after all, basically about making knowledge ready for service or action

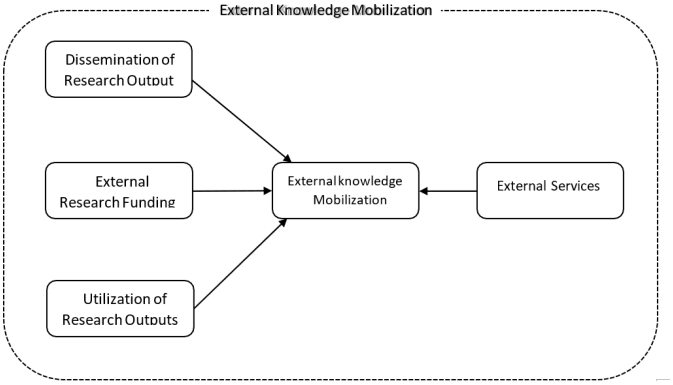


Figure 5: Externa Knowledge Mobilization

Internal KMb Model. As illustrated in Figure 6, for internal KMb initiatives of HEIs to be effective, there is a need to develop and nurture a culture of research among their faculty, provide adequate internal funding and resources, make the research results easily accessible by disseminating and communicating research results especially to stakeholders who can use them or can apply the research results generated, and monitor regularly the implementation of the project while upholding research integrity throughout the whole process.

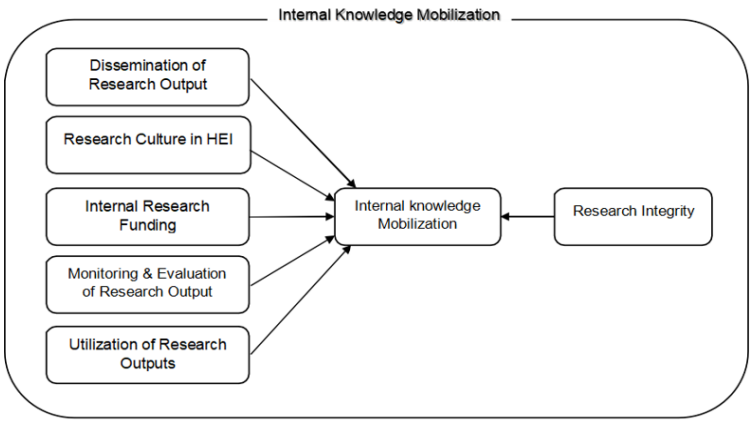


Figure 6: Internal Knowledge Mobilization

9. Discussion

How can the effectiveness of Knowledge Mobilization (KMb) of research results in Higher Education Institutions (HEIs) be assessed? HEIs do not have a uniform and standardized measuring instrument to measure the effectiveness of their research outputs. However, they have their own measuring instrument approved by their Research Center - survey questionnaires prepared by the proponents themselves based on guidelines by the Board of Regents and validated by experts; Customer Satisfaction Survey questionnaire where clients evaluate the HEI's products and services; a report on the number and the frequency of research outputs utilized by DepEd or by the division; an Impact Assessment conducted on the community by its Extension Management Office; Monitoring and Evaluation Forms to keep track of the progress of the research; a publication per million grant for CHED projects and an output-based instrument or 6 Ps (Publication, People Service, Production, Popularization, Partnership, and Policies) for other agencies like the National Research Council of the Philippines (NRCP); feedback from beneficiaries of the project about the benefits they gained from the technology of the research; a visual inspection of the community after six months to find out if there is knowledge use; statistical treatment of data in questionnaire to determine the quality of the cutting, tensioning, the workability, economy, and safety of the machine for its internal stakeholders; a report on the number of research completed or published; Monthly Progress Report, Accomplishment Report, Financial Report, and presentation of the full-blown research; Administrative Order No. 25 with the Planning Director checking their targets and outputs; and a report by faculty members with research completed or published for Performance-Based Bonus (PBB) or Individual Performance Commitment and Review (IPCRF) purposes.

What is the current state of Knowledge Mobilization of research results in Philippine Higher Education Institutions (HEIs)? Philippine HEIs mobilize their research results to their stakeholders in formal reports annually to the Administrative and Academic Council, either in printed or digital format or through the conduct of events. The research results are published in CHED-accredited or international peer refereed journals and Compendium of Abstracts of Students and Faculty Researches and printed copies are distributed to other colleges, specific offices and officials, HEIs-fellow members of the consortia, and concerned government agencies through a courier service.

HEIs create a website for their research portal to upload research activities and digital copies of their research outputs. Dissemination of research results, university memoranda, and action researches is through their social media platforms and institutional email system, policy briefs, research gateways, Online Commons, and academic blogs. They also create an online database for subscribers of other online databases linked together to view it.

Furthermore, HEIs conduct annual face-to-face research colloquia and local and international research conferences, hold institutional webinars and extension services, invite external stakeholders to a presentation of the university's research outputs to discuss appropriate outputs for their use.

How can the mobilization of research results in Higher Education Institutions (HEIs) be measured? To ensure the efficiency and effectiveness of the KMb of research results generated by HEIs in the NCR, an institutionalized, unified, and standardized framework for measuring KMb would help guide the HEIs in incorporating a common set of performance scorecards to monitor, evaluate, and report KMb systematically, effectively, and accurately. The measurement should be in terms of the commercial value of the project, like if it earned the community profits, or if there is commercialization of the Utility Models (UM), Industrial Designs (IDs), and patents developed.

Moreover, the research results should get translated into extension activities that have a positive impact on the community like using the technology to improve businesses' products, services, and operations or create new products and technologies that enhance people's lives, provide livelihood programs so the community can produce their products, start small businesses, and commercialize research outputs to avoid wastage. Further, it should also satisfy the requirements for accreditation and the needs of the clients or agency who commissioned the research. It should be based on knowledge gaps, research gaps, and the needs of the stakeholders.

To sum up, the research results generated by the HEIs should be measured in terms of their usefulness or value to their stakeholders, how they benefit society and improve people's lives, from developing new products and technologies to informing policy-making and advancing scientific knowledge.

10. Conclusion

Effective external KMb promotes and strengthens social progress, innovation, and productivity. This includes working collaboratively with the community whose dynamic participation can efficiently synthesize the different sources of knowledge made accessible to them. For external KMb to be effective, a positive institutional culture that supports cooperation, candor, and learning has to be developed and sustained. Institutions have to put in place a mechanism that will integrate in their operations and strategies a system of recognizing and acquiring external knowledge. This can be done by collaborating with industries and forming consortia with other HEIs and professional organizations. Modern technology such as digital platforms, online communities, and social media make it easier for individuals and institutions to connect, share, and access external knowledge and to accelerate external KMb. Governments can create research-based policies, focus on complex societal issues, and promote economic development by mobilizing external knowledge. Clearly, today's knowledge-based economy relies essentially on external KMb as an important factor of innovation, productivity, and progress.

Similarly, the critical role of internal KMb cannot be downplayed in driving innovation within institutions and organizations. It enables institutions to look into new options, create new solutions, and stay in the lead of the competition by locating, identifying, and communicating relevant knowledge. Further, consolidating varied knowledge sources and viewpoints can lead to the creation of innovative ideas and out of the box approaches to problem-solving. Likewise, internal KMb equips policy makers and decision-makers with up-to-date information. Additionally, organizations can make conscious decisions, reduce the likelihood of problems, and maximize potential developments by taking advantage of internal knowledge. The efficiency and competence of an organization are strengthened as well. A successful Internal KMb needs a fully supportive institutional environment, an efficient system of handling information and resources, and strong stewardship. Institutions and organizations must promote a culture that holds in high regard information sharing, team work, and continuous improvement. They also need to inculcate a strong sense of information management systems that facilitate identifying, securing, storing, retrieving, and disseminating knowledge. In short, Internal KMb enables institutions and organizations to unleash the full potential of their internal accumulated intellectual resources to direct innovation, strengthen decision-making, and enhance overall effectiveness.

Practical Implications: External and internal KMb affect the performance and competitive advantage of an institution or organization, eventually translating research efforts to impact on society.

- Improve research collaboration: External KMb involves forming partnerships with stakeholders such as industry, government agencies, and community that will enable HEIs to gain opportunities in the form of expertise and funding. This can lead to increase productivity and efficiency, and enhance the quality of their research and impact on society.
- Accelerate innovation and technology transfer: External KMb can simplify and speed up the transfer of knowledge, technologies, and innovations from HEIs to their external partners. This can lead to the creation of new products, services, or processes, promote entrepreneurship, and encourage the establishment of new business ventures, thereby contributing to the economic development of the community.
- Enhance curriculum development: Since external KMb involves active engagement with external stakeholders, HEIs get the opportunity to gain a better understanding of growing trends, demands, and challenges in the industry and society. Such knowledge is helpful and relevant in updating and revising existing curricula, introducing new programs, and ensuring that their graduates have the knowledge and skills required for industry employment and social interaction.
- Promote stronger ties with communities: External and internal KMb enable HEIs to forge a strong working alliance with local community groups, local government agencies, industry partners, and non-profit organizations. This strong connection allows HEIs to help improve various aspects of local communities such as help groups of people within the community achieve their full potential. Among the engagement activities they can work together are collaborative research projects, community-level based education plans, and information sharing initiatives that benefit both the institution and the community.
- Boost the influence and honor of the institution: External and internal KMb provide high value to the name of the institution. Thus, by actively collaborating with stakeholders, institutions show the significance, impact, and contribution of their work to the community and society. This can attract

brilliant faculty and students, open doors for funding opportunities, and improve the institution's national and international rankings.

11. Limitations

In this study, the HEIs selected were those located in the National Capital Region, the most urbanized region in the country, where research outputs are expected to be mobilized to improve the economy and the quality of life of the community.

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How Knowledge-Intensive Organizations Thrive Under Dynamic Conditions: An Organizational Capability Perspective

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Abstract: Knowledge-intensive organizations primarily rely on knowledge and expertise as key strategic resources. In light of economic, social, and health-related crises in recent years, such organizations increasingly need to operate in dynamic environments. However, examinations on dynamic capabilities specifically in knowledge-intensive organizations remain scarce. This is remarkable given the role that knowledge holds as an economic resource in developed countries. To provide an explanation of how knowledge-intensive organizations can prevail among competitors under dynamic conditions, the authors integrate two literature streams in a knowledge-intensive context: the knowledge-based view and the dynamic capabilities approach. The knowledge-based view focuses on the nature of organizational knowledge as a critical resource and illustrates specific properties of knowledge in contrast to traditional means of labor such as capital. The dynamic capabilities approach on the other hand is about a firm's ability to integrate, build, and reconfigure internal and external resources and can be drawn on to explain organizational success through adaptation to dynamic contexts. In this conceptual study, the authors propose a research model linking knowledge processes to organizational performance through two different paths: (1) Operational capabilities permit organizations to make their living in the present and refer to efficiency. (2) Dynamic capabilities allow organizations to change their resource base and, therefore, enable their long-term survival in dynamic environments by focusing on effectiveness. Additionally, the authors hypothesize a moderating effect of environmental dynamics on the relationship between dynamic capabilities and performance. The study offers a comprehensive overview on the interplay between dynamic capabilities and the knowledge-based view, offering valuable insights for both researchers and practitioners in the field.

Keywords: Dynamic capabilities, Knowledge-intensive organizations, Knowledge management, Knowledge-based view, Environmental dynamics

1. Introduction

Today's enterprises increasingly face the challenge of having to operate in highly dynamic environments. Dynamics can occur in different areas: for example, enterprises may face pressure from their competitors, so their actions need to be anticipated and appropriate responses taken. For example, competitors may quickly launch new products and services, thereby changing the competitive landscape (e.g. Arias-Pérez et al. 2021). Another area of dynamics is the unexpected changes in customer behavior. For example, customers may show diminishing levels of loyalty and switch to other suppliers. Still another area of dynamics may be the changes in customer demands. As customers are becoming used to gaining quick access to customized products and services, enterprises need to ensure that they can deliver in such short time frames (e.g. Denning 2016). However, the availability of resources may shift under short time frames if central components to their products become scarce. The COVID-19 pandemic has accelerated this situation: lockdowns and restrictions due to the pandemic have led to a shortage of both tangible and intangible resources, such as knowledge. Therefore, competition for scarce resources is accelerating (e.g. Butt 2021). Even at the end of the pandemic as economies are recovering, the shortage of resources remains an issue. This situation raises the question of how enterprises can cope with ongoing challenges posed by a dynamic environment.

Given these challenges, organizations must have the ability to adapt to changing conditions to secure their long-term survival. One approach that helps explain why enterprises thrive in such conditions is the dynamic capabilities (DCs) concept. DCs refer to a firm's capacity to innovate, adapt to change, and create change that is favorable to customers and unfavorable to competitors (Teece et al. 2016). Enterprises need to be able to quickly recognize and make use of opportunities and transform themselves to meet environmental changes. The concept of DCs explicitly acknowledges observations from enterprise practices. It takes into consideration that organizations in rapidly changing environments tend to put less emphasis on extensive strategic considerations and more emphasis on the identification and realization of opportunities. Thus, DCs provide a conceptual framework for understanding the success of enterprises operating in challenging environments.

In the case of knowledge-intensive organizations (KIOs), competitive advantage depends on one specific resource: knowledge. Compared with other resources, knowledge is largely characterized by its intangibility. The question arises of how KIOs can use this intangible resource in knowledge processes to drive their performance, while being able to adapt to dynamic environmental conditions. Contrary to DCs in non-KIOs (e.g. Cegarra-Navarro et al. 2016), considerably less is known about DCs in KIOs. To be precise, the role of DCs in KIOs has hardly been examined (Stei et al. 2021). In particular, it remains unclear what mechanisms link knowledge processes to KIO performance and how KIOs can address environmental dynamics by relying on DCs. This topic seems worth examining, as KIOs are an important type of organizations all around the globe. Knowledge resources can be seen as central resources in many economies. To reflect this relevance research has used the term knowledge economies (e.g. Makani and Marche 2010). The number and economic meanings of KIOs are also likely to continue rising. In this study, we address this issue and examine the nature of relevant capabilities in KIOs.

In particular, our conceptual study explores how organizational capabilities (operational as well as dynamic) can contribute to the performance of KIOs. We aim to answer the following research question: *how do organizational capabilities drive KIOs' performance under dynamic conditions?* We propose a conceptual model that links organizational knowledge processes to relevant forms of organizational capabilities, which, in turn, affect KIO performance in dynamic contexts.

In the following section, we provide the theoretical background to shed light on relevant aspects of the knowledge-based view (KBV). We then analyze the nature of KIOs and describe the role of knowledge management. Next, we elaborate the concept of DCs and its approach to organizational change. We then derive a conceptual model that links knowledge processes to performance through different capabilities. Finally, we discuss our findings, present our contributions to theory and practice, and provide avenues for future research.

2. Theoretical Background

2.1 Knowledge-Based View and Knowledge-Intensive Organizations

In strategic management literature, the KBV of the firm is considered as a variant of the resource-based view (RBV). The RBV regards enterprises in terms of their resources and capabilities. Its central assumption is that not all resources are distributed equally among enterprises, nor do enterprises share the same capabilities. This heterogeneity in resources and capabilities is considered the source of competitive advantage and disadvantage. Especially resources that simultaneously meet the so-called VRIN (valuable, rare, imperfectly imitable and non-substitutable) conditions play a major role in this regard. The RBV therefore provides an explanation of competitive effects caused by resource heterogeneity (Helfat and Peteraf, 2003).

The meaning of knowledge in a knowledge economy is without doubt extensive. Organizational knowledge has found its way into enterprises' strategic considerations. KIOs use knowledge primarily as the means of production as Drucker famously noted (1993). This is a central difference from traditional organizations, which rely on labor and capital. In light of its generally rising importance in many economies, knowledge now represents "the most valuable global commodity" (Gorman, 2002, p. 219).

KIOs require the intellectual capabilities of their employees for the production of goods and services (Singh and Chandwani, 2014). Indeed, almost all organizations use knowledge to some extent to create their products. Even manufacturing firms depend on the knowledge resource, e.g. in servitization efforts. For example, Szász et al. (2017) have described how a more developed context with respect to education and knowledge favors servitization. However, KIOs rely specifically on knowledge, as it is often their only resource. This knowledge represents both input and output of KIOs (Makani and Marche, 2010). Prior research has noted a variety of characteristics to describe the nature of KIOs. KIOs:

- Have a high degree of autonomy and less hierarchical structures (e.g. Greenwood, 2009).
- Operate in a business-to-business market with a relatively small number of customers (e.g. Swart and Kinnie, 2003).
- Are located particularly in the service sector (e.g. Alvesson, 1993).
- Employ workers with formal education, including the doctoral degree level (e.g. Starbuck, 1992).
- Use knowledge as the primary input (e.g. Robertson and Swan, 1998).

Makani and Marche (2010) provide an extensive overview of KIO-defining factors. However, the label of a KIO lacks clarity. For example, the intensity of knowledge can even be heterogeneous within the same company (Makani and Marche, 2010). Given this ambiguity of KIOs, we follow Greenwood (2009, p. 5), who stated that

KIOs "have to integrate and diffuse knowledge throughout the value chain. This kind of broadly diffused and integrated value chain becomes a defining characteristic of [KIOs]". Typical KIOs are consultancy enterprises, marketing agencies, IT developers, or financial providers.

Kogut and Zander (1992) introduced a knowledge-related theory that argues that firms are superior to markets when it comes to the sharing and transferring knowledge of individuals or groups in organizations. According to this theory, knowledge is contained within individuals, but it is also expressed by certain organizational routines, particularly how individuals cooperate in organizations. A routine in this regard might be "behavior that is learned, highly patterned, repetitious, or quasi-repetitious, founded in part in tacit knowledge" (Winter, 2003, p. 991). With respect to this organizational knowledge, Nonaka and Takeuchi (1995) suggest the creation of organizational knowledge as a process of the interaction between explicit and tacit knowledge. This is a common and well established classification: one can distinguish between explicit knowledge, which is "transmittable in formal, systematic language", and implicit knowledge, which is "personal, context-specific, and therefore hard to formalize and communicate" (Nonaka and Takeuchi, 1995, p. 59). Given the relevance of knowledge to organizations, especially KIOs, knowledge must be managed accordingly. Indeed, the management of knowledge is a key strategic challenge to ensure enterprise success and competitiveness (Behringer and Sassenberg, 2015).

The KBV focuses on the role of knowledge as a key resource for organizations. It distinguishes between explicit and tacit knowledge and describes the meaning of knowledge for organizational success. In particular, tacit knowledge can be the source of competitive advantage is it reflects the VRIN conditions. The KBV typically provides suggestions on how to create, retain, transfer and use organizational knowledge (Easterby-Smith and Prieto, 2008). Thus, this approach can be drawn on to explain the role of organizational knowledge and its relevance for organizational success. With respect to the question of how KIOs can cope with environmental dynamics, it however lacks suggestions for organizational change. This topic is central to the DCs concept, which we elaborate on in the next subsection.

2.2 Dynamic Capabilities

The DCs concept gained rising attention in the 1990s (e.g. Teece and Pisano, 1994). Since then, it has become an established concept in management strategy research that acknowledges the dynamics of markets. Specifically, the DCs concept can be drawn on to gain an understanding of the success of organizations in highly dynamic and competitive environments. Its central idea is that, to thrive, organizations need to be aware of opportunities in their environments and make use of these opportunities. The DCs concept acknowledges dynamic developments in the business environment and help explain changes within organizations. It is this connotation of change and evolution that is indicated by the term 'dynamic' (Easterby-Smith and Prieto, 2008). Similar to the RBV, it attributes differences in competitive positions to different possessions of resources and capabilities. These capabilities in turn influence organizational performances.

Originally, Teece et al. (1997, p. 516) defined DCs as "the firm's ability to integrate, build, and reconfigure internal and external competences to address rapidly changing environments". Eisenhardt and Martin (2000, p. 1107) subsequently extended the definition by putting emphasis on the environment: "the firm's processes that use resources—specifically the processes to integrate, reconfigure, gain and release resources—to match and even create market change". These resource (re-)configurations are particularly important in emerging, colliding, splitting, evolving, and dying markets. In a further established definition, Helfat et al. (2007, p. 1) described a DC as "the capacity of an organization to purposefully create, extend, or modify its resource base".

A resource can be understood as an asset or input to production and it is important for the organization to own the asset, control it, or have regular access to it (Helfat and Peteraf, 2003). These assets are part of the organization's resource base and include "tangible, intangible, and human assets (or resources) as well as capabilities which the organization owns, controls, or has access to on a preferential basis" (Helfat et al., 2007, p. 4).

For a better understanding of the nature of DC, it makes sense to consider capabilities in general. An organizational capability refers to "the ability to perform a particular task or activity" (Helfat et al., 2007, p. 1). Literature typically distinguishes between two forms of capabilities: operational capabilities (OCs) and DCs. OCs represent ordinary or technical capabilities. Referencing a hierarchy-of-capabilities, Winter (2003) describes OCs as zero level capabilities or 'how we earn a living now' capabilities. OCs allow for routine operations and ensure short-term survival. While the purpose of OCs is stability, the focus of DCs is on change. Capabilities that change aspects as products or processes are labelled as first-order DCs. DCs shift the organizational resources to where

they can add value in the future. Both types of capabilities are required for the long-term survival of organizations and their thriving in the long run; neither OCs nor DCs can ensure this survival alone.

To describe organizational success, Teece (2007) introduced the DCs framework, which can be drawn on to understand three different aspects of DCs: sensing opportunities, making use of these opportunities, and managing threats/transforming themselves. To gain a long-term competitive advantage, organizations need to rely on capabilities that cannot be or are difficult to imitate by their competitors. Tacit knowledge can be seen as a central resource. If it meets the VRIN conditions, it can enable the creation of capabilities that lead to organizational advantage. DCs are typically developed within enterprises, they usually cannot be transferred in a market. DCs reflect capabilities that are developed through a combination of assets or a re-combination of existing capabilities (Katkalo et al., 2010). Examples are intellectual capital, processes, customer relationships or specialist expertise.

We use the term environmental dynamics to describe volatility that manifests in fast and unexpected changes in environmental conditions. We follow Tallon and Pinsonneault (2011, p. 466) and define environmental dynamics as "the frequency and extent of change in critical market variables". In dynamic environments and extreme forms of dynamic markets, in which even basic industry characteristics such as boundaries, competitors, and customers are in flux, no specific advantage is sustainable. Rather, superior performance occurs by continuously creating temporary advantage (Eisenhardt and Santos, 2000).

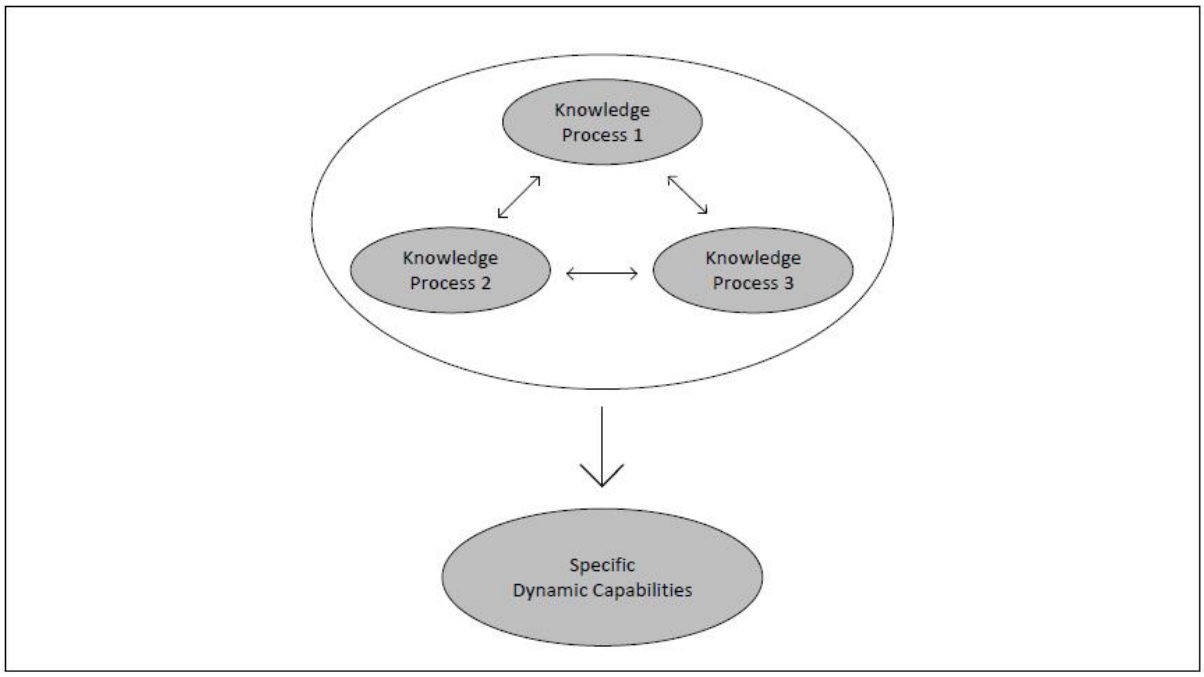


Figure 1: Dynamic Capabilities due to the Interaction of Processes (adapted from Helfat et al., 2007)

DCs are often seen in terms of processes. Helfat et al. (2007) attribute this to the observation that the performance of DCs depends on the processes used to apply them. However, they are an effect of the interaction of processes. For our study, we follow this process perspective on DCs. Figure 1 displays DCs developed from the interaction of different knowledge processes.

3. Towards a Conceptual Model of KIOs Thriving Under Dynamic Conditions

To shed light on how organizational capabilities drive KIO performance in dynamic environments, we propose a conceptual model in the following section. This model shows the relationships between relevant constructs to illustrate to paths by which KIOs can make use of knowledge processes to drive their performance: OCs and DCs. We also include environmental dynamics as a moderating variable.

As mentioned before, knowledge can be seen as the central resource for KIOs. To make use of this resource, KIOs apply different knowledge processes. We follow Alavi and Leidner (2001) and focus on the knowledge processes creation, storage, transfer, and application. On one hand, such knowledge processes can be expected to improve capabilities that favour every day operations of KIOs: OCs allow to organizations to make a living (e.g. Winter, 2003). These capabilities refer to operational improvement and efficiency. We propose:

Proposition 1 (P_1): Knowledge processes have a positive impact on operational capabilities.

On the other hand, these knowledge processes can also contribute to capabilities that allow KIOs to change and adapt to environmental conditions. The knowledge processes can facilitate development of such DCs (e.g. Kaur, 2016). We expect:

Proposition 2 (P_2): Knowledge processes have a positive impact on dynamic capabilities.

DCs allow KIOs to shift internal resources. Therefore, these organizations can help create new capabilities and reconfigure existing operational capabilities (e.g. Eisenhardt and Martin, 2000):

Proposition 3 (P_3): Dynamic capabilities have a positive impact on operational capabilities.

OCs refer to capabilities that allow KIOs to use their primary resource knowledge and offer their products and services. OCs particularly refer to improved efficiency of everyday operations, which can be associated with increased performance (e.g. Tan et al., 2007):

Proposition 4 (P_4): Operational capabilities have a positive impact on KIO performance.

DCs facilitate the adjustment of resources and capabilities, empowering KIOs to respond to changing conditions

(Teece, 2007). This flexibility enables KIOs to capitalize on opportunities and mitigate threats:

Proposition 5 (P_5): Dynamic capabilities have a positive impact on KIO performance.

DCs enable KIOs to respond to their environment, in particular to dynamic developments. One can expect the positive impact of DCs on KIO performance to depend on the rate of dynamics of their environment. In relatively stable environments, the impact may be rather small. However, in dynamic environmental conditions a reconfiguration of resources may be beneficial to performance (Eisenhardt and Santos, 2000). We hypothesize a linear moderating relationship for these dynamics and propose:

Proposition 6 (P_6): The positive impact of dynamic capabilities on KIO performance is positively moderated by environmental dynamic.

Figure 2 displays our research model, that shows the relationships between knowledge processes, OCs, DCs and KIO performance.

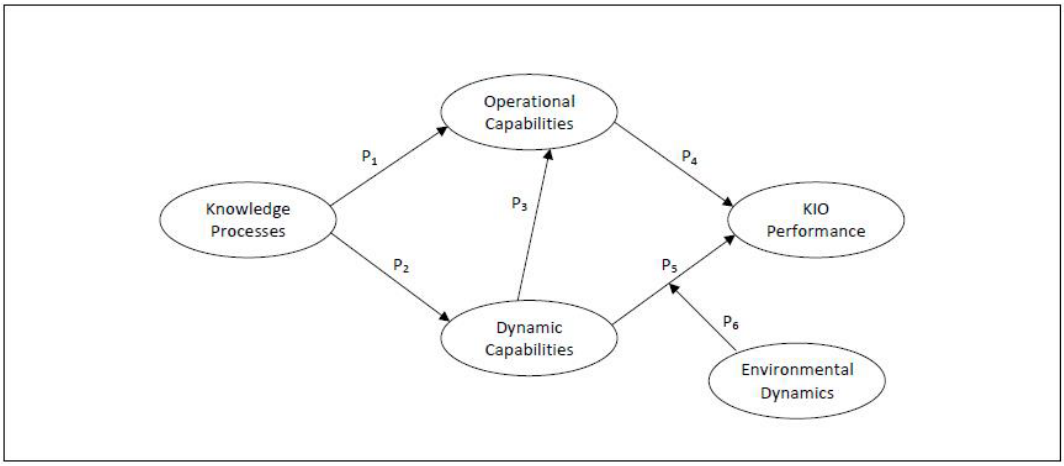


Figure 2: Conceptual Model on the Relationships Between Knowledge Processes, OCs, DCs and KIO Performance

4. Discussion

In our study, we integrate the KBV and DC approaches to explain how knowledge processes impact on KIO performance. While the KBV provides a specific view on knowledge and focuses on the creation, retaining, transfer and use of knowledge - the DCs primarily deal with the development and recombination of capabilities and the renewal of organizational resources and assets (Easterby-Smith and Prieto, 2008).

Both the KBV and DCs concept, stress the importance of the knowledge resource, which is an organizational asset and can be applied to create value. Knowledge assets typically cannot be bought or acquired in a market (Teece, 2001) but, instead, must be built within organizations. While knowledge is owned by the employees of

an enterprise, there is also an organizational knowledge pool. This type of knowledge develops as a result of routines and processes within the organization (see Teece, 2001). Therefore, organizations are knowledge repositories, that need to create, transfer, accumulate, integrate, and use their knowledge assets (Krzakiewicz, 2013). In dynamic environments, KIOs not only need to focus on the amount of knowledge that is being contained within. In such environments, the overall pool of knowledge is not the only key to success; rather, competitive advantage rests on a KIO's capacity to create and renew relevant knowledge (e.g. Eisenhardt and Santos, 2000).

Additionally, both approaches put heavy emphasis on the role of the tacit aspect of organizational knowledge. The nature of tacit knowledge makes it relatively hard for competitors to imitate and transfer this asset. Therefore, it may be seen as a source of long-term competitive advantage (Eisenhardt and Santos, 2000). In today's organizations, knowledge inhabits the role as the most important strategic resource and organizational success rises and falls with the questions of if organizations are able to secure their access to specific knowledge resources or are able to create or renew these knowledge assets (Krzakiewicz, 2013). This tacit knowledge and the processes referring to it can be seen as one of the central aspects of the DC concept (Teece, 2009).

With respect to the organizational capabilities, our model is in line with the hierarchy-of-capabilities concept (Winter, 2003). OCs can be understood as zero-level capabilities, that enable the everyday operational functioning in KIOs. DCs are first-order capabilities that allow KIOs to build, renew and reconfigure OCs (P_3); they are about the modification of functional processes. Additionally, there is an additional capability that represents a second-order capability: organizational learning. This capability resides above the capability hierarchy, as it allows KIOs to change and modify their DCs (Easterby-Smith and Prieto, 2008). In our model, this organizational learning is a result of the knowledge processes that drive OCs (P_1) as well as DCs (P_2).

Despite describing a systematic organizational change approach, DCs are not the only way for organizational change. Winter (2003) describes another way: ad-hoc problem solving. This type of change is of a spontaneous nature and occurs when organizations need to react to sudden environmental influences. However, it is important to note that building DCs does require (sometimes substantial) investments. From an economic standpoint, using ad-hoc problem solving may be more reasonable.

Our proposed model also contributes to research on environmental dynamics with respect to DCs. We include this environmental dynamic in the model as a moderating variable (P_6): we expect that the more dynamic the environment is, the more DCs can affect operational performance; we hypothesize a linear relationship. However, prior research suggests a more differentiated view on these dynamics. According to Eisenhardt and Martin (2000), DCs reveal a certain stability in moderately dynamic environments. With increasing dynamics in 'high-velocity markets', this stability disappears and DCs tend to become unstable and challenging to sustain. In such cases, enterprises often use ad-hoc problem solving to adapt to changing environments.

5. Conclusion

In this research, we propose a conceptual model that integrates aspects from both the KBV and DCs approaches to understand how KIOs can thrive in dynamic environments. Our analysis focuses on the primary resource of KIOs that is knowledge.

Our study has a variety of contributions to theory. We focus on KIOs that require knowledge as organizational fuel. To gain competitive advantage, not only do enterprises need to use this resource properly, but they also need to renew and reconfigure it accordingly (Krzakiewicz, 2013). We have emphasized the role of knowledge for both approaches, KBV and DCs. We have furthermore stressed the role of organizational learning in the development of DCs. In KIOs, the ability to learn is critical to building DCs. According to Teece (2009), the ability to learn and adjust is common in all organizations with strong DCs. In general, organizational learning can be considered as a key requirement for KIO and non-KIO success.

Our study opens up avenues for future research. Further studies may empirically test our conceptual model to find out under what conditions OCs or DCs better mediate the impact of knowledge processes on KIO performance. This would help understanding what drives KIO performance under dynamic environmental conditions. Additionally, we have pointed out different knowledge processes. Particular organizational learning plays a major role in KIOs. This is closely related to the knowledge processes. This learning ability in the DCs context could be further examined. Another topic for future studies is the question of how technological advancements can contribute to the use of knowledge resources. As mentioned, knowledge may be tacit and, thus, difficult to codify. This tacit knowledge may be the key for gaining competitive advantage as it may be in the VRIN (valuable, rare, imperfectly imitable and non-substitutable) conditions. This prevents competitors to

acquire this tacit knowledge and make use of it. Future research could examine the role of this tacit knowledge in the creation of organizational capabilities and determine how organizations can make use of this tacit knowledge. For example, today's communication tools may be able to extract this tacit knowledge from employee communications and codify it automatically.

Our study also provides implications for practice. We describe the interplay between OCs and DCs. In doing so, we address an area of conflict that can be observed in enterprise practice. Organizations face the challenge to balance out today's operations that pay for the current state and tomorrow's operations that will repay in the future. To balance out the diverging goals of these two streams, KIOs face the challenge to find a balance between both paths. It is a reality that organizations need to cope with rapidly und unexpectedly changing conditions in dynamic environments. Today's KIOs have to cope with them and continue pursuing their businesses. The ongoing discussion of organizational agility shows the practical relevance of this topic. Enterprises need to be able to properly function in unpredictable conditions. They specifically need to answer the question of how they can build or adjust their existing resource base to find or create and make use of opportunities in their environment. Organizations furthermore need to be aware of threats and avoid them. Our study can be drawn on to see how organizational knowledge processes can drive KIO performance and, more importantly, what organizational capabilities are at play. In developing relevant DCs, KIOs can become robust to environmental change and even thrive in under such challenging conditions. Organizations may also use our conceptual model to predict their performance in different states of environmental dynamism. This study can provide hints on whether the development of DCs makes sense from an economic perspective. As this development comes with costs, enterprises need to determine if these costs are in a reasonable ration to the expected benefits. Our model can help to quantify the benefits and, therefore, support the organizational investment decision.

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A Systematic Literature Review on Agility in Knowledge-Intensive Organizations

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Abstract: Organizational agility may be an antidote against threats from volatile, uncertain, complex, or ambiguous corporate environments. While agility has been extensively examined in manufacturing enterprises, comparably less is known about agility in knowledge-intensive organizations. As results may not be transferable, there is still some confusion about how agility in knowledge-intensive organizations can be characterized, what factors facilitate its development, what its organizational effects are, and what environmental conditions favor these effects. This study closes these gaps by presenting a systematic literature review on agility in knowledge-intensive organizations. A systematic literature search led to a sample of 37 relevant papers for our review. Integrating the knowledge-based view and a dynamic capabilities perspective, we (1) present different relevant conceptualizations of organizational agility, (2) discuss relevant knowledge management-related as well as information technology-related capabilities that support the development of organizational agility, and (3) shed light on the moderating role of environmental conditions in enhancing organizational agility and its effect on organizational performance. This academic paper adds value to theory by synthesizing existing research on agility in knowledge-intensive organizations. It furthermore may serve as a map for closing research gaps by proposing an extensive agenda for future research. Our study expands existing literature reviews on agility with its specific focus on a knowledge-intensive context and its integration of the research streams of knowledge management capabilities as well as information technology capabilities. It integrates relevant organizational knowledge management practices and the use of knowledge management systems to ensure superior performance effects. Our study can serve as a base for future examinations of organizational agility by illustrating fruitful topics for further examination as well as open questions. It may also provide value to practitioners by showing what factors favor the development of agility in knowledge-intensive organizations and what organizational effects can be achieved under which conditions.

Keywords: Knowledge management, Knowledge-intensive organization, Organizational agility, Systematic literature review

1. Introduction

Organizations facing the challenge of operating in VUCA (volatile, uncertain, complex, and ambiguous) environments aim to develop agility. Such a capability allows them not only to adapt effectively to environmental changes but also to survive or even thrive under unpredictable conditions. In light of increased competition, organizations need to be able to "respond effectively to an incident that has occurred without warning, as well as [have] the ability to maintain a competitive leading position in today's environment" (Lee and Yang, 2014, p. 207). The importance for organizations to achieve agility is also reflected in Aghina et al.'s (2020) recent study, which predicts that organizations with a high level of agility can achieve a 20-30% increase in financial performance.

A considerable amount of research deals with different forms of agility, such as marketing agility (Zhou et al., 2019), manufacturing agility (Lee et al., 2020), and healthcare agility (Mandal, 2018). Prior research has introduced different conceptualizations of agility, mainly focusing on its drivers, enablers, and effects (e.g., Walter, 2020). Accordingly, studies confirm that agility positively affects performance in unstable environmental conditions (e.g., Chan et al., 2017; Yang and Liu, 2012).

However, a topic that has received comparatively less research attention is agility in knowledge-intensive organizations (e.g., financial service providers, consulting enterprises). Such organizations use knowledge primarily as the means of production, the key difference from other organizations, which rely on labor and capital. Knowledge is their primary resource for addressing environmental challenges creating competitive advantage. Nevertheless, little is known about whether research insights into agility derived in a manufacturing context also apply to knowledge-intensive organizations. Therefore, examining this topic in detail is important to generate actionable insights for such firms.

This study examines organizational agility (OA) in a knowledge context. In line with prior research on the impact of knowledge resources on sustained competitive advantage (e.g., Eisenhardt and Santos, 2000), this study adopts the knowledge-based view (KBV). The KBV regards knowledge as the most important strategic resource

among enterprises and as a primary determinant of competitive advantage and performance (Grant, 1996). The KBV specifically recognizes competitive dynamics among organizations. To thrive, organizations need to create temporary advantages by leveraging their knowledge resources. This aspect is closely related to the concept of OA.

Lu and Ramamurthy (2011, p. 932) define OA as "a firm's ability to cope with rapid, relentless, and uncertain changes and thrive in a competitive environment of continually and unpredictably changing opportunities." OA involves sensing environmental changes and efficiently and effectively responding to such changes (Felipe et al., 2016). OA is typically regarded as a dynamic capability (e.g., Roberts and Grover, 2012), which refers to "the firm's capacity to innovate, adapt to change, and create change that is favorable to customers and unfavorable to competitors" (Teece et al., 2016, p. 18). The dynamic capability framework complements the KBV, as it also relates to dynamic environments (Verma et al., 2017). In contrast with so-called ordinary capabilities related to operations and, therefore, to efficiency and thriving in the moment, dynamic capabilities reflect an organization's "capacity to purposefully create, extend, or modify its resource base" (Helfat et al., 2007, p. 1).

There are at least three relevant gaps in current research on OA. First, literature lacks an overview of knowledge management-related antecedents of OA. Furthermore, while prior studies have stressed the role of information technology (IT) in achieving OA (e.g., Nejatian et al., 2018), the question of how knowledge-related IT factors can contribute to OA has not yet been fully explored. Thus, an analysis of this topic with respect to OA is worthwhile. Second, a summary of environmental conditions that favor the creation of OA as well as enhance its effects on organizational performance (OP) (e.g., Eckstein et al., 2015; Gligor et al., 2015) is missing. Third, to date, research has not provided an overview of open research issues related to OA in a knowledge-intensive context.

Addressing these gaps, we present a systematic literature review. By analyzing extant literature on agility at the organizational level, we aim to answer the following research questions: (1) How is OA conceptualized in current research? (2) What knowledge management-related (KMCs) as well as IT-related capabilities (ITCs) enable the creation of agility? (3) What is the moderating role of environmental conditions in the enhancement of OA? and (4) What are knowledge work-related gaps in OA research?

This study provides a concise overview on the topic of agility in knowledge-intensive organizations. It synthesizes prior research and presents conceptualizations, antecedents, and effects of OA on OP. Furthermore, it summarizes topics in need of further examination and suggests avenues for future research.

2. Research Method

This systematic literature review follows the suggestions of Durach et al. (2017) to guide its search efforts and to retrieve as well as synthesize relevant articles. As such, we performed a series of systematic steps. First, we created a framework for the phenomenon of interest. Prior research approaches OA as a dynamic capability (e.g., Roberts and Grover, 2012). Specifically, OA can be understood as a higher-order capability that is facilitated and enhanced by lower-order capabilities (e.g., Cai et al., 2013). Furthermore, we focus on OA in knowledge-intensive organizations. The unit of analysis refers to the organizational level of a firm. The focal object of the search was OA. As we were interested in the effects of OA on OP, and, in particular, the conditions under which these effects hold true, we included both aspects in the research framework. Another aim of the literature review is to examine the impact of different antecedents, in particular lower-order capabilities, that support the creation of the higher-order capability OA. Therefore, the framework includes KMCs and ITCs. Figure 1 shows our theoretical framework.

Second, appropriate inclusion and exclusion criteria must be created. We chose to include English-language articles on OA published in scientific journals. To be included in our analysis, the articles also had to be double-blind peer reviewed. Furthermore, they had to refer specifically to knowledge work or be applicable in such a context. In addition, the articles had to include at least two of the constructs in our research framework as displayed in Figure 1. Subsequently, we decided to exclude OA articles related primarily to a manufacturing context. Another exclusion criterion was the unit of analysis: articles that did not refer to the organizational level, but, for example, to a project level or enterprise network level, were not retained for further analysis.

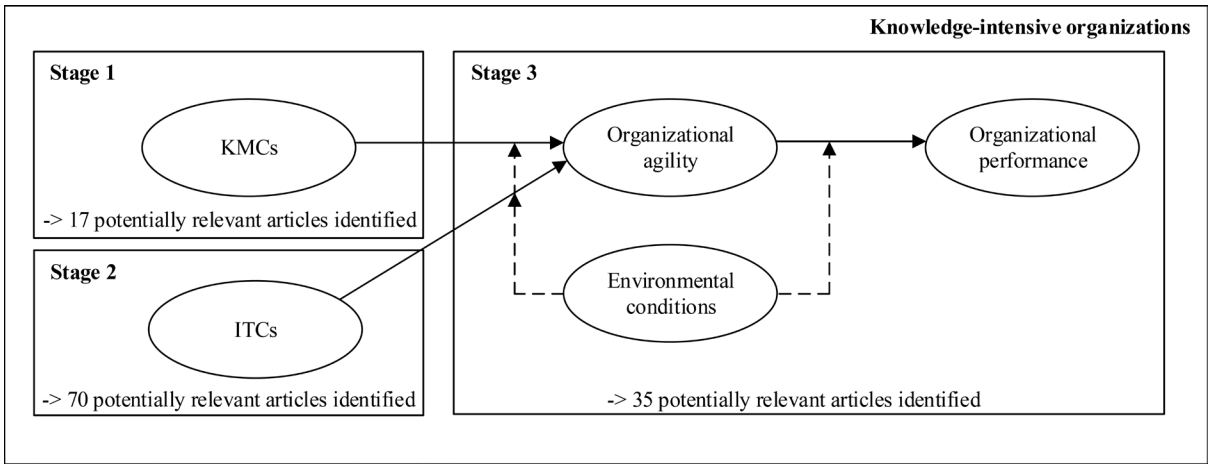


Figure 1: Research Framework

Third, to retrieve a baseline of potentially relevant articles, we conducted a systematic literature search in the Web of Science Core Collection database (Indexes = SCI-EXPANDED Timespan = All years) on all relevant aspects of the research framework. Figure 1 illustrates the logic of the search process, which comprised three stages. In stage 1, we scanned for work on knowledge-related antecedents of OA (17 articles). In stage 2, we searched specifically for studies on IT-related antecedents of OA (70 articles). In stage 3, we identified research on OA and OP (35 articles). After scanning the title, abstract, and body of each article, we eliminated publications that either did not meet our inclusion criteria or met our exclusion criteria (23 articles remained). Afterward, we conducted a forward and backward search to retrieve additional potentially relevant journal and conference articles. This led to a sample of 37 articles for the study.

3. Results

The results show that most articles on OA in knowledge-intensive organizations were published by scientific journals. Only 10.81% of the body of knowledge comes from publications of scientific conferences.

Our analysis also shows a dominance of quantitative research methods. A vast majority of the articles (75.68%) refer to a quantitative research design. By contrast, 16.22% of the articles are of a conceptual nature. Qualitative research methods are present in only 8.11% of the articles.

We chose to classify the search results into primarily knowledge management-related articles and primarily IT-related articles. The analysis shows that most articles focus on ITCs (24 articles) while only 13 articles examine the role of KMCs in creating OA.

With respect to conceptualizations of OA, the data show that a large body of published work describes OA as a multidimensional construct. Table 1 shows different conceptualizations of OA and its dimensions.

Two conceptualizations stand out, as they have been adapted from other studies. The first is the conceptualization of Sambamurthy et al. (2003), who describe OA as a three-dimensional construct. The dimensions comprise three forms of agility. First, customer agility involves “the co-opting of customers in the exploration and exploitation of opportunities for innovation and competitive action moves” (Sambamurthy et al., 2003, p. 246). This form of agility describes the interplay with customers in the creation of agility. Second, partnering agility is the “ability to leverage the assets, knowledge, and competencies of suppliers, distributors, contract manufacturers, and logistics providers through alliances, partnerships, and joint ventures” (Sambamurthy et al., 2003, p. 246). It focuses on the role of agility in organizational partnerships. Third, operational agility reflects “the ability of firms' business processes to accomplish speed, accuracy, and cost economy in the exploitation of opportunities for innovation and competitive action” (Sambamurthy et al., 2003, p. 246). This aspect of agility describes the ability to create and use agility-suiting business processes. A variety of studies have also adopted this three dimensional conceptualization of OA (e.g., Ashrafi et al., 2019; Felipe et al., 2020; Liu et al., 2018).

Lu and Ramamurthy (2011) also present an influential conceptualization. They differentiate between two dimensions. Market-capitalizing agility, or “a firm’s ability to quickly respond to and capitalize on changes through continuously monitoring and quickly improving product/service to address customers’ needs” (Lu and Ramamurthy, 2011, p. 933), refers to a mindset of embracing change in uncertain conditions. Operational

adjustment agility, or "a firm's ability in its internal business processes to physically and rapidly cope with market or demand changes" (Lu and Ramamurthy, 2011, p. 933), focuses on flexible and rapidly responding operations within the organization.

Table 1: Selected Conceptualizations of the OA Construct

Source	Dimensions	Citations in Web of Science (Jan. 2023)
Chakravarty et al. (2013)	Entrepreneurial agility Adaptive agility	203
Lee et al. (2016)	Operation-level agility Strategic-level agility	8
Lee et al. (2015)	Proactiveness Radicalness Responsiveness Adaptiveness	159
Lu and Ramamurthy (2011)	Market-capitalizing agility Operational adjustment agility	512
Panda and Rath (2016)	Business process agility Market responsive agility	23
Park et al. (2017)	Sensing agility Decision-making agility Acting agility	97
Sambamurthy et al. (2003)	Customer agility Partnering agility Operational agility	1429
Ravichandran (2018)	Customer responsiveness Operational flexibility Strategic flexibility	149

The next step of the review focuses on the question of what lower-order capabilities enable OA. The results of the analysis reveal a variety of relevant capabilities. This study distinguishes between KMCs and ITCs.

KMCs have generally been stated to positively affect OA. An organization's KMCs capture "its ability to mobilize and deploy KM-based resources in combination with other resources and capabilities" (Chuang, 2004, p. 460). KMCs play an important role in building OA, as they are a mechanism for mobilizing and deploying knowledge resources (Cai et al., 2013). A wide variety of studies have confirmed this positive impact of KMCs on OA (e.g., Cai et al., 2019; Chan et al., 2019; Mao et al., 2015). One study further differentiates between exploration KMCs and exploitation KMCs (Liu et al., 2014). Another knowledge-related capability refers to absorptive capacity, or a "firm's ability to recognize the value of new information, assimilate it, and apply it to commercial ends" (Kale et al., 2019, p. 276).

ITCs capture "the ability of the firm to organize and employ IT-based resources in coordination with other organizational capabilities to better realize IT's business value" (Panda and Rath, 2018, p. 2). Properly managed and deployed ITCs can provide tools that support the sensing and responding to environmental changes, which increases OA (Felipe et al., 2016). Prior studies have found a positive impact of ITCs on OA (e.g., Baloch et al., 2018; Chan et al., 2019; Lu and Ramamurthy, 2011; Ravichandran, 2018). The articles analyzed reveal a variety of additional IT-related capabilities, including managerial and technical IT capabilities (e.g., Tallon, 2008), IT infrastructure capabilities (Fink and Neumann, 2007), cloud infrastructure flexibility (Liu et al., 2018), and data analytics use (Ghasemaghaei et al., 2017).

Another scope of this research entails the moderating effects on the relationship between different types of capabilities and OA. The results reveal that only a minority of the articles describe moderating environmental conditions. The moderators described in prior research include uncertainty, dynamism, information intensity, diversity, hostility, and technology intensity of the industry. Table 2 provides an overview of these moderators and their effects on different OA-related relationships.

Table 2: Moderating Effects of Environmental Conditions on the Relationship Between Capabilities and OA

Moderator	Relationship	Moderating effect	Source
Environmental uncertainty	KMC-OA	Significant, positive effect	Mao et al. (2015)
Environmental dynamism	ITCs-OA	Significant, positive significant effect on IT competencies-entrepreneurial agility	Chakravarty et al. (2013)
Environmental dynamism	Technical IT capabilities-business process agility	Significant, negative effect	Tallon (2008)
Information intensity	ITCs-OA	No significant effect	Mao et al. (2015)
Information intensity	KMCs-OA	Significant, positive effect	Mao et al. (2015)
Environmental diversity	ITCs-OA	Significant, positive effect	Panda and Rath (2018)
Environmental diversity	KMCs-OA	No significant effect	Panda and Rath (2018)
Environmental hostility	ITCs-OA	- Significant, positive effect on ITCs-market responsive agility - No significant effect on ITCs-business process agility	Panda and Rath (2018)
Environmental hostility	KMCs-OA	- No significant effect on KMCs-market responsive agility - Significant, positive effect on KMCs-business process agility	Panda and Rath (2018)
Technology intensity of the industry	ITCs-OA	Significant, positive effect	Felipe et al. (2020)

Studies have also found a positive effect of OA on OP (e.g., Queiroz et al., 2018). Yet it makes little sense for organizations to strive for OA, no matter the price; rather, the development of OA is associated with cost for organizations (Teece et al., 2016). Therefore, the question arises under what conditions the enhancement of OA is reasonable. In other words: What environmental conditions favor the impact of OA on OP? The studies analyzed reveal a variety of conditions that serve as moderators of the OA-OP relationship.

Table 3: Moderators of the OA-OP Relationship

Moderator	Effect on OA-OP	Source
Technological turbulence	Significant, positive effect	Ashrafi et al. (2019)
Market turbulence	Significant, positive effect	Ashrafi et al. (2019)
Technology intensity of the industry	No significant effect	Felipe et al. (2020)
Industry setting	- Significant, positive effect of service settings on operation-level agility-OP - Significant, positive effect of manufacturing settings on strategic-level agility-OP	Lee et al. (2016)

The moderators in the articles include technological and market turbulence, technology intensity of the industry, and the industry setting (service vs. manufacturing enterprises). Table 3 displays moderators of the OA-OP relationship and describes their effects.

4. Discussions of the State of Research

Our analysis reveals a variety of conceptualizations of the OA construct. The two described conceptualizations of OA from Sambamurthy et al. (2003) and Lu and Ramamurthy (2011) have been cited by a multitude of articles. There is a consensus in literature that OA is best understood as a multidimensional construct. Researchers focusing on OA in knowledge-intensive organizations can build on existing conceptualizations and adapt the conceptualizations that best suit their research purposes.

We identified two capability-related antecedents of OA: KMCs and ITCs. Our results lend support to the view of the hierarchy of capabilities. According to this view, KMCs and ITCs are lower-order capabilities that enhance higher-order capabilities such as OA (Cai et al., 2013). When comparing KMC antecedents with ITC antecedents, we find that KMCs are quantitatively underrepresented. ITCs allow for an examination of relevant phenomena at a more detailed granularity and permit the differentiation of the concepts of interest. A similar development of KMCs is still missing in literature.

Studies have described different environmental conditions that act as moderators of the relationships between capability-related antecedents and OA. These refer to conditions that lead to a lack of predictability about the environment. Surprisingly, most studies do not account for environmental conditions. The same is true for moderators of the OA-OP relationship. This is unfortunate, because it means that studies do not regard the role of the environment.

5. Suggestions for Future Research

The state of current research opens up several pathways for future research on OA in knowledge-intensive organizations. Several questions on OA in a knowledge context still remain unanswered. This section provides ideas for future research and identifies research issues suggested in the articles analyzed in the systematic literature review.

Although several *conceptualizations* of OA exist in the literature, unexplored OA nuances still remain. A promising topic for researchers is the further development of the conceptualization and measurement of agility (e.g., Roberts and Grover, 2012). Moreover, an analysis of the specifics of OA in knowledge-intensive organizations in contrast with manufacturing organizations may help shed more light on the nature of OA in such contexts.

Prior research has identified a variety of capability-related *antecedents*, including KMCs and ITCs. However, this leads to the question of how these capabilities can be developed. The antecedents of these capabilities and the mechanisms in place should be subject to further examination (e.g., Lu and Ramamurthy, 2011). Another road for research lies in answering the question of how these capabilities interact to form OA (e.g., Mao et al., 2015). KMCs and ITCs may not only directly affect OA but also influence each other and therefore exert an indirect or joint effect on OA as well. An analysis of the joint effect of these capabilities might explore what mechanisms are at play and the impact of these effects on each other.

With respect to *environmental conditions*, our results show different environmental conditions and their effect on OA-related relationships. Future research might focus on hypothesizing and testing additional moderating effects. The identification of relevant moderators may be valuable (e.g., Cai et al., 2019; Felipe et al., 2020). An exemplary moderator that may be worth examining in a knowledge-intensive organizational setting is environmental ambiguity. The impact of different cultural backgrounds may also be a valuable topic for future studies. This could help account for the soft factors at play.

Regarding a general research design, the studies analyzed in this systematic literature review show different suggestions. We found that the majority of studies are of a quantitative nature. However, they mostly rely on cross-sectional data. A road for research could be to work with longitudinal data, which would allow for the identification of OA development over time (e.g., Baloch et al., 2018). In terms of data, further research could use objective data to quantify OA. Doing so could help avoid a bias in subjective (e.g., self-reported) data that may influence the results (e.g., Cai et al., 2019).

Applying complementary research methods might also be of value when examining OA (e.g., Chan et al., 2019; Lee et al., 2016). For example, research suggests the use of experimental research designs to examine causal relationships (e.g., Panda and Rath, 2016). Another method that would allow for a deeper examination of OA is case study research (e.g., Tallon, 2008).

6. Conclusion

Our study provides a concise overview of research on agility in knowledge-intensive organizations and synthesizes previous results. It differs from existing literature reviews (e.g., Tallon et al., 2019; Walter, 2020) in three respects. First, the study focuses specifically on agility in knowledge organizations. Second, it provides an overview of conceptualizations of OA and summarizes the impact of environmental conditions that influence the creation of OA. Third, it presents open research questions and describes a map to guide future research. Overall, this research addresses the question of what organizational impact knowledge management exerts. This literature review may build the base for further explorations of the performance impact of KMCs together with ITCs.

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Influences of Cultural Dimensions on Knowledge-Sharing Behaviours: Insights for Higher Educational Institutions in the Philippines

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Abstract: The educational institution's knowledge comprises a mix of experiences, values, and professional insights of its teachers with diverse cultures, enabling a combination of knowledge to create new knowledge. The exchange of knowledge among teachers provides effective learning, which can become a model of knowledge-sharing that promotes knowledge creation, dissemination, and effective application. However, knowledge does not always flow easily and straightforwardly across educational domains. Nevertheless, the success of knowledge-sharing is affected by one's behaviour to share. Apparently, a person's behaviour is shaped by the environmental influences where he grew up with or stayed for a significant amount of time. This research administered an online survey of teacher participants across regions to capture the theoretical or conceptual model of the influences of cultural dimensions (exogenous) on knowledge-sharing intentions (endogenous) and the probability of the intentions transformed into actual knowledge-sharing behaviour (endogenous). Path analysis was employed to analyse the proposed models that exhibit causal mediation processes of relationships between cultural dimensions and knowledge-sharing intention which is also a predictor of knowledge-sharing behaviour. Findings insinuate that all cultural variables were parallel, however, this did not mean that each had the same degree of effects on knowledge-sharing intention. The results vary when the direct effect of each cultural factor was tested. Cultural orientation and beliefs are factors that affect the value of the knowledge being shared and academic institutions wield efforts in motivating their teachers to effectively participate. For knowledge-sharing to be implemented successfully, the academic institution must take into consideration the cultures and beliefs of people in the community. Further research can analyse a wider range of people in a work environment with diverse culture which can elicit more insights into the cultural attitudes in the work environment.

Keywords: Cultural dimensions, Filipino culture, Higher educational institution, Knowledge-sharing, Knowledge-sharing behaviour, Knowledge-sharing intention

1. Introduction

In today's knowledge-based economy, organizations recognize the critical role that knowledge plays in driving productivity, innovation, and competitive advantage. Knowledge is now viewed as a dynamic resource that needs to be created, shared, and applied collectively by individuals and teams. This collective effort, often referred to as knowledge-sharing, enables organizations to harness the intellectual capital of their workforce and generate a synergistic effect greater than the sum of individual knowledge (Nooshinfard & Nemati-Anaraki, 2014).

In the context of higher educational institutions (HEIs), knowledge-sharing is of utmost importance as these institutions are not only the recipients and disseminators of knowledge but also the producers and cultivators of knowledge. HEIs serve as knowledge-based organizations where faculty members, as the principal knowledge workers, are expected not only to possess subject matter expertise but also to actively engage in knowledge-sharing practices within their academic community (Tatlonghari & Tolentino, 2014). Consequently, understanding the factors that influence knowledge-sharing behaviours among faculty members becomes crucial for creating a conducive environment for collaboration and enhancing the overall effectiveness of the institution.

One such influential factor is cultural diversity. In a diverse workforce, individuals bring different perspectives, behaviours, and values shaped by their cultural backgrounds. Cultural diversity not only enriches the intellectual and social capital of an organization but also influences the willingness and behaviour of individuals to share knowledge (Stoermer, Bader & Froese, 2016). Openness to ideas and a trusted inclusive environment are essential elements that amplify knowledge-sharing, leading to knowledge creation and innovation (Shelley, 2018). Consequently, understanding the impact of cultural diversity on knowledge-sharing behaviours becomes crucial for fostering an environment that encourages effective knowledge exchange and utilization.

However, there is a lack of research specifically focused on the knowledge-sharing behaviours of Filipinos (Montemayor, 2015; Fiscal, 2019). The need for research on knowledge-sharing arises as various government agencies in the Philippines strive to improve their knowledge flows and utilization through knowledge management strategies aimed at enhancing organizational learning and project implementation (DOH, 2017; PPPC, 2021).

While previous research has acknowledged the importance of knowledge-sharing behaviours and the influence of cultural factors, there remains a research gap in understanding the specific relationship between cultural dimensions and knowledge-sharing behaviours within the context of HEI. Few studies have examined teachers' knowledge-sharing behaviours within a framework or theoretical analysis (Montemayor, 2015). This gap inhibits a comprehensive understanding of how culture affects knowledge-sharing practices and the development of strategies to foster a culture of collaboration and knowledge-sharing in HEIs. Hence, more research is needed to contextualize knowledge-sharing behaviour within the local educational system.

Therefore, this research aims to address the research gap by examining the influences of culture, in Philippine context, on knowledge-sharing behaviours within HEI. It employs a theoretical or conceptual framework to analyse the causal mediation processes between cultural factors and knowledge-sharing intentions, which, in turn, predict knowledge-sharing behaviours. By exploring the cultural dimensions that shape knowledge-sharing behaviours, this research seeks to provide insights and practical implications for HEIs in creating a conducive environment for effective knowledge-sharing and collaboration.

Overall, this study aims to contribute to the existing body of knowledge by shedding light on the relationship between cultural dimensions and knowledge-sharing behaviours in the specific context of Philippine higher education. It is anticipated that the findings of this research inform HEIs about the importance of cultural understanding and provide guidance on strategies to facilitate knowledge-sharing practices, enhance collaboration, and foster innovation within their academic communities.

2. Related Literature

2.1 Knowledge-sharing in Social Construct

Knowledge exists through interactions between individuals. It is created through participation in shared social activities and the use of artifacts and cultural symbols (Holmes, 2010). Knowledge is considered inter-subjective and shared within and between communities (Lindgren & Packendorff, 2009).

In the field of knowledge-sharing, it is important to understand human behaviour in social contexts. From a social constructionist perspective, knowledge is shaped by individuals and communities in society (Fletcher, 2003). Different types of knowledge exist, such as theoretical and experiential, and they form a continuum where new knowledge is created and learned (Travica, 2013). The creation and application of knowledge rely on the social context and the contributions of individuals within communities (Hu & Randel, 2014; Weinberg, 2015). This dynamic process of knowledge transfer is influenced by a person's capabilities, capacity, and intention to share (Wied, 2006). Knowledge transfer and sharing are crucial aspects of knowledge acquisition which occurs between contributors and recipients in various organizational levels (Hassan, Noor & Hussin, 2017; Nguyen & Burgess, 2014).

Knowledge-sharing is fundamental to an organization's success. It involves the exchange of knowledge between individuals, teams, units, and organizations (Paulin & Suneson, 2012). But it goes beyond mere exchange; it involves the interaction of individuals and their human capital (Travica, 2013). Successful knowledge-sharing requires more than the transfer of specific knowledge. It involves addressing relationship issues and examining the structure of knowledge to ensure its effective flow (Cummings, 2003). Overcoming obstacles to knowledge internalization is as important as the activities involved in knowledge-sharing (Cummings, 2003). Thus, social interactions play a vital role in the transfer and transformation of knowledge (Chen & Hew, 2015; Chu, Krishnakumar, & Khosla, 2014; Jolaee, Nor, Khani, & Yusoff, 2014; Richards, 2014; Shahzadi, Hameed, & Kashif, 2015). It contributes to the acquisition and application of new knowledge (Reichertz & Zielke, 2008). It influences individuals' intentions and behaviours; hence, culture and networks play a significant role (Barrick et al., 2015). Therefore, engagement is a key factor in shaping knowledge-sharing behaviours (Barrick et al., 2015).

2.2 Behavioural Intentions

A person’s actual behaviour could be determined by considering his prior intention along with the beliefs that the person would have for the given behaviour. They referred to the intention prior to an actual behaviour as

the behavioural intention (BI) and defined it as a measure of one's intention to perform the behaviour (Chuttur, 2009). BI could be determined by considering the attitude that a person has towards the actual behaviour and the subjective norm associated with the behaviour in question. The Theory of Reasoned Action (TRA) includes perceived behavioural control as a key component of the theory of planned behaviour which provides a conceptual framework for understanding human behaviour in specific contexts (Fishbein & Ajzen, 2010; LaCaille, 2013).

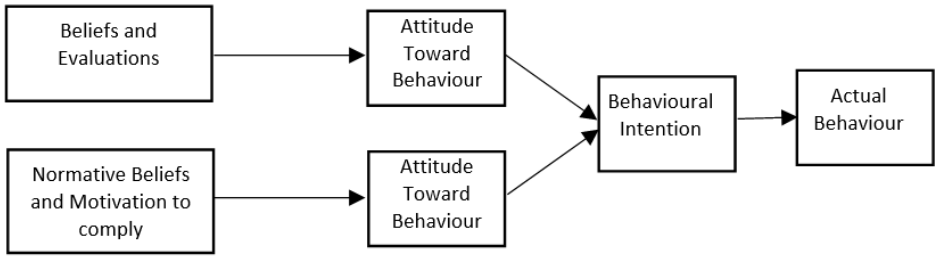


Figure 1: The Theory of Reasoned Action (TRA) model (Adapted: Davis, Bagozzi and Warshaw, 1989)

The Theory of Planned Behaviour (TPB) posits that human action is influenced by behavioural beliefs, normative beliefs, and control beliefs. These factors shape an individual's behavioural intention, which in turn influences their actual behaviour (Tsai, Chen, & Chien, 2012). Knowledge-sharing intention (KSI) is influenced by TPB and its sub-factors such as attitude, subjective norms, and perceived behavioural control.

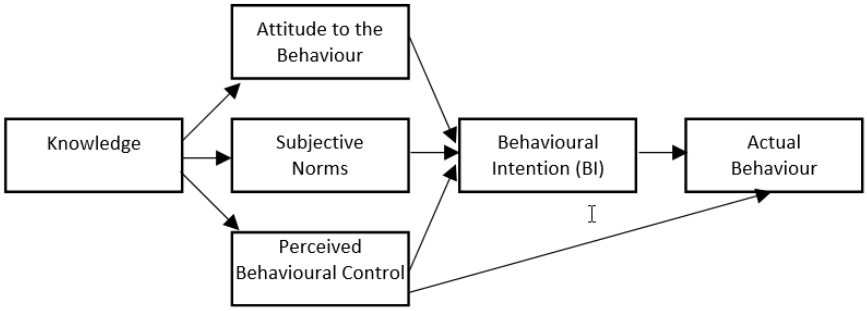


Figure 2: TPB Model by Ajzen (1985)

Attitude refers to an individual's evaluation of a behaviour as favourable or unfavourable and acts as a mediator of knowledge-sharing intention (Shahzadi, Hameed, & Kashif, 2015). It is influenced by external variables and the perceived consequences of performing a behaviour (Aliakbar, Yusoff, & Mahmood, 2012). *Subjective norm* is the perceived social pressure to perform or not perform a behaviour. It is influenced by the desire to act in line with important referent others' expectations (Chen, Chen, & Kinshuk, 2009). Organizational support plays a positive role in shaping a supportive environment to strengthen people connections. *Perceived behavioural control* refers to an individual's belief in their capability to perform a behaviour. It is influenced by both external controlling variables and internal factors such as epistemological beliefs (Weinberg, 2015). External controlling variables generate beliefs about the consequences of behaviours, while internal control variables are more proximate determinants of behavioural intention.

Understanding these theories and their components is crucial for organizations to encourage and induce knowledge-sharing behaviours among their members. By identifying the factors that influence behavioural intentions, such as attitude, subjective norms, and perceived behavioural control, organizations can create supportive plans, implement a positive organizational culture, and provide necessary resources to facilitate knowledge-sharing (Shahzadi et al., 2015).

These theories provide valuable insights into the motivational factors, social influences, and individual perceptions that shape knowledge-sharing behaviour in organizations. Applying these theories can help organizations develop strategies and interventions to promote effective knowledge-sharing practices and enhance organizational success.

2.3 Cultural Dimensions:

Certain characteristics of culture fostered better knowledge-sharing (Demigha & Kharabsheh, 2016). Studies have shown that cultural dimensions may explain related behaviours (Luria, Cnaan & Boehm, 2014). These

were used in identifying their influences on inclusion climate which served as a conducive context to effectively implement diversity and inclusion management practices and create inclusion climates (Stoermer, Bader & Froese, 2016).

Power distance portrays inequality in a society and how strongly people accept differences in status (de Mooij, 2017). People in high power distance organizations have high regard for the knowledge being shared by the supervisors and the top management (Kucharska & Bedford, 2019). *Collectivism* emphasizes interdependence which shows high group orientation (Hofstede, 2012). A culture with a high index of collectivism is always based on teamwork and employees' commitment and has a positive impact on knowledge-sharing (Kucharska & Bedford, 2019). *Uncertainty avoidance* is the extent to which societies are uncomfortable with unpredictable situations and try to avoid ambiguous situations (Hofstede, 2010). A work environment with clear rules, procedures, distributed control systems, and objective policies encourages its workers to comfortably participate in knowledge-sharing with minimum hesitation (Kucharska & Bedford, 2019; Tabajen, 2020). *Short-term orientation* reveals a society's orientation in the shape of thrift and perseverance, or a strong belief in past virtues, as a sign of respect for tradition. Long-term orientation culture, instead, focuses on achieving long-term goals and encourages better knowledge-sharing (Kucharska & Bedford, 2019).

2.4 Knowledge-Sharing Behaviour (KSB):

Knowledge-sharing behaviour refers to the individual behaviors involved in sharing work-related knowledge and expertise with other members within an organization (Yi, 2009). A person's intentions play a crucial role in determining their willingness to engage in knowledge-sharing. Intentions are motivational factors that influence specific behaviors and significantly contribute to the success of knowledge-sharing activities (Gagne, 2009).

Factors that affect intentions and subsequently impact knowledge-sharing behaviour need to be identified. Perceived behavioral controls, as identified by Ipe (2003), play a role in individuals' knowledge-sharing perceptions. These controls include the perceived need to acquire knowledge, the perceived willingness of the receiver to accept knowledge, the perceived ability of the receiver to understand the knowledge, and the perceived appreciation and rewards received by the sharer.

2.5 Filipino Knowledge-Sharing Behaviours:

Montemayor (2015) conducted an exploratory study on Filipino communicative behaviours in knowledge-sharing, building upon the MINU IPE knowledge-sharing framework developed by Ipe (2003). The study analysed Filipino knowledge-sharing behaviours across three dimensions: natural, normative, and ethical.

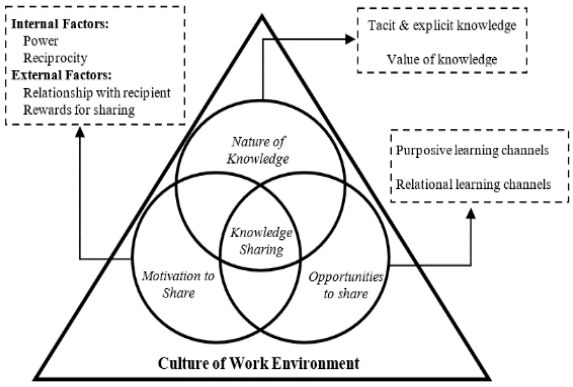


Figure 3: Knowledge-Sharing framework by Ipe, 2003

In the *natural* dimension, Filipinos emphasize the concept of "balance" and perceive themselves, others, and the space they occupy as interconnected entities. This notion of balance influences knowledge-sharing, as individuals may choose to share knowledge only if it is reciprocated, maintaining a sense of equilibrium. On the *normative* dimension, the Filipino trait of "*pagkakamag-anak*" (familism) promotes close relationships and collective interests. Knowledge-sharing is more likely to occur among individuals who share commonalities and perceive benefits for the group. The *ethical* dimension highlights the value of "*hiya*" (personal dignity), which prompts individuals to consider others' feelings when taking actions or making decisions. This trait influences knowledge-sharing by affecting interpersonal relationships.

Montemayor's (2015) findings provide key insights into Filipino communicative behaviours in knowledge-sharing. Some of the notable points include the restraining effect of attitude on knowledge-sharing, the importance of accuracy in shared knowledge to protect one's face due to the value of shame, the role of fellowship in driving reciprocity, the influence of fellowship in motivating knowledge-sharing, the avoidance of sulking resulting from the inability to demonstrate fellowship, the impact of power dynamics and collectivist culture on knowledge-sharing, the expectation of appreciation as a form of soothing feelings, the reliance on non-verbal cues and the virtue of fellowship when sharing knowledge among individuals who are not close, and the influence of collectivist Filipino culture on group rewards. Additionally, reciprocal relations and leader-centered networks are prevalent in knowledge-sharing within the Filipino work context (Fiscal, 2019; Muya & Calupitan, 2019).

3. Knowledge-Sharing in HEI

Knowledge-sharing is crucial in HEIs as it directly impacts the quality of teaching, research, and overall knowledge production. Hence, effective knowledge-sharing strategies are necessary to achieve the goals of higher education. However, many HEIs have not fully embraced the importance of knowledge-sharing among faculty members.

Yeshinegus and Hong (2018) discuss the significance of knowledge-sharing in HEIs. They emphasize that knowledge-sharing preserves knowledge, facilitates personal growth, makes learning accessible, promotes unity and collaboration among faculty members, identifies gaps and opportunities, and ensures quality higher education.

Shahid and Naveed (2020) conducted a study on the knowledge-sharing behaviour of academicians at the University of Sargodha in Pakistan. The results indicated that academicians engaged in knowledge-sharing through various means such as documents and reports, personal conversations, team meetings, brainstorming sessions, and presentations. The study found no significant differences in knowledge-sharing behaviour based on gender, social background, education, and teaching experience. However, age and number of publications were found to be correlated with knowledge-sharing behaviour. The findings of this study can help university administrations in promoting a knowledge-sharing culture for collaborative learning and research.

Promoting knowledge-sharing among faculty members in HEIs is essential for enhancing the quality of education and research. By understanding the challenges and adopting effective strategies, institutions can create an environment that fosters knowledge-sharing and encourages continuous learning and growth.

Overall, the review emphasizes the importance of understanding behavioural patterns and cultural influences in promoting successful knowledge-sharing. It highlights the need for organizational support, attention to cultural diversity, and the consideration of individual motivations and attitudes. The findings from Montemayor's study shed light on the unique cultural factors that shape knowledge-sharing behaviours among Filipinos, underscoring the significance of incorporating cultural values and social relationships in knowledge-sharing initiatives in the Philippines.

4. Statement of the Problem

This study analysed the influences of cultural dimension on the knowledge-sharing behaviours of teachers. Specifically, it sought answers to the following questions:

- How do cultural dimensions (power distance, collectivism, uncertainty avoidance, and short-term orientation) influence knowledge-sharing behaviours and practices within HEIs?
- What are the effective approaches for promoting and facilitating knowledge-sharing practices in HEIs, considering the cultural values, social dynamics, and contextual factors unique to the Philippine setting?

These research questions provide avenues for further investigation into the knowledge-sharing behaviours of Filipinos and can guide empirical studies to gain a deeper understanding of the cultural and social factors influencing knowledge-sharing in the Philippines.

5. Research Hypothesis

The hypothesis proposes that the cultural dimensions of power distance, collectivism, uncertainty avoidance, and short-term orientation play a significant role in shaping the knowledge-sharing behaviours and practices within HEIs. By examining these dimensions, researchers can gain insights into the cultural factors that

influence knowledge sharing and develop strategies to enhance knowledge exchange within diverse cultural contexts.

Hypothesis: The cultural dimensions of power distance, collectivism, uncertainty avoidance, and short-term orientation significantly influence knowledge-sharing behaviours and practices within Higher Education Institutions (HEIs).

6. Methodology

This research administered an online survey to 155 teacher participants from different branches of the university to obtain insights into the cultural factors and determined their influences on the knowledge-sharing behaviors of teachers in HEIs. The venue of this study is a university that has five campuses located across the Philippine regions, representing the regional culture manifested in its peoples' behaviours. The knowledge-sharing behaviours of the participants from different branches were a significant representation of the data this study desired to analyse. The aim is to measure their cultural dimensions summarized and transformed into the regional level and to measure and understand the participants' perception on the local branches' implied knowledge-sharing. This was necessary because it provided insights on the basic understanding on the participants' behaviour towards knowledge-sharing practices in their institution.

Path analysis was used to capture the theoretical or conceptual model of the effects of cultures (exogenous) on knowledge-sharing intentions (endogenous) and the probability of the intentions transformed into actual knowledge-sharing behaviors (endogenous). Hence, the path model exhibits causal relationships between these variables of which an outcome variable (intention) is also a predictor variable of another variable (behaviour).

7. Results

The results of the analysis indicate significant relationships between the cultural dimensions. The interrelationships of the independent variables, such as Power Distance (PD), Uncertainty Avoidance (UA), Collectivism (C), and Short-term Orientation (STO), were found to have strong positive correlations, as shown in Table 1.

Table 1: Description (Strength) of Relationships Between the Independent Variables

Relationship between the independent variables (Cultural Dimensions)	R-value	Description
Power Distance and Uncertainty Avoidance	.614	Strong positive correlation
Power Distance and Collectivism	.604	Strong positive correlation
Power Distance and Short-Term Orientation	.732	Strong positive correlation
Uncertainty Avoidance and Collectivism	.795	Strong positive correlation
Uncertainty Avoidance and Short-Term Orientation	.732	Strong positive correlation
Collectivism and Short-Term Orientation	.702	Strong positive correlation

Regarding the influence of culture on knowledge-sharing intentions (KSI), the analysis using Linear Regression revealed that cultural dimensions significantly influenced KSI. Hence, the hypothesis is accepted. The obtained F-value was 49.056, which was within the acceptance region. The adjusted R square value of 0.555 suggests that 55.5% of the intention to share knowledge can be attributed to culture, while the remaining 45.5% is influenced by other variables or unknown factors.

Table 2: Result of the Regression Model

Model	df	F	Sig.	Adjusted R square
Regression	4	49.056	.000[b]	.567

Predictors: Power Distance, Uncertainty Avoidance, Collectivism, and Short-Term Orientation
Dependent: Knowledge Sharing Intention

Further analysis of the relationships between cultural dimensions and KSI revealed specific findings. Power distance had a significant negative influence on KSI, indicating that participants were less likely to share knowledge with individuals in higher positions of authority. Uncertainty avoidance positively influenced KSI, implying that participants who agreed more with policies and rules related to knowledge-sharing were more likely to have intentions to share knowledge. Collectivism also had a significant positive influence on KSI, indicating that participants were more willing to share knowledge with others from their own group. However, short-term orientation did not significantly affect KSI.

Table 3: Effects Between Each Cultural Dimension and KSI

Relationships of the following cultural dimension on KSI	Coefficient	P-value	Significance
Power Distance	-.239	.003	Significant (NEGATIVE)
Uncertainty Avoidance	.455	.000	Significant
Collectivism	.354	.000	Significant
Short Term Orientation	.162	.090	Not Significant

Dependent Variable: KSI
Significant level at. o5

The individual effects of cultural dimensions on the predictors of KSI (attitude, subjective norm, and perceived behavioral controls) were also examined. All cultural dimensions had significant effects on these predictors. Power distance, uncertainty avoidance, collectivism, and short-term orientation influenced participants' attitudes, subjective norms, and perceived behavioral controls to varying degrees.

Overall, these results suggest that cultural dimensions play a significant role in influencing KSI. Factors such as power distance, uncertainty avoidance, and collectivism have a notable impact, while short-term orientation has a weaker influence.

8. Conclusion

In this study, TPB served as the foundation for analysing the knowledge-sharing behaviour of teachers in HEI. TPB posits that BI, influenced by attitude, subjective norm, and perceived behavioral control, play a crucial role in predicting an individual's intention to engage in a specific behavior at a given time and place. The TPB emphasizes the importance of both intention and the ability to control behavior in determining actual behaviours (LaMorte, 2019; Chen, Chen & Kinshuk, 2009; Chien-Ta et al., 2009; Tsai, Chen, & Chien, 2012).

The findings of this study supported the interrelationships between cultural dimensions as guided by the dimensional paradigm proposed by Hofstede (2011). While significant correlations were observed among the cultural dimensions, their effects on participants' knowledge-sharing intentions varied. Each dimension did not assume a significant or equal degree of influence on knowledge-sharing behaviour, despite the existing literature and the study's own findings suggesting interconnections between these dimensions.

Culture was found to have a profound impact on KSI in the work environment. Studies have indicated that culture can explain related behaviours, highlighting the influence of cultural differences on individuals' behaviors within and across cultures (Hofstede, 2011; Williams, 2015). In the context of Filipino culture, which is characterized by collectivism and a high regard for authority, certain cultural traits were found to influence KSI among teachers. The findings align with previous assertions that Filipino work behaviors are influenced by their culture (Ipe, 2003; Jocano, 2001; Montemayor, 2015).

The study revealed that power distance, a cultural dimension, negatively influenced teachers' knowledge-sharing intentions. Filipino teachers tend to consider the position and authority of the person they share knowledge with, leading to hesitance when sharing with individuals in higher positions. Teachers were more hesitant to share knowledge with individuals in higher positions of authority, indicating the importance of reducing the gap between superiors and subordinates for effective knowledge-sharing (Zhang & Begley, 2011). This study further found that the expertise and reputation of the knowledge sharer were highly respected, affecting the acceptance or rejection of shared knowledge.

The collectivist nature of Filipino culture was found to influence KSI positively. Teachers were more willing to share knowledge within their group and exhibited greater confidence when sharing knowledge with

acquaintances. Building small groups for collaboration and fulfilling social obligations were identified as important factors influencing knowledge-sharing among Filipino teachers. However, it was further found that this collectivist behaviour can limit the people sharing their knowledge with.

The cultural orientation of uncertainty avoidance significantly influenced knowledge-sharing intentions. A work environment with clear rules, procedures, distributed control systems, and objective policies encouraged teachers to participate in knowledge-sharing comfortably. Teachers emphasized intellectual property rights, confidentiality, proper communication mechanisms, and assurance of no harm in knowledge-sharing (Kucharska & Bedford, 2019; Tabajen, 2020).

Although the normative behaviour of Filipino teachers, characteristic of a short-term orientation, did not directly impact their intention to share knowledge, it indirectly influenced knowledge-sharing intentions through the three predictors of intention (attitude, subjective norm, and perceived behavioral control). Teachers recognized the importance of knowledge-sharing in their profession, which aligns with their focus on achieving long-term goals.

This study demonstrated the influence of culture, particularly in the context of Filipino teachers, on KSI. The findings emphasized the significance of cultural dimensions, and their interrelationships in understanding and promoting knowledge-sharing behaviour among teachers. By recognizing and addressing cultural factors, HEIs can foster an environment conducive to knowledge-sharing, leading to innovation and improved outcomes.

9. Recommendations

HEIs should prioritize initiatives aimed at reducing power distance and fostering a more egalitarian and collaborative culture. This can be achieved through leadership development programs, mentoring opportunities, and creating platforms for open dialogue and idea sharing. Policies and guidelines related to knowledge-sharing should be designed in a way that minimizes uncertainty and provides clear expectations and support to teachers. This can include the development of standardized procedures, training programs, and creating a supportive infrastructure for knowledge-sharing activities. Promote a culture of collectivism by encouraging collaboration, teamwork, and creating communities of practice where teachers can share their experiences and expertise. Building strong networks and fostering a sense of belonging and shared purpose can significantly enhance knowledge-sharing efforts. While short-term orientation may have limited impact on knowledge-sharing intentions, it is important to promote a long-term perspective that emphasizes the value and benefits of knowledge-sharing. Encourage teachers to recognize the long-term advantages of sharing knowledge and the potential positive impact on their professional growth and the institution.

Further research is recommended to explore additional factors that may influence knowledge-sharing intentions, such as individual motivations, reward systems, and organizational culture. Understanding these factors can provide deeper insights into the dynamics of knowledge-sharing and help refine strategies for promoting a culture of knowledge exchange in educational settings.

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Knowledge Management in Crisis Conditions and Financial Results of Enterprises

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Abstract: The article addresses the considerations concerning key issues affecting the proper functioning of enterprises. The global situation related to the COVID-19 pandemic in recent years has contributed to significant changes in terms of management. In this publication, the attention is drawn to a necessary element of the functioning of enterprises, i.e., knowledge management. Actions taken in the field of implementing innovation, implementing IT systems as well as implementing the concepts of sustainable development translate into proper knowledge management in enterprises. The above issues are defined and constantly deepened in literature. However, there are few studies that combine this topic and analyze interrelationships. The review of literature indicates the significance of these issues and confirms the need for further research in this area. In this publication, the issue of innovation is addressed, as a “driving wheel” of enterprises operating in the market environment. The link between the implementation of innovation in enterprises and the development of IT systems, taking into account the idea of sustainable development, is also analyzed. The considerations are deepened by the relations between knowledge management and innovation, IT systems and sustainable development. The article includes the empirical part in which two enterprises from Poland, operating primarily on the domestic market, are subject to the analysis. In the article, a case study has been applied using economic analysis based on two selected enterprises. The objective of the article has been to learn about the components of knowledge management used in crisis conditions. It should be noted that the pandemic period was a crisis situation for enterprises and the conducted research has showed what actions in terms of knowledge management were taken by enterprises to survive on the market. The conducted analyses have proved that enterprises, despite the same industry, took different actions, which translated to the achieved financial results. The functioning of modern enterprises in crisis conditions, taking into account the issues discussed in the article, is the key to their success. Therefore, the topic of the article is up-to-date and relevant.

Keywords: knowledge management, Innovation, IT systems, Sustainable development

1. Introduction

Knowledge management, innovativeness of enterprises, information systems, and sustainable development include very complex issues. Therefore, modern companies are increasingly oriented to going beyond their comfort zone and seeking a common denominator that connects these areas in order to cope with crisis conditions. In the article, the term "condition", identified with the COVID-19 pandemic, was intentionally used. "Condition" is defined as a determinant of the occurrence of a certain situation (Bednarska-Wnuk, 2010). Crisis in literature is defined as the peak moment of an escalating crisis situation. It is mainly characterized by lack of information, an increase in unforeseen events, lack of control, instability of the situation, and dynamics of changes. It should be noted that the proper flow of information plays a crucial role in crisis situations (Marjański, Starczewski, Ciekanowski, 2017). The COVID-19 pandemic has drastically changed the established rules of enterprise management, including broadly defined knowledge management. There are many interpretations of knowledge management in literature. The complexity of this issue is confirmed by the fact that theoreticians and practitioners continuously expand the definitions of this concept. Knowledge management is defined as a whole of various activities related to enterprise management (Salojärvi, Furu, Sveiby, 2005). Knowledge management is a complex process involving various actions that contribute to establishing favorable decisions in companies (Anshari et al, 2023). This process consists primarily of knowledge recognition, creation, storage and sharing of acquired knowledge. These activities seek to use knowledge to increase the efficiency of the enterprise (Wang, Wu, 2021). Proper knowledge management in enterprises is also conducive to gaining a competitive advantage. Deepening the considerations on knowledge management, it should be noted that it is also the organization's ability to acquire knowledge on time and in the right place in crisis situations (Oktari et al, 2020).

It should be noted that from year to year, it is observed that more and more companies undertake innovative activities. Moreover, the term "innovation" gains a broader meaning. Therefore, for the accuracy and relevance of the concept of innovation, the constant enrichment and updating of definitions is crucial. Schumpeter is recognized as the precursor of this issue. He indicated that innovation is considered a comprehensive change. It is not only a process aimed at improvement but also the creation of something entirely new that will significantly deviate from existing norms (Schumpeter, 1960). Currently, innovation is treated as a comprehensive change

that takes into account various areas it is intended to affect. It is reasonably considered as a type of experiment, as its effects are difficult to assess at the stage of implementation (de Carvalho Pereira et al, 2015).

The literature distinguishes many categories of classification of knowledge management components. Researchers isolate, categorize, and explain components from different perspectives (Usman, Zaveri, Hamza, 2021). They use different research methods to identify the components of knowledge management in different types of enterprises (Mohammadzadeh Ravshti, Ghiasi, Tahmasebi Limooni, 2020). This article highlights four key components of knowledge management from the perspective of crisis situations. Due to the occurrence of crisis conditions, managers had to transform the operations of companies, mainly directing them to the implementation of innovative solutions, IT systems, and implementation of the assumptions of sustainable development. In the area of these components, enterprises implement activities that affect the proper management of knowledge.

In the article, the method of critical analysis of literature was used, as well as the method of economic analysis, and a case study. The triangulation of the research methods allowed for the in-depth analysis of the issues. The objective of the article is to learn the components of knowledge management used in crisis conditions. In most companies, the elements, such as, knowledge management, innovations, IT systems, and sustainable development are not new. However, they are currently the foundation of business management. They should be constantly explored and updated. Therefore, the topic of the article is important and relevant.

2. Innovativeness as a "Driving Wheel" of Enterprises Operating in the Market Environment

An important criterion for assessing the effectiveness of enterprises is their innovativeness (Jap, 2001). The efficient functioning of companies is highly integrated with the implementation of innovation. The current review of literature takes into account the impact of innovation on achieving a competitive advantage for enterprises in the market (Sobczak, Głuszczuk, 2020). This means that innovativeness corresponds to the company's ability to maintain its competitive potential in the market, which depends not only on its assets but also on the knowledge and skills of its personnel. Innovation increases the competitive advantage, and thus distinguishes the company in the market environment (Matos et al, 2015). It should be noted that this also has an impact on shaping the overall market situation and to some extent also causes the establishment of prevailing trends in the market. The development of companies is determined by the level of implemented innovation. The review of literature indicates that more and more researchers identify the level of innovation in companies with maintaining the stability of the entity in a situation of economic fluctuations in the environment (Hou, Hong, Zhu, 2019).

In today's world, enterprises implement various types of innovation. There is process, marketing, organizational, and product innovation. Process innovation primarily involves streamlining and creating entirely new methods, especially within supply and production. The characteristic feature of marketing innovation is the implementation of new marketing methods. Organizational innovation relates to changes in terms of management methods in different structures of the company's operation. Product innovation is a key type of innovation. It involves creating entirely new products, but also improving existing ones. Such a wide range of types of innovation created by companies provides the opportunity for continuous development and gaining an increasingly competitive advantage in the market (Brodowska-Szewczuk, 2019).

In their strategies, companies should primarily consider the dynamic development of technology. With such an approach, entities, especially large companies, have the chance to compete in the global market and gain a competitive advantage. Technological novelties have a positive impact on the company's image because this indicates development and adaptation to a dynamically changing environment (Szuper, 2021).
Literary studies indicate that product innovation is identified with something innovative that allows customers to acquire products that deviate from accepted norms, while enabling the company to expand its business to new markets, new customers, and suppliers. It is also necessary to analyze the market innovation itself, which constitutes the key link to product innovation. Researchers define it as the completely innovative understanding and functioning of the company in the market. This is related not only to originality in terms of promoting products but mainly recognizing market perspectives, this is also innovation in terms of analyzing the market itself and reaching new markets (Wang, Ahmed, 2004).

The individuality of the market sets a type of determinants of belonging. Therefore, it can be concluded that it is enterprises and their level of innovativeness that create the market. The benefits from innovation are oriented to the entity implementing it but also, on a broader scale, even globally (Jaakson, Aljaste, Uusi-Kakkuri, 2019).

This is innovation that drives the market since companies, to strengthen their competitive advantage, strive to increase their own innovativeness. Moreover, enterprises aim at maximizing profits, and the ability of entities to create innovation translates into achieving financial benefits (Kumar, Haleem, Sushil, 2019). This also affects belonging and survival in the market, as well as efficient and effective functioning (Jaakson, Aljaste, Uusi-Kakkuri, 2019).

It is worth emphasizing that knowledge of innovativeness is recognized as an essential element allowing for understanding economic phenomena (Reagans, Zuckerman, 2008). Innovation as a "driving wheel" of enterprises operating in the market environment is a general statement, but precisely defining the situation that has been observed for years. Companies constantly compete in terms of implemented innovation. They try to create innovative solutions that will surprise both competitors and customers themselves. By implementing new solutions, companies stimulate other entities to innovate. Therefore, this affects both enterprises and the entire market itself (Łęgowik-Świącik, 2022). Moreover, it is difficult to imagine creating innovative solutions without considering the development of IT systems, which are of fundamental importance from the perspective of the company, competitors, the market, and above all, customers.

3. Knowledge of Innovation in Enterprises and Integrity of Development of IT Systems, Considering the Idea of Sustainable Development

The development of knowledge of sustainable development in enterprise management has been affected by the recognition of social objectives of the enterprise, taking into account justice and solidarity among people, on an equal footing with economic goals (Booth, 1998). Sustainable development in the 21st century is an equally important issue as innovation. When analyzing literary studies, one can notice an increasing number of scientific publications on innovation and sustainable development that combine these two issues.
The implementation of innovation by enterprises is inseparably linked to the application of the idea of sustainable development. Innovation in enterprises is also related to the development of diversified IT systems. All types of IT solutions have a crucial impact on the proper functioning of enterprises in such a dynamically changing environment (Amin, 2019). From the perspective of the enterprise, implemented IT systems are primarily intended to improve its functioning. Literature sets define the IT system as a complex set, the operation of which is affected by individual components. It should be noted that individual pieces of information are accumulated but also processed (de Carvalho Pereira et al., 2015). It should therefore be pointed out that in the 21st century IT systems are assigned a key role for proper knowledge management in enterprises. One of the many advantages is the strengthening of the position of enterprises in a given market environment (Stroińska, Trippner-Hrabi, 2017). A literature review confirms the existence of links between knowledge management and innovation. It is precisely innovations that depend to a large extent on knowledge. It is indicated that knowledge management is a source of innovation (Hussain, 2019).

Over the years, the definition of sustainable development has significantly evolved. Currently, the assumptions of this concept include not only the broadly understood ecological aspect but also the social and economic ones. Knowledge management in the context of sustainable development aims to intensify activities implementing the assumptions of this idea (Martins, 2019). Its main objective is to balance these areas rationally to aim at satisfying needs and providing future generations with the opportunity to use these goods. These ideas focus primarily on common sense, rationality, balance, and responsibility. The concept of sustainable development assumes counteracting destructive activities, particularly those that have an impact on the environment (Duran et al., 2015). This concept should not be understood as abandoning development. To maintain proper balance in all areas, development is crucial. Mainly in underdeveloped countries, the ideas of sustainable development come down primarily to reducing disparities in people's living conditions. In this context, development is understood as a paradigm in fulfilling the idea of sustainable development (Klarin, 2018). It is precisely entrepreneurs that bear significant responsibility for the common future. The implementation of new technologies, IT solutions, is necessary with such rapid technological progress. Enterprises, implementing innovation, must consider the ideas of sustainable development. Innovation, IT systems, sustainable development, and knowledge management are analyzed primarily separately. Under crisis conditions, proper knowledge management is an essential component of business operations. The listed components and the activities performed by enterprises in their regard affect knowledge management (Schiuma, Jackson, Lönnqvist, 2021). Therefore, it is necessary to deepen these considerations and take into account the dependencies between them. Figure 1 shows the interaction of individual components.

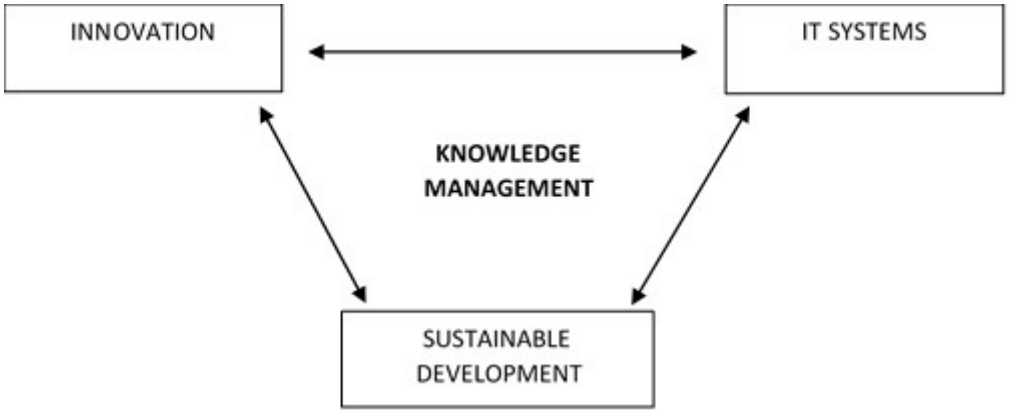


Figure 1: Impact of Individual Components

To sum up, it is worth emphasizing that the analysis of Figure 1 shows that innovation creates IT systems and improves existing ones without directly affecting them. IT systems contribute to shaping innovation and directly affect it. On the other hand, the ideas of sustainable development directly affect and influence the process of creating, implementing, exploiting, and withdrawing innovation and IT systems. This means that innovation and IT systems directly affect sustainable development. Therefore, innovation, IT systems, and the ideas of sustainable development contribute to proper knowledge management in companies. All the above-mentioned components are essential for the proper functioning of the enterprise and are closely linked to each other.

4. Research Methodology

The empirical research was conducted based on the method of economic analysis and a case study. The method of economic analysis allowed for the thorough examination of the processes taking place in enterprises, mainly in financial terms (Grzenkowicz et al., 2017). On the other hand, the case study allowed for the detailed analysis of the studied companies, taking into account their overall functioning (Eisenhardt, Graebner, 2007). Two companies from the clothing industry in Poland were selected for the study: Wittchen S.A. and Monnari Trade S.A. The research sample was deliberately selected due to the availability of the data and the wide range of activities of these entities.

5. Description of the Research Sample

The research period adopted in the analyses covers the years 2016-2021. The selection of the research sample was mainly conditioned by the availability of financial and non-financial data, similar scope of activity of the companies and specificity of their functioning.

The Wittchen company started its operations in 1990. It has been listed on the Warsaw Stock Exchange since 2015 and belongs to the WIG-clothing index. The main activity of Wittchen is the sale of footwear, clothing, luggage accessories and mainly leather accessories. It is a dynamically operating company on both domestic and foreign markets. The products are sold in stationary stores and in an online store. It also uses marketplace platforms (https://www.wittchen.com/, Wittchen S.A. financial report for 2021).

The Monnari brand was founded in 1998. It has been listed on the Warsaw Stock Exchange since 2007 and belongs to the WIG-clothing index. The company is mainly engaged in retail sales of clothing. It also offers accessories, bags, and footwear. Monnari Trade S.A. sells its products in stationary stores, an online store and on marketplace (https://emonnari.pl/, Monnari Trade S.A. financial report for 2021).

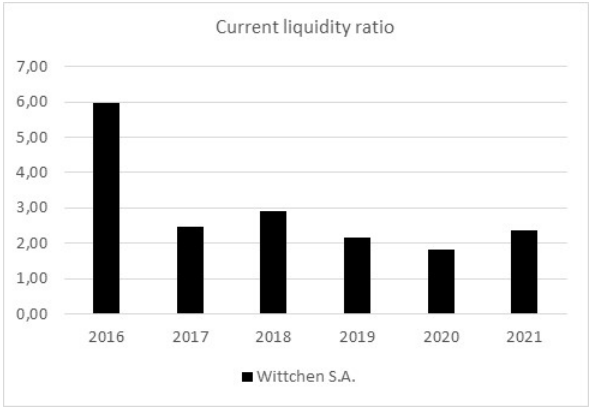
Wittchen S.A. and Monnari Trade S.A. are the leaders in the industry, characterized primarily by a strong market position.

6. Economic Analysis Of Wittchen S.A. and Monnari Trade S.A.

The analysis was conducted based on the research period of 2016-2021. The extensive time frame will allow for the in-depth examination and comparison of the occurring changes, taking into account the crisis conditions. The most important economic indicators from the following groups were used in the research:

- liquidity ratio,
- debt ratio,
- profitability ratio.

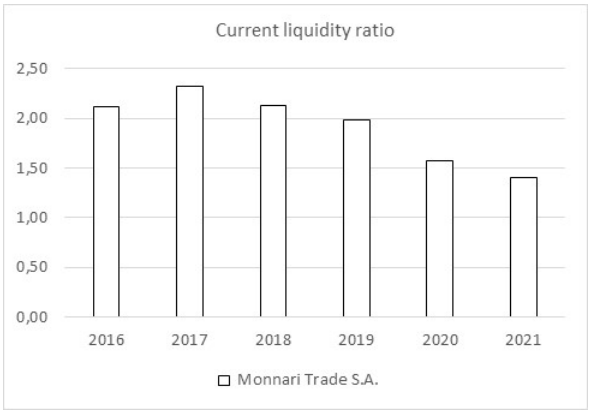
Figure 2 shows the current liquidity ratio of Wittchen S.A.



Source: Own study based on the financial statements of Wittchen S.A. for 2016-2021.

Figure 2: Current Liquidity Ratio of Wittchen S.A.

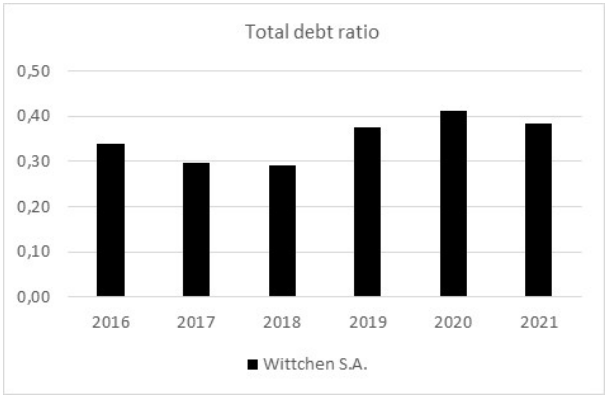
The optimal level of 2.0 was significantly exceeded in the years 2016-2019 and in 2021. Thus, excess liquidity was observed, which indicates a significant amount of free cash. The correct level of the current liquidity ratio was recorded in 2020. Figure 3 presents the current liquidity ratio of Monnari Trade S.A. in the years 2016-2021.



Source: Own study based on the financial statements of Monnari Trade S.A. for 2016-2021.

Figure 3: Current Liquidity Ratio of Monnari Trade S.A.

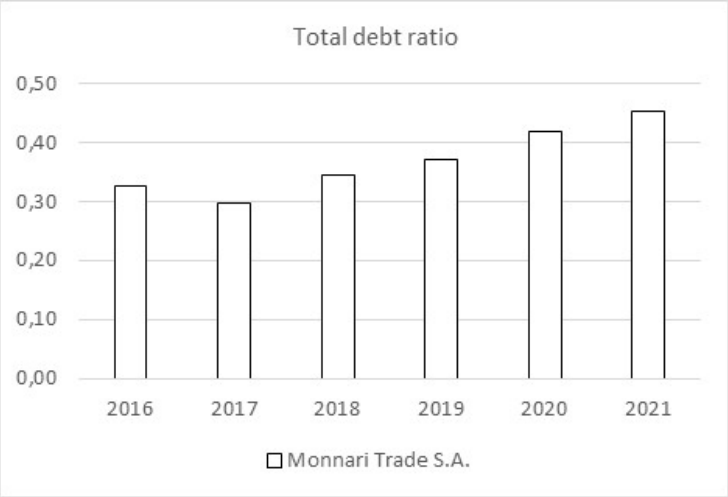
In the years 2016-2018, the current liquidity ratio exceeded the recommended level of 2.0. This indicates the occurrence of financial overliquidity of Monnari Trade S.A. On the other hand, from 2019 to 2021, the ratio decreased year by year. The lowest value was reached in 2021. It should be noted that despite the regression, these values are within the range of 1.2-2.0, indicating that the company had knowledge to efficiently utilize capital. Figure 4 shows the total debt ratio of Wittchen S.A.



Source: Own study based on the financial statements of Wittchen S.A. for 2016-2021.

Figure 4: Total Debt Ratio of Wittchen S.A.

During the research period of 2016-2021, the total debt ratio in each year was at the correct level. This indicates primarily the financial independence of Wittchen S.A. and thus the proper knowledge management. Figure 5 presents the total debt ratio of Monnari Trade S.A. in years 2016-2021.



Source: Own study based on the financial statements of Monnari Trade S.A. for 2016-2021.

Figure 5: Total Debt Ratio of Monnari Trade S.A.

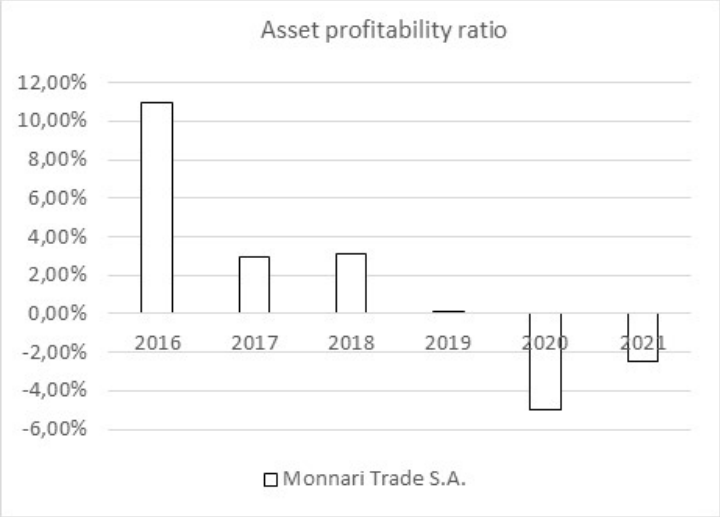
Monnari Trade S.A. is financially independent as the total debt ratio over the analyzed years did not exceed the optimal level of 0.57-0.67. Thus, the company has the knowledge of how to properly manage it. It should be noted that the highest level was achieved in 2021. Figure 6 shows the asset profitability ratio in Wittchen S.A.



Source: Own study based on the financial statements of Wittchen S.A. for 2016-2021.

Figure 6: Asset Profitability Ratio in Wittchen S.A.

In the years 2016 and 2021 there was a fluctuation amplitude in the asset profitability ratio values. The lowest value of the ratio was recorded in 2020. However, there was a significant increase in the ratio in 2021. More than PLN 0.13 of net profit was generated from PLN 1 of assets involved. This situation indicates that the financial situation of the analyzed enterprise improved, and knowledge was managed more effectively. Figure 7 presents the asset profitability ratio of Monnari Trade S.A.



Source: Own study based on the financial statements of Monnari Trade S.A. for 2016-2021.

Figure 7: Asset Profitability Ratio in Monnari Trade S.A.

In Monnari Trade S.A., there has been a significant regression in the asset profitability ratio value since 2019. The financial condition of Monnari Trade S.A. deteriorated from year to year. A net loss occurred in 2020 and 2021.

7. Discussion

The above analyses demonstrate that Wittchen S.A. coped well under the crisis conditions. Temporary drops were recorded in the years of the outbreak of the COVID-19 pandemic. However, the company maintained a stable position, and its financial situation has been constantly improving. The positive situation is the result of a range of actions taken by the management before and during the pandemic. The very successful online store has contributed to the ability to continue sales in difficult times. The activity reports indicate that the company continued to develop and adjust its online sales during the pandemic. The company also operates dynamically on marketplace. Diversified distribution channels enabled sales to continue. Furthermore, the Board Members of the company took specific actions and limited their salaries to PLN 1 gross per month. Negotiations with representatives of shopping malls resulted in rent exemptions and reductions during lockdown periods. Wittchen S.A. significantly focused on controlling and optimizing operating costs. Therefore, the decisions made by the management were crucial in reducing the negative effects of the COVID-19 pandemic. Wittchen S.A. also focuses on research and development, which contributes to constant changes, and thus implementing innovation. The importance of all types of IT solutions is confirmed by the fact of having an online store. The company also takes actions related to implementing the concept of sustainable development. The company carries out a number of activities aimed at the good of the environment. It implements them in products, but also in the company's headquarters and showrooms. The product range includes those that are made of recycled materials. Systems are installed at the company's headquarters and in the showrooms to reduce electricity consumption. The presence of knowledge management components is noticeable in the company's activities. Therefore, it should be indicated that Wittchen S.A. managed its knowledge correctly, and the company coped with the difficulties arising from factors beyond its control (Financial Statements and Activity Reports of Wittchen S.A. for the years 2016-2021).

The conducted analyses indicate that Monnari Trade S.A. recorded a net loss in the years 2020-2021. Thus, the company faced difficulties to effectively operate during the COVID-19 pandemic. Many actions were taken, as evidenced by the financial statements and activity reports, including negotiation talks with lessors, which were aimed at considering the global situation. The offer was expanded and adjusted to current conditions. The actions oriented to expanding the company's activities to new distribution channels were relevant. Innovation was implemented, the online store was improved, and remote work was introduced. Financial assistance was also obtained. It should be noted that the company also considers the ideas of sustainable development in its operations. The company constantly analyzes its activities, has implemented, among others, Environmental Policy, Social Policy. The carbon footprint has also been calculated. It is noticed that the company implements activities that are largely focused on meeting the assumptions of sustainable development. The suppliers with

whom Monnari Trade S.A. collaborates are mainly foreign suppliers, mostly from Asia. The problems with timely deliveries and frequent lockdowns could have been crucial for the company's financial situation. Such a situation did not result from internal problems, but from events beyond the company's control. Despite the difficulties, the company is currently achieving increasingly better financial results. Among the various activities that were undertaken in the enterprise, the presence of knowledge management components is noticeable. It should be emphasized that Monnari Trade S.A. managed its knowledge correctly during the crisis conditions since it survived in such difficult times. The management took various actions that must have significantly reduced the negative effects (Financial Statements and Activity Reports of Monnari Trade S.A. for the years 2016-2021).

The conducted analyses enabled the identification of knowledge management components used in crisis conditions. Despite being in the same industry, the companies took various actions. However, in both companies, innovation implementation, the use of sustainable development concepts, and IT systems were observed. These components contributed to proper knowledge management. It should be noted that each company and industry is characterized by different specificity, and thus, different components and actions may occur.

8. Conclusions

The theoretical considerations presented above emphasized the importance of using innovation, IT systems, and the idea of sustainable development in companies. It should be noted that these components are crucial in proper knowledge management in crisis conditions. Companies should continuously improve their actions to manage knowledge properly and effectively. Knowledge management focuses on the present but also serves as a type of indicator of the future. How the company manages knowledge now will translate into its functioning in the future. The interconnection and interaction of the above-mentioned components plays a fundamental role in knowledge management. The empirical research indicated that the occurrence of knowledge management components, i.e., innovation, IT systems, and the idea of sustainable development, allows enterprises to survive difficult times and, above all, provides opportunities to stabilize the financial situation. To sum up, proper knowledge management translates into a whole of functioning and achievement of favorable financial results in companies.

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Masters Research Paper

How Can the Irish Construction Industry Become Less Fragmented and More Productive?

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Abstract: Globally the Construction Industry is in a fragmented state and the Irish Construction Industry (ICI) is no exception. The ICI has a history of delivering National infrastructure projects over time and over budget. Irish Government publications have identified that low productivity within the ICI is a prevalent issue. Lean construction (LC) is proposed in this research as an antidote to assist the ICI in becoming less fragmented and more productive. Research indicates that successful incorporation of lean methodologies can cut completion times by 30% and costs by 15%. Further research demonstrates that Construction Industries (CI) are lacking the education required to implement lean methodologies. There is a lack of awareness within the ICI regarding the principles and benefits of lean. Lean Construction Ireland (LCI) membership numbers are increasing at a glacial pace. Traditional project management techniques that are autocratic in nature and focus on critical path items and milestones are extensively used in the ICI. These techniques prioritize measuring metrics such as commercial performance which means measuring other performance related metrics such as workflows slip down the order of seniority. This approach conflicts with the principles of lean and limits the opportunity for continual improvement. There is therefore a requirement for government, management, leaders and all project stakeholders to change their way of thinking regarding their project management techniques and embrace change. Aligning these stakeholders will strengthen the entire Irish Construction Supply Chain and only then will the benefits of lean be fully realized. Building Information Modelling (BIM), whilst not technically a lean tool shares multiple characteristics of lean and is further vehicle that can assist in this transition. The results suggest that with enhanced education in lean, alignment of project stakeholders, an overhaul of traditional project management techniques and heavier incorporation of BIM that a shift towards lean and higher productivity is possible for the ICI.

Keywords: Lean, Education, Barriers, Project management, Irish construction industry

1. Introduction to Lean

The lean philosophy was pioneered by the Japanese in the 1950s by the manufacturing industry (Womack, Jones and Roos, 1990). The lean ethos has a very detailed structure, it does not have limitations and can evolve to incorporate other mechanisms as required. The principles of lean are to reduce waste, increase productivity, value and profitability which requires close collaboration between all involved parties in the supply chain from the design stage all way to the end user (Pheng, Gao and Lin, 2015). From its inception and success in manufacturing it has made advances in the CI whereby clients and contractors are trying to incorporate the lean techniques traditionally used in a controlled and repetitive manufacturing environment into the less controlled environment of construction sites. Introducing these techniques from the predictive environment of the manufacturing industry into the unpredictable environment of the construction world is a challenging undertaking. Whilst acknowledging the difficulties that exist between these industries Koskela, (1992) contributed to this transition by suggesting an alternative way of thinking that puts a focus on the flow of information, material, construction activities and how these flows are measured. It has been recognised in previous research that there is a difficulty marrying lean to CIs (Cano *et al.*, 2015; Hines, Taylor and Walsh, 2020; Mano, Gouvea da Costa and Pinheiro de Lima, 2021).

2. Literature Review

The CI globally has an issue delivering projects on time and within budget (Bertelsen and Koskela, 2003; Flyvbjerg, Bruzelius and Rothengatter, 2003; Fraser, 2004; Flyvbjerg, 2011; CNN, 2020; Steininger, Groth and Weber, 2021). A trend of underperformance and low productivity has been set and maintained and it is one this sector is struggling to shake. The ICI is no exception in this regard and has its own demons relative to time and budget on major projects (Cunningham, 2017; Engineers Ireland, 2018; McGee, 2019; Department of Public Expenditure and Reform, 2020)

Literature examined indicates that CIs are uneducated on the concepts of LC and a lack of understanding exists (Sarhan and Fox, 2013a, 2013b; Ahmed and Sobuz, 2020; Albalkhy and Sweis, 2020). The ICI is not unlike its global counterparts and also suffers from a lack of education in this area (Ebbs et al., 2015; Power and Taylor, 2019).Membership numbers of Lean Construction Ireland (LCI) are low (Lean Construction Ireland, 2022) and despite government publications identifying poor productivity issues within the ICI and LC being a potential

remedy (Department of Public Expenditure and Reform, 2020; Construction Industry Federation, 2021) it would appear that little progress has been made.

There is a reluctance for stakeholders to move from traditional project management techniques towards the process based collaborative approach that fuels the lean ethos (Nesensohn, Demir and Bryde, 2013; Ghannoum et al., 2019; Hettiaarachchige *et al.*, 2022) which may be compounding the fact that global productivity of CIs is increasing at a lethargic rate (Barbosa et al., 2017).

Industry needs to put a stronger focus on measuring items that fall outside of the commercial remit (Ghannoum *et al.*, 2019). Continual improvement revolves around measuring and monitoring performance on an ongoing basis which therefore requires that processes and workflows should also be considered thus exposing opportunities for improvement (Koskela, 1992). Each workflow in a process is dependent on another and the consequences of one failing can cause a domino effect that causes the next to fail (Wernicke, Lidelöw and Simu, 2019) meaning it is critical to gather data on these workflows throughout the entire process and create opportunity for intervention. Autonomy and leadership are critical qualities to assist in a shift towards continuous improvement (Kelly, 2016).

The manufacturing industry has proven that lean is a vehicle for success (Singh, Singh and Singh, 2018; Kelly and Hines, 2019; McKie et al., 2021). The CI has also demonstrated that LC can help to deliver impressive results (Andersen, Belay and Seim, 2012; Maraqa, Sacks and Spatari, 2021).

A strong Construction Supply Chain is critical in order for project stakeholders to harnesses long term relationships with their suppliers, engage with them collaboratively and form partnerships that develop mutually beneficial strategies (Ewuga and Adesi, 2022). However, stakeholders operating in the commercial remit of projects can be detrimental to these relationships being formed (Ahmed, Pasquire and Manu, 2022).

Building Information Modelling (BIM) by default is a lean tool. BIM and lean methodologies share similar principles and lean is indirectly embedded in BIM. These approaches when combined complement each other and are proven methods of achieving higher quality structures that are produced quicker and cheaper in a more collaborative environment (Sarhan, Olanipekun and Xia, 2016; World Economic Forum, 2016; Koseoglu, Sakin and Arayici, 2018; Meng, 2019; Ahmed and Sobuz, 2020; Albalkhy and Sweis, 2020; Evans *et al.*, 2021; Maraqa, Sacks and Spatari, 2021).

3. Methodology

Quantitative and qualitative data collection methods were used in this exploratory research which required the adaptation of a positivist approach for quantitative and an interpretive approach for qualitative. The mixed methods approach was deemed by the Author as being the best equipped mechanism to provide reliable and valid results in the following areas of interest:

- Determining the current levels of productivity within the ICI.
- Establish the ICIs level of education regarding LC.
- Determine the ICIs current level of engagement in LC.
- Demonstrate how the ICI can learn from the lean experiences of other industries and countries.

3.1 Quantitative Methodology

Purposive sampling was used to identify the target population for the Quantitative research. The target population was deemed to be 239 construction professionals. By using a 6% confidence interval and the target population figure of 239, the Author established that a sample size of 126 respondents was necessary to achieve a 95% confidence level. 131 valid responses were gathered. By using the findings from the literature review the Author compiled a survey consisting of 22 questions. The survey questions employed different formats including multiple choice, some of which offered the “other” option which allowed respondents to engage more precisely when appropriate. The Likert scale method was used in 3 of the questions to extract the attitude of the respondents relative to the research topic.

3.2 Qualitative Methodology

A semi state organisation (Company X) that employs more than 7000 people in the energy sector was identified by the Author as being a suitable source of data. This organisation has in excess of 5 years’ experience in lean and has developed a thriving lean academy. As this organisation operates in an industry not

dissimilar to the ICI and considering their experience in lean, Company X was deemed a source that could provide valuable knowledge to the ICI.

Semi structured interviews were employed for the qualitative element of this study. The information gathered in the literature review and data collected from the quantitative element of this study presented crucial information that was necessary in designing the interview questions. The interviews consisted of a series of open and closed questions. Three interviewees were selected that had successfully passed predetermined criteria.

3.3 Quantitative Data Analysis

Statistical Package for the Social Sciences software was the primary tool used to assist the Author in verifying relationships between variables and extract common trends from gathered data. Cronbach's Alpha was also used to analyse Quantitative data. Cronbach's Alpha is a data analysis technique used to measure and determine the reliability of results gathered from summated rating scales (Cronbach, 1951). This methodology is amongst the most commonly used approaches to determine consistency amongst items in a scale and measures what degree of correlation exists between question responses.

3.4 Qualitative Data Analysis

Upon completion of all semi structured interviews the gathered data was analysed using thematic analysis. In order for qualitative research to be credible, research must be conducted in a systematic manner. It is therefore critical that the consequential data analysis also be conducted systematically in a robust manner that acknowledges the methodologies used are credible (Nowell et al., 2017). Braun and Clarke, (2006) recommend that the steps shown in Figure 1 be followed when using thematic analysis.

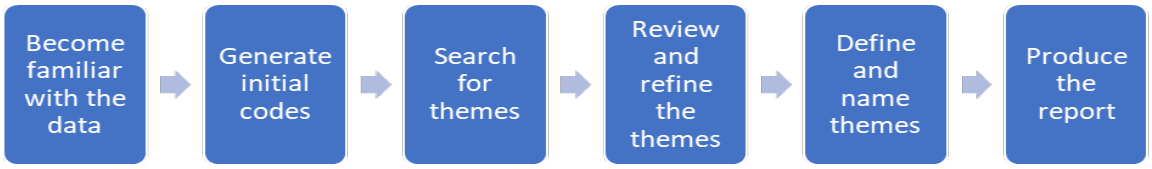


Figure 1: Sequence for the Completion of Thematic Analysis (Braun and Clarke, 2006)

4. Discussion of the Findings

The literature review of this research demonstrated that the ICI is fragmented, underperforming and has a history of delivering projects over time and over budget. The quantitative research element of this study tested the above findings within the ICI and the results resonated with those that emerged in the literature review as 39.7% (n = 52) of survey participants said they are delivering their projects over budget and 40.5% (n = 53) of survey participants said they are delivering their projects late. It would appear that the ICI is explicitly aware of its unproductive status as 76.3% (n = 100) of survey participants feel that their respective organisations could improve regarding the identification and elimination of waste. Multiple factors were proposed by participants as to why projects run over budget and over on time. The common contributing factor that emerged is that poor design leading to excessive variations has a significant negative effect on productivity levels in the ICI.

Despite limited availability of Secondary data applicable to lean in the ICI, the literature review identified that there is a lack of knowledge and education in the ICI regarding lean. Low membership numbers in LCI also outlined in the literature review indicates a lack of belief or interest in this area. The literature examined has recommended that campaigns to educate the ICI in lean are required. The quantitative element of this study tested the above findings and strong correlations emerged such as only 28.2% (n = 37) of survey participants practice LC methodologies and only 26.7% (n = 35) of survey participants employers have considered adopting LC which indicates a lack of knowledge and possibly a lack of faith in lean. The vast majority of participants are not familiar with five of the primary lean methodologies indicating a lack of knowledge in lean. This indication was strengthened by 77.1% (n = 101) of survey participants feeling there is inadequate awareness and knowledge of lean within the ICI. Interviewees that participated in the qualitative element of this research demonstrated a thorough understanding of lean and continuous development in this area through their Lean Academy. Company X are seeing positive results through the education they are providing.

The literature review identified multiple incumbent barriers to lean and these barriers were tested in the Quantitative element of this study. Table 1 presents the top ten barriers to LC in the ICI identified in the Quantitative element of this study.

Table 1: Top 10 Barriers to Lean Construction in the Irish construction industry

Rank	Barrier
1	Lack of education
2	Clients over use of lowest price tendering
3	Traditional Project Management techniques
4	Reluctance from Management to change
5	Poor design making efficient delivery difficult
6	Lean not being a requirement on public contracts
7	Lean not being a requirement on private contracts
8	Lack of Government support
9	Reluctance from Employees to change
10	High turnover of workforce

The barrier related findings shown in Table 1 were used as a basis for further investigation throughout the qualitative element of this research. Data comparison opportunities were limited between the findings shown in Table 1 and that of the qualitative findings. However, some comparisons could be made where learnings can be extracted such as:

- Company X are educating and training their staff to a high level through the establishment of a Lean Academy. It is evident from the findings that this has been a crucial component on their lean journey. The ICI can learn from this, furthermore heeding publications recommending improvement in this area may be a strong starting point in overcoming what appears to be the biggest barrier to lean in the ICI.
- Traditional project management techniques were identified in the literature review as a barrier to lean implementation and this correlated with the findings in Table 1. However, findings from the qualitative element of this study suggest that traditional project management techniques can be successfully blended with lean if used in the right measures.
- Reluctance to change was an additional barrier that emerged from the literature review. This correlated strongly with the findings in Table 1. These findings were further strengthened in the qualitative findings of this research where Company X interviewees stated that they have not fully overcome this barrier and getting buy in from staff presents an ongoing challenge. These correlations indicate that a reluctance to change and achieving buy in from staff is a challenge for more industries than just construction.

Correlations were identified between Table 1 and findings regarding productivity issues discussed earlier. These correlations are shown in Table 2.

Table 2: Correlating Factors Between Lean Barriers and Productivity Issues in the Irish Construction Industry

Barriers	Productivity issues
Clients over use of lowest price tendering. **Lean not being a requirement on public contracts.** **Lean not being a requirement on private contracts.**	Unrealistically low tenders being submitted by Contractors at tender stage.
Poor design making efficient delivery difficult.	Poor design leading to excessive variations.

Table 2 indicates that there may be issues with the procurement mechanisms being employed by the ICI. It would appear that there is an over reliance on lowest price tendering in the ICI. The result of these procurement mechanisms seems to have created an aggressive market where contractors are being awarded contracts at unrealistically low prices which is apparently having a negative effect on budgets and programmes. Table 2 further suggests that the most economically advantageous tender format (De Giacomo *et al.*, 2019) may not be getting utilised as a vehicle to incorporate lean into tenders. The fundamental principle of lean is to reduce waste and increase productivity & profitability. Incorporating lean into Irish tenders and the tender evaluation process would seem to be a prudent choice to encourage lean, increase productivity and create a shift away from the commercial focus currently being put on tenders. Table 2 also indicates that poor design appears to be a barrier to lean and may be a contributing factor to poor productivity within the ICI. As mentioned in the literature review, the flow of information is critical for projects to succeed. The apparent prevalence of poor design in the ICI contradicts the principles of lean and will continue to hamper its progress if not addressed.

An important finding from the literature review was the importance of a strong Construction Supply Chain and long-term working relationships between project stakeholders These strengths combined can contribute to the creation of an environment that allows lean to thrive. The quantitative findings from this research would suggest that there is generally a strong relationship between project stakeholders within the ICI. 51% (n = 67) of survey respondents are maintaining long term relationships with suppliers and Sub Contractors. These findings should be viewed as positive and need to be harnessed, they may help to form a foundation for the ICI to build on and shift towards lean. An additional positive finding from the quantitative research suggests that 70.2% (n = 92) of participants believes collaboration could be further improved upon with stronger adaptation of lean methodologies.

Relationship findings from the qualitative research findings indicate lean has helped Company X break down siloes, improved knowledge sharing and collaboration. This was further complimented by other qualitative findings which indicated lean has positively influenced decision making in Company X. The need for an element of autonomy emerged in the literature review and this is a characteristic that is aligned with the values of lean that promotes continuous improvement. Autonomy was also discussed with Company X and it was felt that an element of employee autonomy was important. The above data is valuable information that the ICI can use to build on the earlier mentioned positives and transition towards lean.

A significant theme that bled through in the literature review is the benefits on offer when implementing BIM and lean concurrently in construction projects and the positive influence that the digitalisation of processes and procedures can have. Interviewees from Company X had not heard of BIM as their core discipline of business is not construction. When asked if they felt Company X had fully benefitted from the digitalisation of processes and procedures responses were quite mixed. Some strong points were made that evidenced digitalisation within Company X, however it was also evident that improvement can be made. This finding correlated with the findings in the quantitative research where 48.1% (n = 63) of survey participants felt they were not maximising the benefits on offer to them through the digitalisation of processes and procedures. Furthermore, findings in this area demonstrated that only 37.4% (n = 49) of survey participants use BIM. These findings suggest that the digitalisation of processes and procedures is a challenging undertaking for more disciplines than construction, however it also suggests that the ICI is implementing BIM on quite a small scale.

Further findings from Company X indicated that interviewees felt lean helped them to complete projects quicker and more cost efficiently, that lean is not restricted to the repetitive environment of a production line which was substantiated by confirmation that lean was successfully being applied throughout many areas of their business.

5. Conclusion

5.1 Limitations of the Research

Several limitations became apparent to the Author throughout this research process such as:

- Limited Irish Literature - Secondary data specific to LC in the ICI was limited. This created an unanticipated gap in the literature which steered the Author to rely quite heavily on LC literature produced outside of Ireland.
- Survey responses – The target audience for the collection of Primary data was created based on a balanced volume of professionals from three categories being contractors, designers and public body

representatives. The number of responses received were not equally balanced between the three categories and contractors were responsible for the majority of responses. A more balanced response rate between the categories would have provided a more accurate representation of the ICI. Additionally, the population sample was skewed towards professionals based in the Leinster area so therefore the findings are somewhat limited to the opinion of Leinster based professionals.

- Semi Structured Interviews – Three strong candidates were interviewed as part of the Qualitative research. Had more candidates been available for interview this may have provided additional information to complement and thicken the valuable data extracted from Company X.

5.2 Further Research

This study has presented multiple opportunities for further research that could provide the ICI with additional knowledge and data to further assist it in becoming a more productive industry such as:

- Poor design – Design issues within the ICI has been suggested in this study as a contributing factor that is hampering productivity levels within the ICI. It is also suggested that poor design is making the implementation of LC difficult. A study to investigate how the ICI can improve in this area could be a worthy area of research.
- Traditional project management techniques – This study identified conflicting opinions regarding the combination of traditional project management techniques with LC. A thorough study to determine how or if these methods should be combined is worth considering.
- Procurement – This study suggests that lowest price tendering is having a negative effect on productivity levels within the ICI and the implementation of LC. Further study in this area could be a valuable exercise that may confirm or refute this indication.
- Digitalisation – This study suggests that it is not only the ICI that is struggling to master the digitalisation of processes and procedures. Further study should be considered in this area to try and establish what the existing barriers are and how they can be overcome.
- BIM and lean – This study suggests that BIM and lean complement each other when implemented concurrently. If the ICI can successfully incorporate LC more heavily into its regime, it could be very valuable in the future to carry out a study to identify a strategy that could assist the ICI in successfully marrying these mechanisms.

6. Conclusion

The findings from this study suggest that the ICI is fragmented and operating in a wasteful and unproductive manner. Stakeholders within the ICI are aware of this deficiency and are also aware that improvement is needed. LC is proposed in this study as a remedy that can contribute to the ICI transitioning from its current state towards a lean and productive state. This study has demonstrated that lean can produce impressive results when implemented and this has been historically proven in the manufacturing industry and more recently in the construction industry. The myth that lean cannot be implemented outside of a repetitive environment is a weak argument and one that must be extinguished.

However, in order for this transition to be possible the ICI must be willing to embrace change and adopt a new way of thinking. The ICI should consider accepting the recommendations proposed in this research and previous publications and become educated on the principles and merits of lean. A lack of education is suggested as being the biggest barrier to LC in the ICI, but many others exist. Leadership, experience and a hunger for cultural change are required to promote an initiative to combat the lack of education barrier, however these qualities will also be crucial in overcoming the other barriers outlined in this study.

6.1 Recommendations

Subsequent to the analysis of the findings in this research the Author recommends the following:

In the interest of creating a more productive industry, all stakeholders involved in the ICI must come together to formulate a mechanism or campaign that will promote and educate the ICI on the principles and merits of LC. LCI currently provides white, yellow and green belt lean training (*Books - LCi Lean Construction Ireland*, 2023) and Atlantic Technological University currently offer a free lean six sigma white belt course (*Free Online Courses - Atlantic Technological University Sligo*, 2023). Such resources are very valuable to the ICI and should

be harnessed to help break down the lack of education barrier that exists. Financial support may be required from government to assist such a campaign but support of this kind must be viewed as an investment that will be reimbursed to the state over time. Successful roll out of such a campaign will also play its role in protecting public funds that are invested in public capital projects and promote value for money within the ICI.

As lean is a proven mechanism for increasing productivity and reducing waste in the construction industry and other industries the government should consider investigating ways to incentivise its use. This should be done in conjunction with the incentivisation of BIM, modern methods of construction and digitalisation in general.

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Non Academic Papers

"How to … Lessons Learned - a Space Sector Study of Best Practice"

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Abstract: The European Space Agency is a learning organisation committed to gathering experience from its projects and activities as they progress. In setting out its internal processes and means for Lessons Learned in 2017, the Agency took reference of previous best practice of lessons learned available at that time, both from within and outside of the space sector. Now some 6 years later, the Agency is seeking to both continue to learn from others, particularly those in the space sector, and to provide its experience and expertise gained in this area to others in the space domain. The collection of experience and hence lessons include gathering experiences from other organisation through lessons learned, the exchange of experience between the Agency and other organisations and the collaboration and exchange of state-of-the-art approaches to lessons learned means and process. This is needed as the full adoption to experience sharing and learning is not simply a process change (the way we do things – climate), but also one of culture (our belief set, reinforcing why we do things). In this it is recognised that "the hard stuff is easy, and the soft stuff is hard" – meaning that building tools and documenting the process is the easy part, getting the adoption and use, and the belief that it is beneficial is the harder part. Indeed, investment in tools is generally short term, but the investment in people to create a shift in organisational culture takes much more time. This paper will take a fresh and broad look at lessons learned in the space sector, identify best practices, by gathering data from around a dozen significant space players: space agencies, major space industry and new space entities. It will then present the findings and propose the next steps, both for the European Space Agency, but also for others in the space sector to consider applying within their own organisations.

Keywords: Space sector, Lessons learned, Best practice, Culture, and Climate change

1. Introduction

The European Space Agency is a learning organisation* committed to gathering experience from its projects and activities. In setting out its internal processes and means for Lessons Learned in 2017, the Agency took reference of established lessons learned best practice available at that time, both from within and outside of the space sector.

> *Learning Organisation: An organization that emphasises learning that expands the skills of its employees to achieve the development of new organisational capabilities in response to evolving stakeholder needs and market-place demands (ESA 2022).*

Now some 6 years later, the Agency is seeking to both continue to learn from others, particularly those in the space sector, and to provide its experience and expertise gained in this area to others in the space domain. The collection of experience and hence lessons include gathering experiences from other organisation through lessons learned, the exchange of experience between the Agency and other organisations in line with Agenda 2025 (ESA 2021) and the collaboration and exchange of state-of-the-art approaches to lessons learned means and process.

Lessons learned (LL) at ESA provides for the capture and exchange of experience from the projects and activities of the Agency, established at the corporate level through the creation of a dedicated framework (policy and process documentation), dedicated capture means and a central web-based tool. The lesson learned capability has become the "way of working" for the Agency with Directorates (of which there are 11 in the Agency) either moving to or assuring process and content compatibility with corporate process. The prime focus on achieving systematic learning outcome, is achieved through learning actions set to update or create generic or corporate processes, products, or training. In turn this has assured the lessons learned process has achieved learning at the point of use, and minimised the learning only being retained within the (now) established Lessons Learned portal.

Whilst what the Agency has established works well at ESA and continues to gather an increased level of support and participation, it cannot be assumed that this approach would work for other Agencies, or for Industry working together with the Agency, or performing the same tasks. In wanting to better understand what is considered best practice, or for those who have no experience in lessons learned, then what are the learning needs of these organisations, ESA has conducted a survey of Space Agencies and Industry. This paper reports on the outcomes of this survey, to establish what is regarded as lessons learned best practice and assess whether the Agency is best placed to share its methods and means with these organisations.

2. Research Design

The research design took the form of a survey (i.e., questionnaire) for the data gathering, sent to 2 main target groups, space industry and space agencies. As the European Space Agency, the questionnaire was focussed on industry from ESA member states countries, both the Lead Space Integrators (LSIs - large space industrial organisations, typically European multinationals), and also medium and small-sized enterprises (known a "MidCaps" and "SME's"). As ESA has established connections with industry over the past 50 years, it was possible to use an existing network including more than 800 LSI's, MidCaps and SME's. For the Agencies, a survey was sent to each ESA member states with an established space agency (which amounted to 6 member states). The survey was modified slightly between the two types of groups (agency and industry), however on ly to the degree that the question remained relevant to that organisation, whereas the responses remained mostly the same. In this way both approaches were designed and intended to provide data to allow for cross comparison between the two target groups, to highlight similarities and differences in best practice.

Questionnaire design

The survey was designed with specific intent and covered the following data gathering need; for each of these an insight into the selection and purpose of each question topic is provided (and this relates to both Industry and Space Agency. The length of the questionnaire was limited by completion time, and this was limited to and tested to being approximately 15 minutes.

- Do you consider your organisation as a learning organisation?
    - It was important to have a comparable indicator of the perception of the individual of their organisations approach to learning from experience. Whilst this question is subjective, it is important to establish your culture and climate regarding learning – which is the fundamental basis of lessons learned. The open questions allow you to provide us some insight in to the way you think and act in your organisation in the area of learning, and provides us your unique perspective of how you view and implement this.
- Please indicate the level of priority, difficulty and benefit for the following aspects (people, process, technology and organisation) for successful Lessons Learned in an organisation
    - When implementing change in an organisation, "best practice" states that you should consider the aspects of "people, process and technology". These are needed to assure the desired change (in the case of lessons learned an improved learning from experience) is embedded in the everyday work of an organisation. In understanding the industry perspective, on the importance of these issue and the challenges and benefits associated with them, the Agency can then focus its efforts on what is perceived as important by industry. In addition, it has been proposed that the organisation itself also directly impacts successful change implementation, and hence this is also included over and above the three establish criteria from change management theory.
- Please indicate the level of importance of the pre-requisites for establishing Lessons Learned in your organisation
    - When establishing a change within an organisation, it is important to consider what needs to already be in place in order to promote the adoption of the change applied. Results of a previous ESA research activity (Herd 2022) as given in Figure1, determined a number of key prerequisites that were needed when implementing lessons learned at the Agency as a vehicle for change in learning from experience. Recognising that industry and the Agency are somewhat different in structure and business goals, it was important to test the Agency's best practice against the perceptions of industry to establish any similarities or differences in these 6 key areas.
    - *Identify key stakeholders*
    - *Communication means*
    - *Training means*
    - *Process for publishing documents*
    - *Technology / Infrastructure (IT and Tools)*
    - *Predefined terminology*

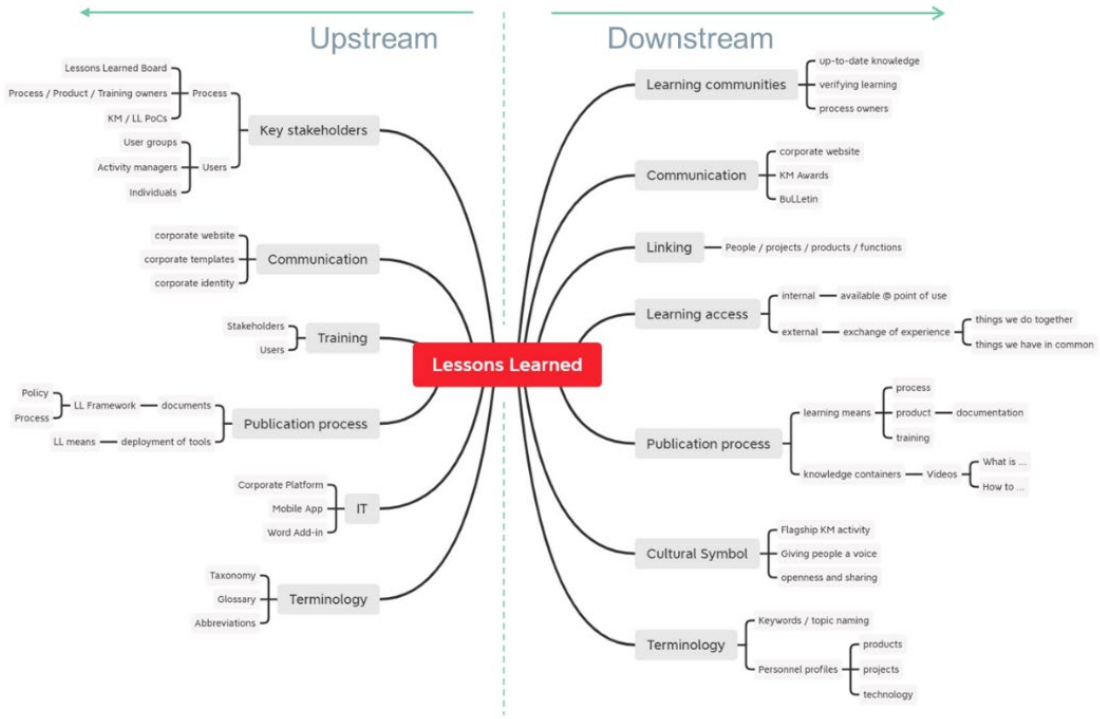


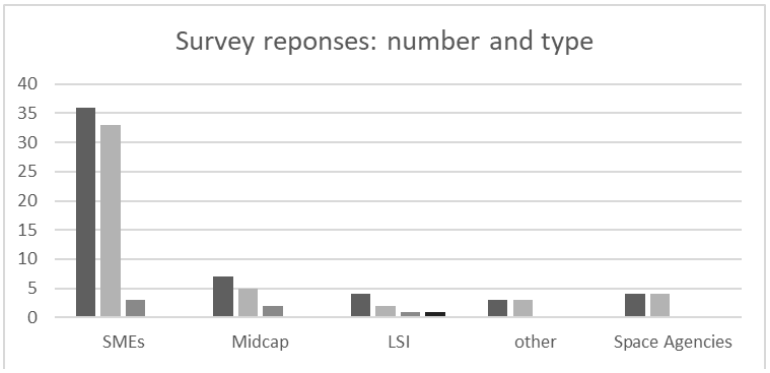
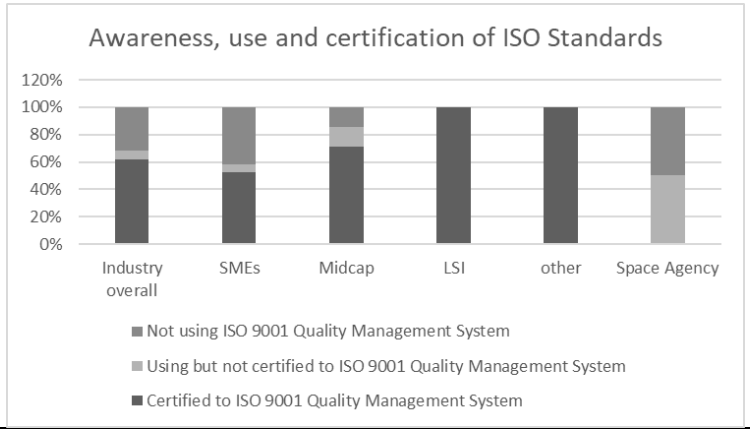
Figure 1: Upstream and Downstream Considerations for Establishing Lessons Learned Process (Herd 2022)

- Please indicate the level of benefits to be gained in establishing (or in running) Lessons Learned in your organisation
    - Also from the Agency research (Herd 2022), as given in Figure 1, we looked at the benefits realised and needed to check these 7 categories of potential benefit against industry experience or expectation of learning from experience.
    - Establishing communities of practice
    - Communication of learning and benefits
    - Creating a learning dialogue and exchange of experience
    - Creating greater access to learning
    - Capturing new processes and learning means
    - Creating cultural change / symbol of learning
    - Improved terminology
- Please indicate your organisation's level of interest in topics where capturing experience could provide learning
    - When examining the ESA lessons learned database, we find there are 6 main areas of learning. Whilst the Agency's lessons learned is relatively new, in that it has been actively as a corporate activity for the last 6 years, these 6 themes are repeated and reinforced with each capture event, and therefore are identified by the Agency as being our main areas of learning.
        - Management
        - Engineering
        - Quality
        - Launch / Operations
        - Procurement
        - Information Technology / Human Resources / Communication
- What other areas of learning are important to your organisation
    - To support industry best in learning from experience the Agency is seeking to better understand where industry needs are (for each of these areas) and also to allow for other areas of learning to be identified of which the Agency was not aware.
- Please state your agreement that Lessons Learned provides discussion a) topics b) content, c) justification and d) taking action

  - At ESA we have evidence of lessons supporting and creating communication between experts, by providing topics and content of that interaction and exchange of knowledge. It is seen that lessons are the sole reason for the dialogue to be set-up and engaged in, and in addition has provided the justification for taking action to create the identified learning needed to address the lesson (i.e., assuring the repetition of a positive experience or the prevention of a negative one).
- How far do you agree that Lessons Learned can be applied to capture experience and learning from the following: project, activity, function, technology, product.
  - Lessons learned can be applied to many areas within an organisation, and at ESA it is primarily apply it to major space development projects. However, it has also been applied to activities, functions, technologies and also products to gather experience and determine the most beneficial learning needed (for the processes, the documentation recording those processes and the training for needed skills). This question then allows the feedback from industry of what topics are thought to be most suitable for lessons learned.
- ESA is considering whether to develop a Lessons Learned tool for use outside of the Agency; would your company be interested to use this tool and what would you use it for?
  - The Agency is committed to make a difference by supporting industry directly through the capture and exchange of experience. By requesting feedback on industry interest in a direct intervention (the provision of a on-line tool to support lessons learned) ESA then be more effective in supporting industry in this area.
- What would be the main reason(s) for using Lessons Learned in your organisation: improvement in business, product, quality (product), quality (process), lower costs.
  - Understanding the reasons for industry to engage in lessons learned, and the areas in which industry believes it can improve also provide the Agency with both the mandate and direction in which this support can be directed. This question can also highlight the expected benefits to gained both by the Agency and industry alike when exchanging experience.

3. Results

Table 1: Characteristics of Responding Organisations

Your type of company / organisation and has your company / organisation ever worked on an ESA project as a prime or subcontractor?	
Has your organisation implemented ISO 9001 Quality Management System?	

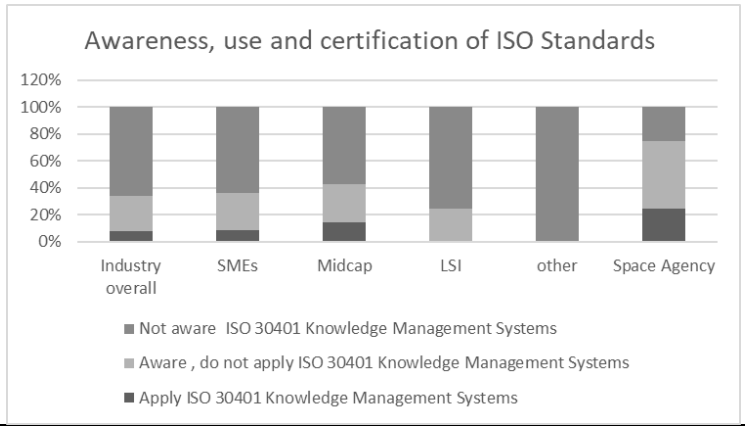
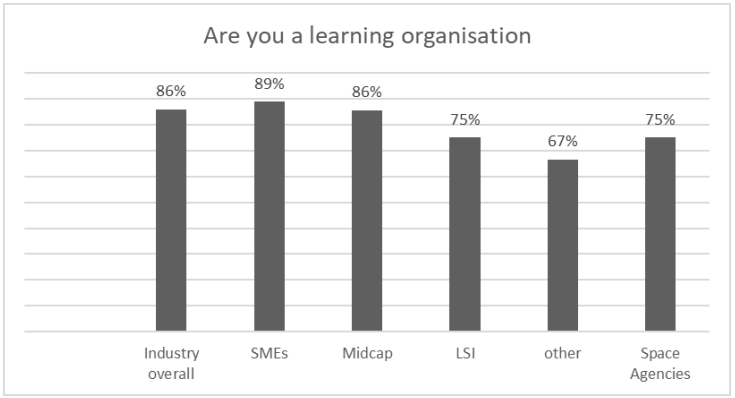
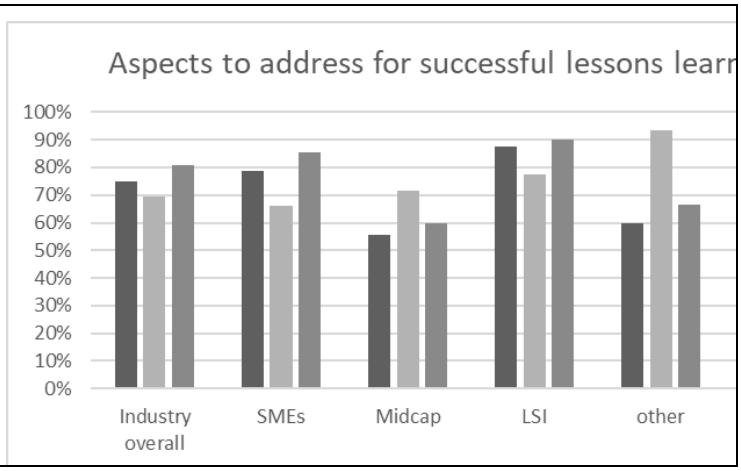
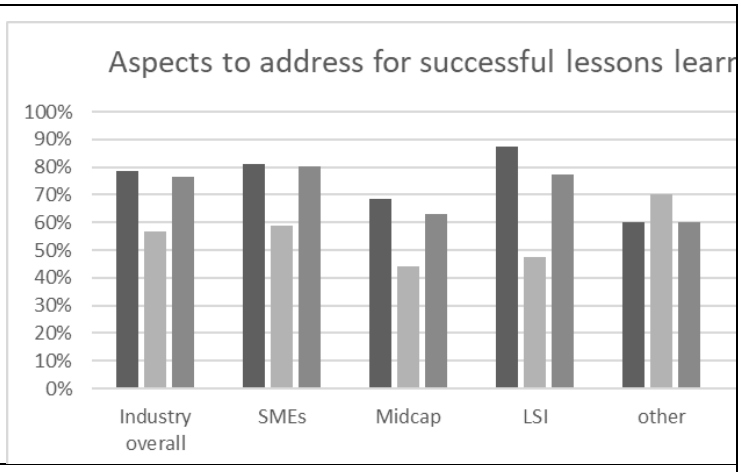
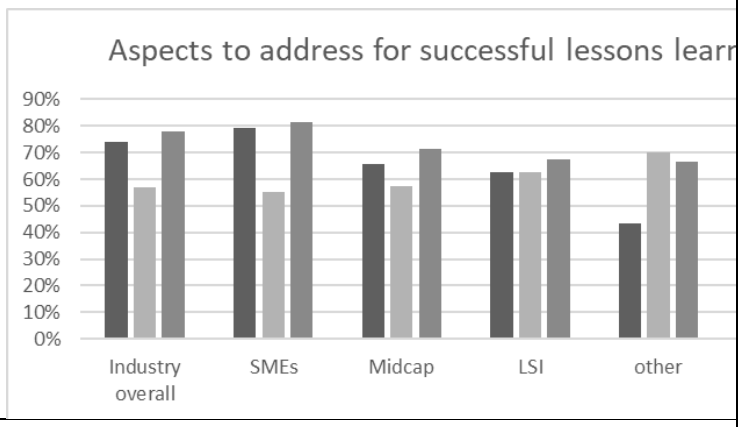
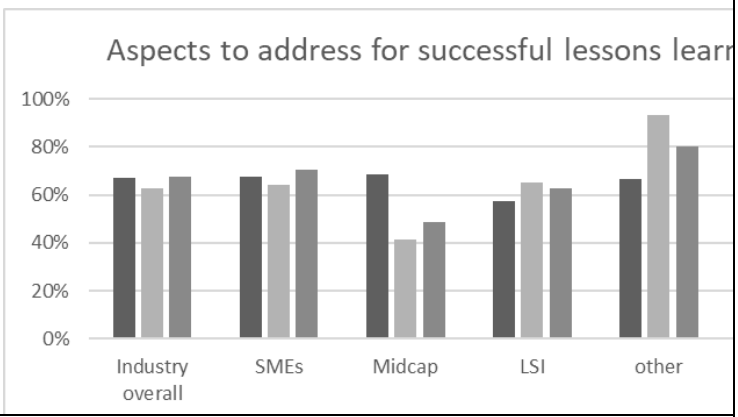
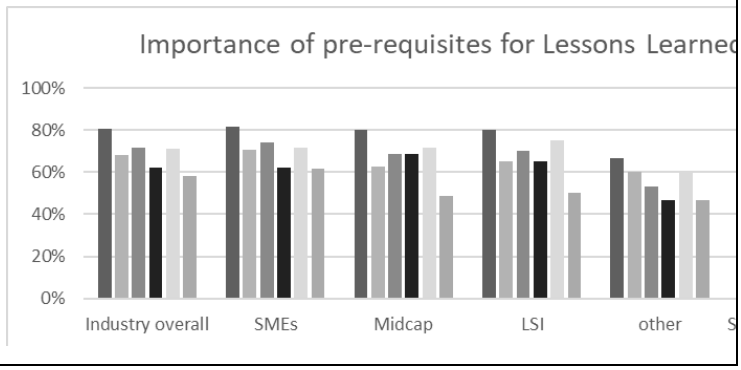
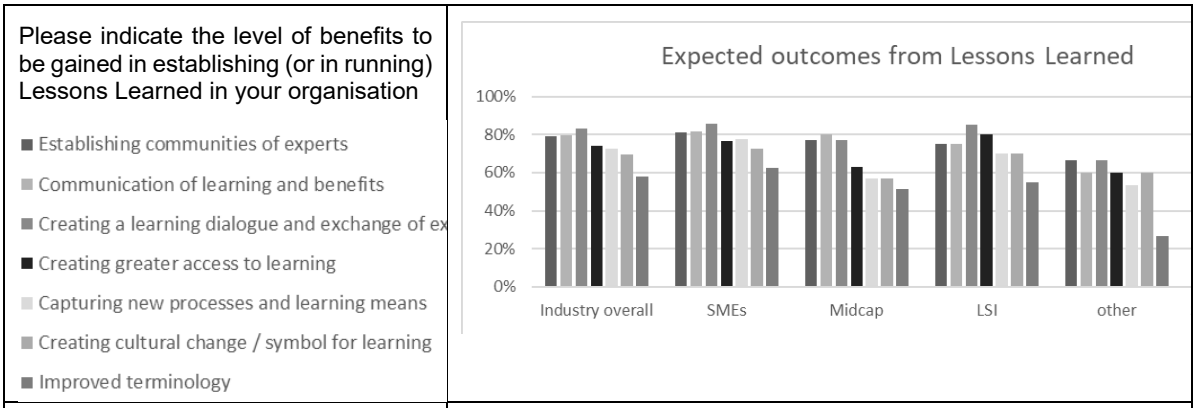
Are you aware of the ISO 30401 Knowledge Management Systems standard and do you apply or take reference from it?	
Do you consider your organisation as a learning organisation?	

Table 2: Responding Organisations on "Best Practice" in Lessons Learned

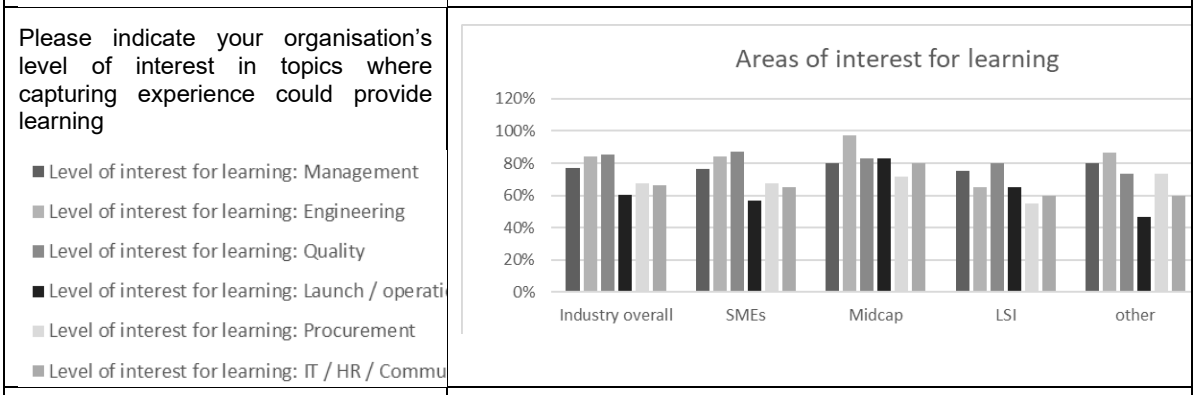
Please indicate the level of priority, difficulty and benefit for people related aspects for successful Lessons Learned in an organisation People related - Priority People related - Difficulty People related - Benefit	

Please indicate the level of priority, difficulty and benefit for process related aspects for successful Lessons Learned in an organisation Process related - Priority Process related - Difficulty Process related - Benefit	
Please indicate the level of priority, difficulty and benefit for technology related aspects for successful Lessons Learned in an organisation. Technology related - Priority Technology related - Difficulty Technology related - Benefit	
Please indicate the level of priority, difficulty and benefit for organisation related aspects for successful Lessons Learned in an organisation. Organisation related - Priority Organisation related - Difficulty Organisation related - Benefit	
Please indicate the level of importance of the pre-requisites for establishing Lessons Learned in your organisation Identify key stakeholders Communication means for new initiative Training means available Process for publishing documents Technology / infrastructure (IT and tools Pre-defined terminology	

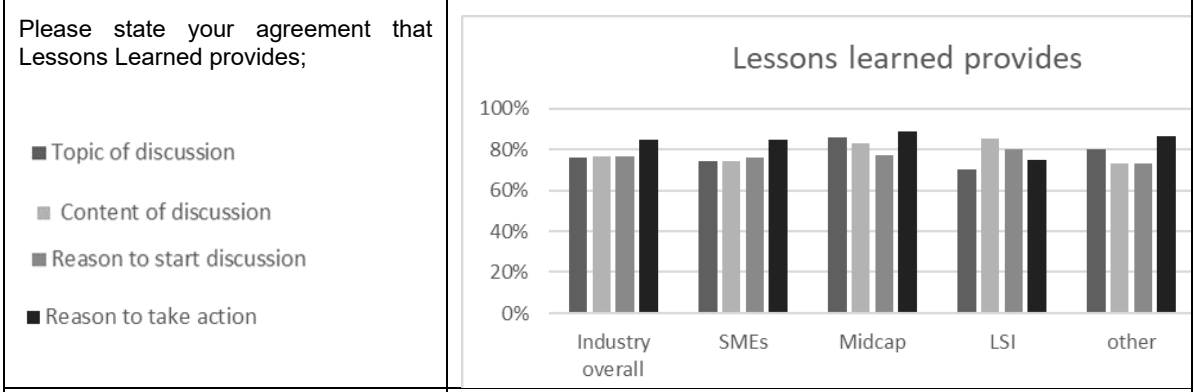
Please indicate the level of benefits to be gained in establishing (or in running) Lessons Learned in your organisation



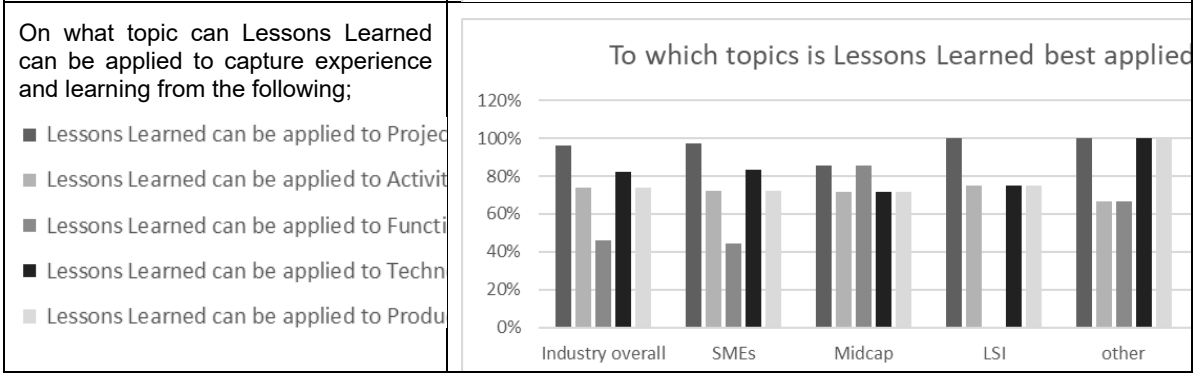
Please indicate your organisation's level of interest in topics where capturing experience could provide learning



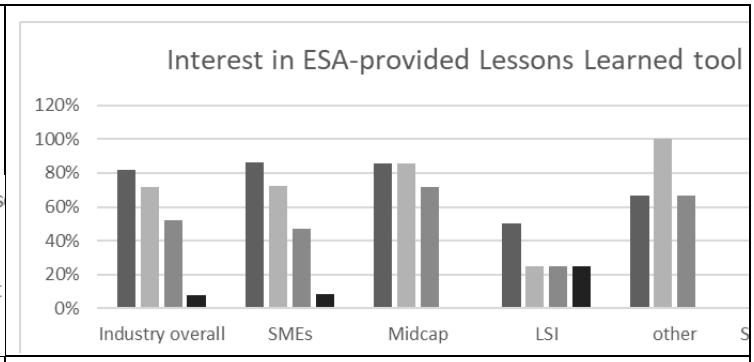
Please state your agreement that Lessons Learned provides;



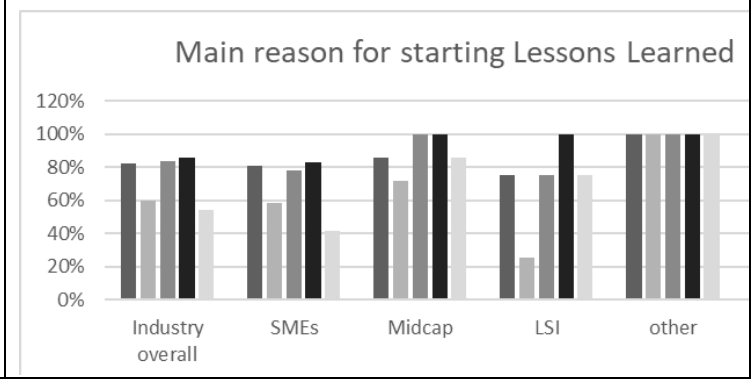
On what topic can Lessons Learned can be applied to capture experience and learning from the following;



ESA is considering whether to develop a Lessons Learned tool for use outside of the Agency; would your company be interested to use this tool and what would you use it for?



What would be the main reason(s) for using Lessons Learned in your organisation:



4. Discussion

The survey was sent out to around 800 small and mediums-sized (space-related) enterprises that were registered as part of the space industry with the European Space Agency. This community was informed of the launch and asked to respond to the survey through ESA Learning Hub (ESA 2023) – the ESA SME web platform and e-newsletter used for holding and promoting information and training of benefit to space industry, and ESA Star (ESA 2023) the Agency's procurement webpage and newsletter, in addition to highlighting the survey's release via ESA Twitter feed (ESA 2023) and ESA LinkedIn (ESA 2023). These channels provided a survey response rate of around 7% (taking a target audience of 800) - which is low but within an acceptable range for questionnaire responses (typically push surveys having a response rate of around the 11%, with a range of between 6% and 16%).

In order to have a comparative set of data, other sizes of space industry were included, MIDCAPS and Lead System Integrators (LSIs), with the size / type of organisation being self-declared. As a comparator to space industry, the survey was also sent out in parallel to 8 national space agencies with 4 responses being received.

Of the responses from industry, around 70% came from the SME population and 14% from MIDCAPS, with 2% from Lead System Integrators (LSI).

The statistics taken from ISO 2021 Survey results (ISO 2022) of certification of ISO 9001 (ISO 2015) gives the number of certified businesses in the ESA member state countries as being 280,000 business against a total number of businesses of 26.3 million overall. This then gives an approximate level of 1% of all registered industry as certified, whilst the survey indicated that 60% of respondents were ISO 9001 certified. Whilst the standard ISO 9001 does contain a sub-section relevant to knowledge management (i.e., clause 7.1.6), seeking for organisations to "*determine, maintain and make available knowledge necessary for the operations of process and achieving conformity of products and services*", the standard is used as an overall indicator for the process-based nature of an organisation. and specifically consider this relevant for lessons learned, which is highly process based. Around a third of the respondents were using or aware of the ISO 30401 Knowledge Management Systems (ISO 2018), however ISO does not publish certification numbers for this standard in order to make an industry comparison to the survey sample.

SME's were the group to report themselves highest as being learning organisations and in the open responses as to why this was so, the justification for the response highlighted the following aspects;

- Learning by doing (21 instances)
- Learning through training (15 instances)

- Learning through processes (15 instances)
- Learning through technology (4 instances)
- Learning through recruitment (1 instances)

With regard to the industry indication of the priority, difficulty and benefit associated with people, process, technology for successful lesson learned in an organisation, an interesting result is obtained by using the following equation giving an outcome plotted below, and indicating that the survey response indicate that when assessing the motivators and barriers to adoption, they would equally address process and technology, less likely to address people related aspects, and unlikely to address organisational aspects.

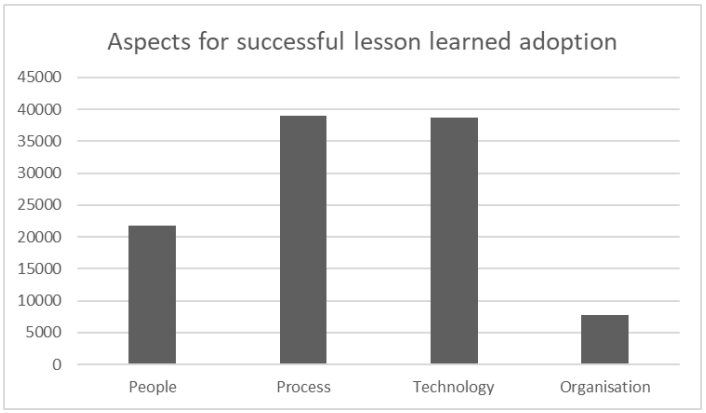


Figure 2: Plot of "Overall Likelihood of Successful Lesson Learned = Priority (Benefit -Difficulty)"

For pre-requisites needed to establish lessons learned in an organisation, identified as upstream considerations in Figure 1, across the range of survey responses the highest was "*identifying key stakeholders*", and the least having a "*pre-defined set of terminology*". For the outcomes, identified as downstream outcomes in Figure 1, the highest overall was "*creating a learning dialogue and exchange of experience",* whilst the lowest was "*improved terminology*".

For an organisation's interest in specific topic to which lessons learned could be applied to create learning, the top (equal) were "*engineering*" and "*quality*", with the lowest being "*launch / operations*".

For what lessons learned provides in terms of learning, the overall highest aspect was that of giving a "*reason to take action*" with an overall equal score for "*topic of discussion*", "*reason to start a discussion*" and "*content of discussion*".

For the selection of best topics to apply to lessons learned, the highest was "*projects*" and the lowest being "*functions*".

As to the interest of the respondents to use a lessons learned tool, there was an overall majority of interest to use a tool "*for use in ESA projects to share lessons with ESA*", and also "*for internal use*" (within the responding organisation). There was a lower, but still overall positive response for sharing experience to the "*space community at large*".

The main reasons for using a lessons learned process in an organisation was given as equally, "*business*" and "*quality (product and process)*" improvement, whilst "*lower costs*" was least likely to be a reason for use of lesson learned.

5. Conclusion

In order to identify what was considered by the European space industry was best practice the Agency undertook this survey of European space-related industry, using the network of connections within an active community. The response rate gives some credibility to the survey responses as far as being representative of the likely overall opinion of SME's of what is lessons learned best practice. However, for MIDCAPS, LSI's (of which there are 3 organisations that the European Space Agency engages as Lead System Integrators) and Space Agencies, a more direct data gathering approach is recommended to complement better the insights to compare to those provided by the SME community (whilst the data obtained from these smaller groups does provide some interesting comparison, this is by no means significant). In this ESA is already working with some Agencies to establish a protocol for experience exchange and that this has already been put into action between the

respective Space Agencies, and we will continue to apply this approach to other space organisations supporting tis individual organisation-to-organisation exchange. The established of a tool for lessons learned may well better support this exchange to be more common practice and "every day".

The further exploration of the differences between the SME response and the ESA proposed benchmark of best practice in terms of needed pre-requisites and also the outcomes deemed as most important will help the Agency respond in a more relevant manner when creating the dialogue with SMEs on how to realise the needed exchange of experience and to assure the identified learning.

It is recognised that in the analysis of which aspects need addressing (people, process, technology and organisation) and the benefits and barriers to doing this, that the results of the survey support the principle of "*the hard stuff being easy and the soft stuff being hard*" – however this does not negate the fact that the soft stuff identifying key stakeholders for example, is still rated as the highest key aspects for the pre-requisites of establishing lessons learned in an organisation.

For the definition of a learning organisation as proposed by ESA, in the comparison of what industry perceives, it is considered that there are no non-linearities between the two. However, SME's seem to be even more focussed on an ability to change through learning ("*learning by doing*"), which could be as an influence of their market place demands and funding dynamics, and the size of the organisation (with their size being an enabler for change, and people as opposed to process being major influences in the climate and culture dynamic of an organisation).

Contrary to the SME consideration for importance of terminology, at ESA we have found that having a common agreed set of terminology (reported by SMEs as lowest needed pre-requisite, and lowest outcome) is essential in order to capture and communicate the learning effectively. Indeed, even the basic enabler for the initial retrieval of knowledge based on a user need for learning, which hinges only on the keywords used by that individual when performing a search of the lessons learned database. In this regard ESA will look at the application of knowledge graphs, natural language processing and understanding (NLP and NLU) (Mihaylov 2022) in order to make the proposed lessons learned capability offered to industry more flexible (for the user) but still more robust (for the data processing) – by helping the user to identify (common and agreed) keywords when initially capturing a lesson. This technology is in the early stages of being rolled out at ESA and the Agency will share its learning on this as it is further used and improved to meet user needs (mostly ease of data entry, and, ease of data retrieval).

The European Space Agency will now further engage and explore how to address the identified need for SME's to have access to a lesson learned capability (i.e., tool) for use both within projects undertaken with the Agency but also for an SME's internal use. For now, though, the Agency is happy to share its learning on this latest step forward in understanding best practice and through this better enabling the sharing of experience and knowledge through lessons learned, for both the space community and other communities that could benefit from this work.

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Knowledge Management in Public Transport: A Portuguese Empirical Study

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Abstract: This paper aims to investigate knowledge management processes in a metro company. We focused on core knowledge and its impact on the overall performance of a public transport operator. It presents a case study from the Lisbon-based public transport operator Metropolitano de Lisboa, E.P.E. The challenges of knowledge management in a metro company, such as time savings and efficiency, can be mitigated by the creation of a structured and target-oriented knowledge framework and information architecture that enables knowledge reuse throughout KM aims the company or/and in specific communities of practices. The current study seeks to investigate the role of signalling experts in knowledge management in a metro company through the use of a case study based on accessing the documentation required to deliver their technical outputs. Qualitative methods were used to conceive, design, and implement the specific experience under analysis. The approach involved semi-structured interviews with a sample of five core operational managers and an online questionnaire directed at the study's core knowledge actors (90 experts) and a Delphi Study applied to the five signalling experts. The results showed that optimizing knowledge management leads to increased operator efficiency and decision-making. The findings of the empirical case analysis combined with the literature review provide useful insights to construct a target-oriented knowledge management methodology in a metro company. One of the study's key findings is the relationship between decision-making and knowledge management tools. The findings of the empirical case analysis, combined with the literature review, provide useful insights into the awareness of an urgent target-oriented knowledge management framework in a metro company. This study was built on the available data from Railway signalling metro experts, which may be perceived as limited in the overall context. We consider that there is no special bias associated with this area of expertise and that the overall approach could be adopted and further tested in any other metro company, regardless of size. This essay added novel information to the available body of knowledge by providing an in-depth analysis of a core discipline of metro mode by addressing the accessibility to information by Railway signalling professionals.

Keywords: Knowledge management, Case-based learning, Core knowledge, Organisational performance, Public transport operator

1. Introduction

There is worldwide consensus on unsustainable mobility patterns and the need for a standard shift towards smart, sustainable solutions that can anticipate current and future mobility challenges in cities (Collins and Chambers, 2005; Gerald et al., 2008; Stern, 2011).

Public transport aims to contribute to the quality of life in every city. Improving urban mobility requires strategies and proposals for intervention in management decisions and Knowledge Management (KM), both of which affect the overall performance of the public services provided.

There are four fundamental phases in KM life cycle: knowledge creation, storage, sharing, and application (Alavi and Leidner, 2001; Kayworth and Leidner, 2003; Zaim, 2006; Fong and Choi, 2009; Turner, Zimmerman and Allen, 2012).

KM aims to extract information from organisations to increase productivity, add value, competitiveness and knowledge exchange (Davies, 2000). Knowledge management has been accepted as a crucial strategic pillar for the success of a company (Gupta &McDaniel, 2002, Halawi et al., 2005).

The objectives of this empirical study are to identify key knowledge and evaluate the impact between accessing information and the decision-making process.

To the best of our knowledge, this is the first study to assess the impact of knowledge management in a metro company.

2. Literature Review

2.1 Knowledge Management

Several authors have shown the relevance of immaterial asset management as a factor in the competitiveness and sustainability of companies (Matos et al., 2019). Not applying intellectual capital management policies may jeopardise the future of old companies, especially when the retirement age for highly specialized managers in some core functions of the business becomes close.

On the other hand, knowledge must be retained within the companies (Edvinson, 1997). It is necessary to implement measures to prevent employees from leaving with core knowledge and without transferring their knowledge capital.

The value added to the company in the short term is no longer reflected in the medium term because the knowledge created is not retained, and there is no concern to transfer it to other company colleagues (Matos & Lopes, 2009).

There are four fundamental phases in the KM life cycle: knowledge creation, storage, sharing and application (Alavi and Leidner, 2001; Kayworth and Leidner, 2003; Zaim, 2006; Fong and Choi, 2009; Turner, Zimmerman and Allen, 2012).

2.2 Knowledge Management and Value Creation

The goal of Knowledge Management is to disseminate ideas, experience, and information; to ensure that these are accessible wherever and whenever you need so that you can take advantage and take documented decisions; improve efficiency by reducing the need to reuse knowledge.

The ISO management systems standard for knowledge management aim is to support organisations to develop a management system that effectively develops and enables value-creation through knowledge, as defined in the ISO Knowledge Management Systems framework (ISO, 2018).

Alternatively, knowledge must be intentionally created, consolidated, applied, and reused faster than the rate of change. Workforce friction and turnover in today's society have implications for knowledge management. Moreover, in many organisations, critical knowledge is often managed in silos and/or retained or even hidden by experts, at the risk of being lost when the organisation changes or these experts leave. Organisational factors affect knowledge retention (Lin, Chang and Tsai, 2016; Levallet and Chan, 2019; Azaki & Rivett, 2022).

Usually, the effects of particular decisions on the performance of a company are analysed, such as investment, operational decisions or the adoption of specific management practices. Wu and Chen (2006) demonstrated the benefits of IT and ICT investments, whereas Devaraj and Kohli (2003) discovered the effects of technology on organisational performance. In addition, some empirical studies proved the relationship between "Knowledge capital" and innovation and productivity (Czarnitzki, Kornelius, 2004, Co and Chew, 1997). Some studies relate Human Resources (HR) practices and organisational performance (Wright et. al.., 2005; Sels et. al., 2006). When referring to the concept of performance, we refer to how a company quantifies the efficiency and effectiveness with which it carries out its business activities, according to Dumay (2016).

2.3 Knowledge Management in Public Transport

The Research Report (TCRP, 2017) systematizes a framework for transit agencies to manage all stages of the Information Lifecycle Management (collection, retention, and transfer). A Transit agency is a public entity responsible for administering and managing transport services.

This report outlines the common functional domains that require KM: finance, human resources, vehicle maintenance, facilities maintenance, and operations service design. However, there is no focus on specific business knowledge, i.e. which areas are core and non-core.

Considering that the scope of this report is transit agencies, which include different types of transport (bus, trains, metros, Bus Rapid Transit, etc.), the core areas for each mode of transport would also differ according to each one.

Metro de Lisboa is a member of the International Benchmarking Group COMET[1] and the most recent study on the subject of Knowledge Management was conducted in 2001. The following benefits were identified:

- Better decisions-time-cost-accuracy.
- Increased profits and reduced costs.
- Reduce waste through unnecessary rework.
- Sharing lessons learned among members helped reduce costs.

[1] https://en.wikipedia.org/wiki/Community_of_Metros

One of the identified challenges was the difficulty to develop a business case in KM.

The mobility sector demonstrated how knowledge management (KM) influenced the decisions of the company and consequently its results (STCP, 2014). Management practices of any organisation have a vital impact on its global performance. As a result, it is of the highest importance to assess the magnitude of the management of knowledge transfer and decision-making. Despite the vast literature on Knowledge management, there are limited studies in the transport sector. Even though there are studies mainly focused on knowledge management's lifecycle (Raymundo et al, 2014; Radhika et al, 2016).

A new approach is required, which focuses on the individual and collaborative sharing and knowledge building (Becker, 2015). Given the growing importance of railway systems, with huge investments and technological progress, it is essential to have talents with the skills to operate and collaborate across a variety of functions. To overcome this challenge, it is necessary to improve recruiting efforts and retain the best talents at an international level (Amirault, 2015).

The review of the literature reveals a lack of use of knowledge management to leverage the performance of public transport companies. Based on the assessed literature, no evidence-based research has ever been conducted on the core knowledge of a metro company, and previous studies have only examined this phenomenon on a bus company to analyse political and/or management decisions, i.e. macro-level decisions.

3. Case Study: Metropolitano de Lisboa, EPE (ML)

The public transport case study presented here is about the company that operates the Lisbon metro system. This study explores the impact of knowledge management on network expansion investment decisions.

Metropolitano de Lisboa (ML) is the public metro operator in Lisbon, the capital of Portugal and the core city of Lisbon Metropolitan Area (LMA), which includes 18 municipalities with an overall area of 3.015 km^2 and almost 3 million inhabitants (IMob2017). The area of ML´s operations comprises of 3 municipalities with Lisbon being the central one. The company´s history dates to 1948, but the operation only started in 1959. Now, ML operates 4 metro lines comprising 56 stations and 44, 5 km of network and is currently expanding its network.

Considering the importance of knowledge to efficiency, productivity, and the subsequent impact on service quality, Knowledge management was selected as a critical goal to manage. We believe that employee knowledge influences a company's ability to remain competitive in the market and that KM contributes to companies' market positioning. Due to the company's current period of network expansion, the analysis of the subject of knowledge management and namely of core specialties is critical for sustainable public transport management.

4. Methodology

4.1 Data Collection and Analysis Methods

This work aims to assess how information availability affects the technical documentation that signalling experts have to deliver in their core discipline. The following five key research questions were derived from the objective:

- Does information access impact the time it takes to develop technical outputs?
- Does information access impact the quality of their technical outputs?
- Do the technical outputs impact the metro network expansion?
- How much time is necessary to access the required information to deliver their technical outputs?
- How long does it take to access information from other technical disciplines to generate technical outputs?

Both quantitative and qualitative methodologies have pros and cons (Saunders et al., 2007). The disadvantage of qualitative research is that it is based on case studies and is difficult to generalize to the entire population. On the other hand, when the data for the quantitative studies is collected in random samples, it can be extrapolated to the population. Nevertheless, qualitative research is also appropriate when we need to deepen a phenomenon or a problem in an organization, assessing specific relationships and concepts. This study was divided into three sections based on the qualitative technique. Firstly, in-depth semi-structured interviews were conducted to gain a better insight into the issues facing knowledge management. Secondly, an online survey was carried out in 2022. Of a total of 90 surveys, 42 valid surveys were obtained for this study, representing approximately 50% of the response rate.

In the third stage, a Delphi study was conducted with the signalling experts. Table 1 shows a summary of descriptive statistics for the sample of experts under study.

Table 1: Sociodemographic Characterization of the Respondents

Area of expertise	Number of experts	Gender (F)	Age (min-avg-max) Un: years	ML seniority (min-avg-max) Un: years	ML Business unit areas
Railways signalling	5	0	42-52-60	22-27-32	Maintenance, Civil works, Security&Safety
Energy distribution network	7	2	49-57-64	29-32-34	Maintenance, Civil works
Track	1	0	62	39	Maintenance
Electromechanical equipment	2	0	41-45-49	3-8-12	Maintenance, Civil works
Electronics	2	0	40-47-53	16-23-29	Maintenance
Telecommunications networks	5	1	45-50-55	17-28-32	Maintenance, Civil works, Security, Operations
Civil works	10	4	47-47-59	21-21-22	Civil works
Architecture	4	2	42-49-58	17-27-35	Heritage, Civil works, Maintenance
Rolling Stock	1	0	41	3	Maintenance
Total respondents (including all the expertise areas)	42	10	26-51-64	3-25-39	Maintenance, Civil works, Security, Operations, Clients, Security & Safety

This portrait of ML experts cannot be complete because we are only considering those who responded. However, regarding the knowledge areas that are the core business, they are much better represented than the others.

The managers responsible for core areas identified the technical experts with critical knowledge for the business and that work in their areas. In terms of Railway signaling experts, the selected sample represents the entire community of experts in this field in the Lisbon Metro.

Although the entire Knowledge Management framework that can be applied to any transportation company is presented in the report TCRP (2017), the core and non-core knowledge are not differentiated.

An ideal solution in a metro company is to tackle KM (core and non-core) as a whole. Implementing KM in a metro company may seem overwhelming or difficult. This difficulty triggered the present work in a core area of expertise by starting on core areas and then expanding to other core and non-core areas of expertise. On the other hand, the implementation methodology MASK (Method for Analysing and Structuring Knowledge) (Ermine, 2013), starts with the strategy and drills down to certain operational solutions in a cohesive alignment and can be adapted to a future KM framework. One of the four phases that realize the Knowledge Cycle for KM is the capitalization of the key Knowledge domains, which the present study deepens and broadens the body of knowledge in metro companies.

4.2 Interviews

The data was collected by interviewing five managers with extensive experience in the following areas of expertise: Maintenance, Operations, Civil Works & Expansion Projects, Customer Management, Safety and Security.

4.3 Survey

An online survey was carried out and the author distributed and delivered the survey by email and divided it into the following sections:

- Socio-demographic information

- Areas of expertise
- Professional Associations
- How to develop own knowledge
- How to set up and sustain a Knowledge Network
- How to transfer and manage knowledge
- Future challenges (short and medium-term)

4.4 Delphi Technique

Several research instruments could have been used such as focus groups and interviews but it was decided to analyse straightforward questions and answers by a more sophisticated technique. A Delphi Study to collect the necessary data and following some other studies that also used this methodology (Remenyi, 1996; Day and Bobeva, 2005; Guglyuvatyy and Stoianoff, 2015; Grime and Wright, 2016).

The Delphi technique is a group consensus process and a valuable tool in attempting to produce agreement in the opinions of a group of experts. It is designed to assist in the collection and analysis of expert opinion to obtain a deeper understanding of issues and/or trends. It is a reiterative process requiring a questionnaire to be completed several times, and the completion time should be quite short. This technique is triggered by the respondents seeing the average scores for each question in the previous round. The standard deviation may also be supplied. The number of rounds may vary but, in this case, and following the literature (Remenyi, 1996), we used 3 rounds of questions.

Using the first-round results, the administrator calculates the arithmetic means and the standard deviations for each question. The participants are offered the questionnaire again along with the result of these calculations.

The participants are expected to reconsider their opinions/scores in light of their reflection on the opinions of others expressed through the means and standard deviations supplied.

It is expected that the opinions of the participants will tend to move towards the mean and the standard deviation.

The participants are offered the questionnaire again (for the third time) together with the result of the calculation made by the administrator after the second round.

Structured questions were used with the specification of a number in a range between 1 and 5. The number of questions is carefully limited considering that it is aimed at experts and because of the time limit to complete the questionnaire. Each round needs to be completed relatively promptly – one to two weeks.

It is important that each proposition expressed is unambiguous. Another relevant aspect of the study is the selection of the experts' panel.

The following flowchart portrays the structure of the master plan for the Delphi study (Figure 1):

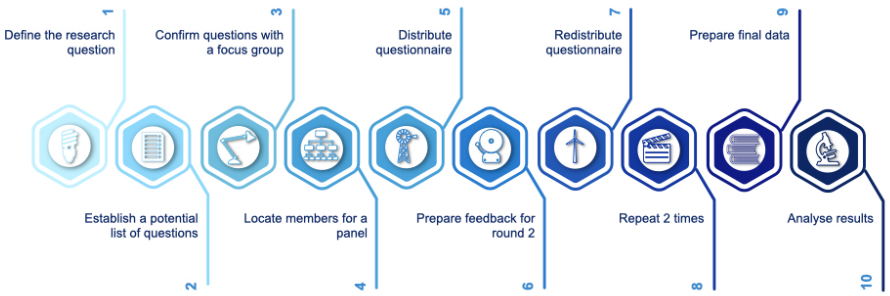


Figure 1: Methodological Delphi Technique

5. Analysis of Results

The modelling approach presented above aims to understand the impact of accessing information and the time necessary for decision-making. In establishing the Delphi Study, a list of understood aspects of signalling decision-making was developed and ended with six Questions and a open-ended question that would allow participants to make their comments. The five experts who participated in this study represent the whole community of Railway signaling experts in ML.

The participants were invited to complete the online questions and submitted their answers. The first three questions regarding the impact of non-accessibility of the information were calibrated on a 1 to 5 scale with 1 being Strongly Disagree and 5 being Strongly Agree. The other three questions measuring the time delay resulting from the lack of access to information, were calibrated on a 1 to 5 scale with 1 being 1 month; 2 being 2-3 months; 3 being 3-6 months; 4 being 1 year; 5 being 1-2 years.

A total of 5 responses were received for the First Round, 5 responses for the Second and 5 responses for the Third keeping the number of responses in the 3 rounds.

One of the interesting aspects of the Delphi process is that it combines quantitative and qualitative data. Although quantitative analysis employed relatively elementary techniques such as the calculation of means and standard deviations as well as ranking scores. Due to limited comments in the open-ended question, it was not possible to generate a topic model.

The scores for each of the items in the Delphi instrument have been monitored over the three rounds with Means and Standard Deviations calculated. This is shown in Table 2.

Table 2: Summary of the Scores from the 3-Round Delphi Study (General Analysis)

Questions	Mean Round 1	Standard Deviation	Mean Round 2	Standard Deviation	Mean Round 3	Standard Deviation
Information access impacts time to produce the technical output	4,8	0,45	4,8	0,45	4,8	0,45
Information access impacts the final quality of output	4,8	0,45	4,6	0,55	4,6	0,55
3.The technical output impacts ML's expansion	4,8	0,45	4,6	0,55	4,6	0,55
4.How long should it take to access information (based on past experience of 10 years)	1,4	0,55	1,4	0,55	1,4	0,55
5.How long it takes to access the necessary information (based on past experience of 10 years)	2,2	0,84	1,8	0,45	1,6	0,55
6.How long it takes to access other technical information areas (based on past experience of 10 years)	3,2	1,10	3,2	1,10	3,2	1,10

As the sample is composed totally of males (as we can confirm in Table 1) it was not possible to assess differences based on gender.

To establish if there is a consensus over the three rounds of the Delphi Study, the Mean scores at the end of each round were examined and a line graph of the Mean scores for each round was plotted in Figure 2.

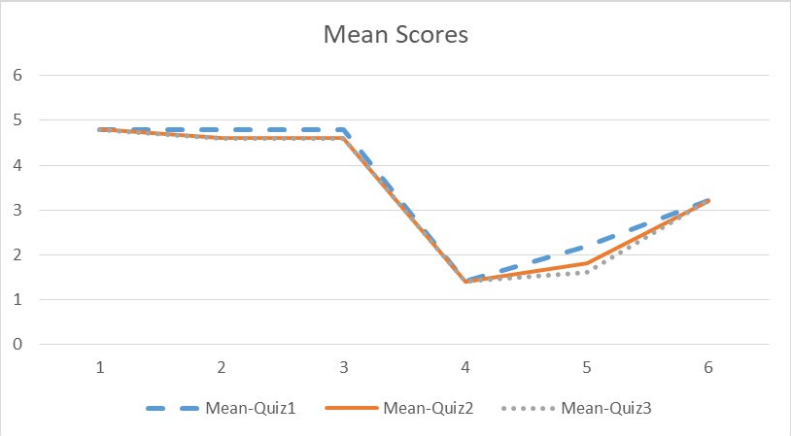


Figure 2: Mean Scores for all Questions of the 3 Rounds

In Figure 2 we can verify that there are small changes in the scores assigned from one round to the next one.

On the face of this information, it appears that respondents did not change their scores from round to round. To confirm this, it was necessary to examine the Standard Deviations. These statistics are shown in Figure 3.

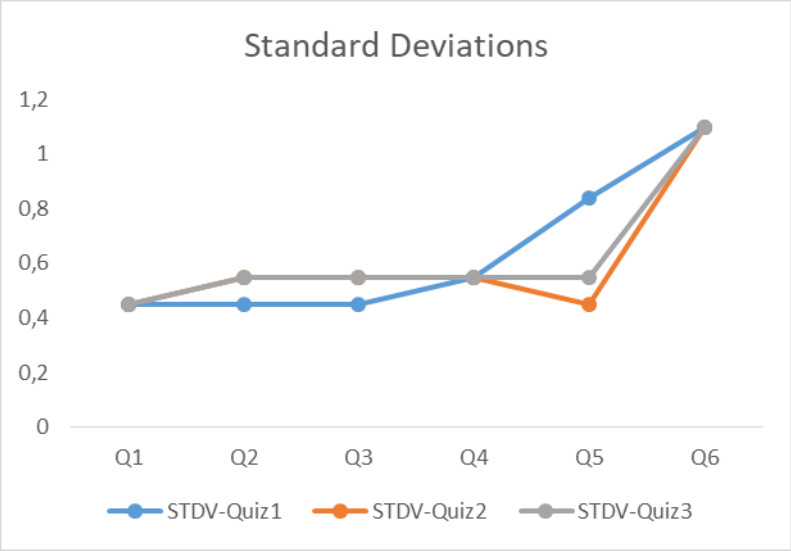


Figure 3: Standard Deviations Scores of all Questions in Each of the 3 Rounds

Considering the low degree of variation in the scores and how the Standard Deviations hardly varied, a

one-round study would have produced a similar result as far as the scores are concerned.

Questions 1, 2, 4 and 6 were always stable during the 3 rounds. Question 3 changed in the 2nd round and then remained stable. Question 5 was the most unstable question during the 3 rounds, suggesting uncertainty in the timeline necessary to respond to the signalling specifications and worried by the challenges they have to face. In the 1st round, they assumed it would take longer, and in the 3rd round, they were already reducing the time.

To establish which issues the respondents may have considered relatively more important it was examined more closely the questions scored higher than the Mean.

Recalling the research question, which is the impact of accessing key information in the decision-making process and a wake-up call to the impact of KM framework and the metrics to track its impact.

This study was built on the available data from signalling metro experts, which can be perceived as limited in the overall context. This fact can restrict the results due to the possible different realities and contexts between metro companies. Yet, we consider that there is no special bias linked to this area of expertise and that the results could be adopted and tested in any other area of expertise and metro companies.

Additional data for different core areas of expertise would be an experimental improvement, as these interventions and evaluations should be performed on different areas of expertise. Nevertheless, the Delphi study developed here can be further used in the future with more comprehensive datasets and estimate reliable impacts on the performance of the company.

6. Conclusions and Limitations

This approach enabled the author to record internal requirements and pain points in the current knowledge management, set priorities and evolve to a new knowledge framework that alleviates managers' and core knowledge actors' pain points and supports them in their daily business and long-term decisions.

The panel of experts was unanimous on the importance of access to information. It was mentioned that the difficulty in accessing information influences the time and quality of the technical work that needs to be produced for the expansion of the network. Concerning question 6, where the standard deviation is higher, this may be because some of the technicians have more experience in Projects than others. Of the five specialists, two have more experience in Projects and three in Maintenance.

The main limitation of this study was the limited participation of the five experts representing the whole cluster of Railway signalling in ML. Although numbers/scores are collected they should be regarded as descriptive indicators and thus essentially qualitative in nature.

For future research, the author advocates that the focus should be on developing the appropriate KM framework and assessing the impact using metrics.

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Next Generation Knowledge Management for Europe Based Life Insurer: An End-To-End Solution to Assist Insurance Platform Modernization and Ongoing Efficiency Improvement

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Abstract: Purpose of this paper is to showcase the advantages and benefits of positioning a Tool driven approach to create and manage knowledge in an enterprise. As Organizations traverse thru multiple platform and technology changes to drive transformation, the processes & the documents associated to these solutions also need to change and the employees who operate on the processes on day-to-day basis need to be trained/re-trained accordingly. Ability of an organization to manage the process documents in an effective way and drive large scale changes in a systematic manner acts as a key factor in how successful these platform/technology changes are. A technology solution/tool driven approach to manage the process documents, enabling mass changes to the existing knowledge and creating new knowledge at a rapid pace can be the answer for the challenges organizations are facing with respect to Process documents/knowledge articles. The implementation and usage of the solution is aligned to the Knowledge Centred Service (KCS) methodology.

Keywords: Knowledge artefact lifecycle, Knowledge centered service, KM technology, Knowledge process, SOP, Process documents, Rapid creation, Knowledge transformation

1. Business Scenario

A leading global insurer based out of Europe had various challenges that were impacting their customer growth and experience. As part of the customer experience transformation program, their core Insurance platform was modernized. This impacted ALL the knowledge artefacts - Standard Operating Procedures (SOPs) that were being used by their back office and contact center teams while serving the end customers. The Insurer lacked the capability to achieve the objectives as their current process involve manual SOP creating involving multiple stake holders and documents stored in multiple repositories without much of control measures. It also impacted the pace at which the Insurer can roll out the new Core Insurance platform for their customers as the internal teams are not ready to leverage the platform without the relevant SOPs created at the same pace. To minimize this platform, change impact on their customers and to bring the SOPs up to date, the Insurer was looking for a next gen Knowledge Management Platform that can streamline, govern, and speed up the knowledge creation process.

TCS participated in a competitive bid against various market products and had won the deal to implement their knowledge management platform (TCS Adaptive Knowledge Bank – AKB). The out of the box functionalities driven by two+ decades of domain led operations experience and the state-of-the-art architecture enabling the self-serve features with utmost flexibility helped in achieving the same. TCS solution was successfully implemented within 16 weeks and helped the knowledge authoring team to create and govern the knowledge artefacts with speed and accuracy. The following sections provide an overview of the TCS solution, and the benefits provided to the Insurer.

2. Methodology and Solution Details

2.1 Methodology

TCS Adaptive Knowledge Bank (AKB) solution delivers features which are in line with Knowledge Centered Service (KCS) methodology. AKB helps organizations to solve the Knowledge management challenges thru

- Capturing the existing knowledge
- Arranging them in meaningful way thru metadata and other features
- Increase the use of the knowledge and enhance it thru collaboration

Solution also helped the enterprise to evolve with respect to knowledge management practices through

- Reports/Dashboards and Insights on Knowledge and User participation

- Integrating with multiple Knowledge repositories and processes
- Ability to provide process evaluations as needed

Overall AKB aligns to the methodology of Knowledge centered Service and delivers the right capabilities to the organization in managing and enhancing their knowledge.

2.2 Solution Details

TCS Adaptive Knowledge Bank© (AKB), *a TCS Intellectual Property (IP) solution for* end-to-end knowledge management (covering knowledge creation, governance, and search), was implemented to meet the business needs of the platform modernization team and back-office teams to expedite the SOP creation and manage the existing SOP documents in efficient manner. Its template driven, collaborative SOP creation process helped the modernization team to create new SOPs in short duration and with high quality. Its easy-to-use feature-rich web interface and advanced cognitive search capabilities enabled agents to quickly retrieve relevant information to process the service requests. This has helped the back-office team to reduce the Average Handling Time and manage their SOPs efficiently for on going changes.

Key objectives of the implementation were:

- SOP Writer module roll out – Enable the new platform team to leverage the module of AKB with in built word editor to create new SOPs. Worklist based assignment and edit capabilities to help the team to create sections in parallel and reduce the overall creation time
- Enable content driven search and retrieval of relevant information quickly without the need to manually navigate knowledge sources
- Aggregate, baseline and organize the knowledge artefacts across the sources
- Help business manage content effectively and maximize benefits
- Increase team efficiency with the collaboration features in addition to knowledge management capabilities

The below picture (Figure 1) depicts the key features of the solution that helped in achieving the objectives of the project,

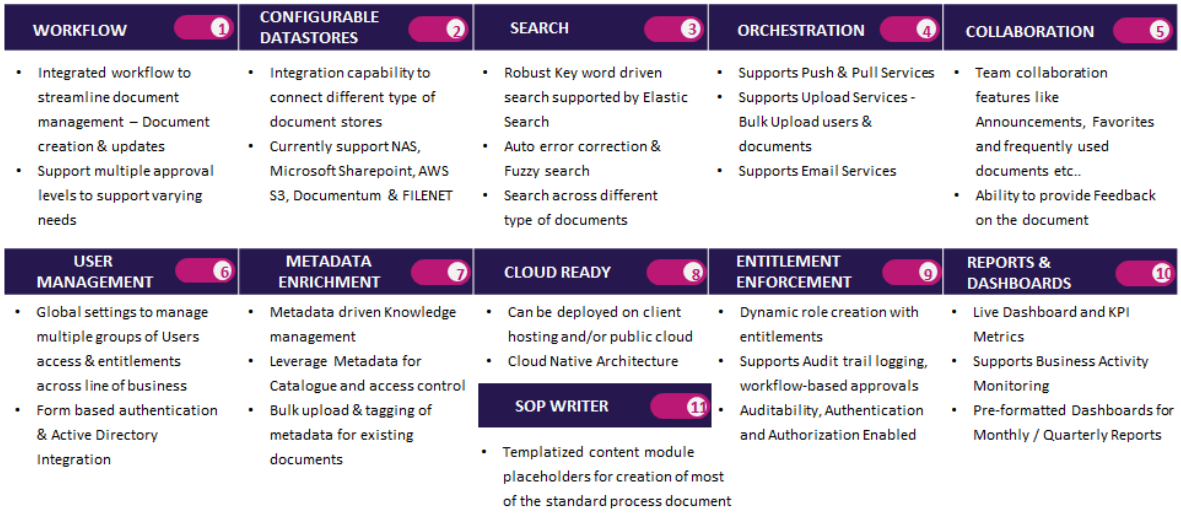


Figure1: Key Features of AKB Solution

Please Note: The brochure about TCS Adaptive Knowledge Bank is available on https://www.tcs.com/knowledge-management-solution-improved-cx

3. The Infrastructure

3.1 Solution Implementation

The solution is implemented as On-premise setup within customer Infrastructure. To enable the smooth adoption and value delivery, AKB has been rolled out in multiple phases. The Initial Phase is rolled out to the new platform team, who is focused on creating new SOPs and the subsequent phases AKB rolled out to the rest of the back-office team.

The Initial implementation and roll out to new platform team successfully completed in 4 months. This has helped the new platform team of 200+ users to create relevant SOPs in a quick and collaborative manner. Back-office rollout has been taken as Phase 2 with additional SOP repositories and 400+ users leveraging AKB for their day-to-day business operations.

Key activities involved in the implementation are:

- Establishing the collaborative process in creation new SOPs
- Role based access definitions to enable quick creation and approvals for SOPs
- AKB to own the File server repository for new SOPs to expedite the roll out of the solution
- Identification of relevant Metadata, approval setup and Reports etc.
- Unique way of requirement analysis with the help of user stories and iterative demos
- Solution design, installation, setup and base configuration – with extensibility to multiple tenants
- Customized and iterative implementation of the user requirements– agile deployment within and across the tenants
- User training and user acceptance testing – multi level user testing to ensure zero business disruption
- Production Go Live in a phased manner

3.2 Technology Stack

The TCS solution is pre-built using .Net core on top of Elastic search with metadata in MS SQL Server. While the solution can integrate with different storage sources like NAS (Network Attached Storage), SharePoint, document management systems, cloud services etc., NAS was the preferred option for this implementation. A load balancer is used to route and manage the traffic to the various tenants.

Key technical building blocks used in this implementation are:

- AKB Portal – an intuitive interface for knowledge authors, users, approvers, administrators etc. to use the features of the application
- SOP Writer – Module to collaboratively create end to end SOP document using in-built word editor. Module also support template driven creation and Worklist capabilities
- API driven services – APIs for intra-module and inter-application communication
    - Auth Services – Integrated with customers' AD for seamless authentication into the application
    - NEST API – Used for supporting ingestion of documents and metadata into the solution during the initial onboarding and for indexing and querying the documents supporting the searches
    - Document API - Add/Version/Delete documents by the authors/reviewers
    - Search Services/API – To support search interface of the portal by retrieving relevant information based on search terms
    - AKB Internal API – To orchestrate with incoming and outgoing traffic and capture the activities in the log database
    - Notification API – To send email alert to users with FYI
- Workflow – The configurable Low Code/ No Code (LCNC) workflow module is used to define/refine the document intake/update/approval process.
- Administration – As part of the initial setup, administrative users were created for each tenant. Administrators used this module further to manage users, roles, entitlements, metadata, preferences, etc.
- Reporting and Dashboard – Usage metrics configured as per the requirements
- Collaboration – Enabling continuous enrichment of knowledge and keeping information up to date
    - Access favorites and provide feedback on the document
    - View announcements, glossary and recent searches

4. The Challenges

4.1 Risks and Mitigation

The following are the key risks that were envisaged/faced and mitigated timely during the implementation

Challenges	*Solutions*
Creation of new SOPs in parallel to new platform rollout accommodating the dynamic changes as per the platform capabilities	AKB helped with Worklist based SOP creation process, where multiple stakeholders can work on their sections in parallel and configurable approval levels, which enables the right amount of control measures. Together with these features AKB was able to expedite the SOP creation process and kept up to speed on dynamic changes
Ambiguity in the target state requirements for the solution from business perspective	The AKB team used EPIC/User story driven requirements gathering and finalization approach keeping the business users need in perspective. This helped the business team to understand the must-have features for the day-to-day operations against the nice to have features
User adoption to the structured solution-based approach compared to the current state of manual processing	The AKB team provided an agile based implementation approach where the users were given opportunities to get a good handle on the solution before the production migration. This helped the team to understand the solution features and how the target state process will work
Risk of knowledge documentation becoming stale	During the implementation of the solution, there were major upgrades to the core platform which impacted the SOPs (making some of them possibly obsolete). To ensure that the documentation is up to date, knowledge governance team was established with SOP writer module rolled out first to support SOP creation/upgrade/versioning etc.
Document proliferation and organizing	As the no. of users and documents were increasing over a period, document organization was getting difficult for the teams. The team introduced the Hierarchy feature that helped to organize the documents as needed.

5. How the Initiative was Received by the Users or Participants

AKB solution was received well by the Operations team. With the functional and configuration capabilities, business ops teams were able to create SOP documents in line with their planned timeline.

From the start date of implementation, Ops team was able to get the solution in production in 16 weeks and start the creation of SOPs. AKB helped the team to create SOPs to reduce their SOP creation time by 40 to 50%.

In a quick timeframe, Business Ops team was able to create 100+ SOPs associated to the new insurance platform, which helped the team keep up their pace with larger organization schedule.

As the teams leveraging the solution for new SOPs, they have extended the capabilities to the existing back-office setup to support their day to day need in accessing and managing the existing SOPs. In this journey AKB was able to create great value in the form of productivity improvement.

Listed below are some of feedback received from the users

> *"I just wanted to take this opportunity to say what a great experience this project has been. I've had the opportunity to work on several projects during my years with several outside vendors and working with TCS has been one of the best experiences I've had. Team continues to be very responsive. I'm excited to see more and more business areas begin to use AKB" – Senior Business Unit Manager*

> *"I want to take this opportunity to say thank you to the entire team for helping us build AKB. Features are very user friendly, and I think the all the Users will love it. Product team has been super easy to work with and very patient and respectful with answering our questions and supporting us with our needs. I truly appreciate the time, expertise, and help"– Back-Office Operations Lead*

6. The Learning Outcomes

Post implementation, contact center agents have better access to information, thus reducing AHT and increasing the first call resolution. Benefits are calculated using the handle time/unit time for each user, business team and process to establish a base line of their activity processing prior to AKBs implementation and their support overhead (referral volume, unit time and drivers) to understand the drop out for each month. The same metrics were used post implementation to assess whether the timings/referrals have reduced, which colleagues have reduced and use a combination of AKB search reports and AKB download reports to validate what information users are looking for.

We also worked with business teams to drive a reduction in referrals through promotion of AKB material that can help colleagues self-serve and monitor search volumes vs referrals to establish if certain colleagues are utilising the system more which is causing them to need less support.

The following (Figure 2) are the key highlights of outcomes from the solution.

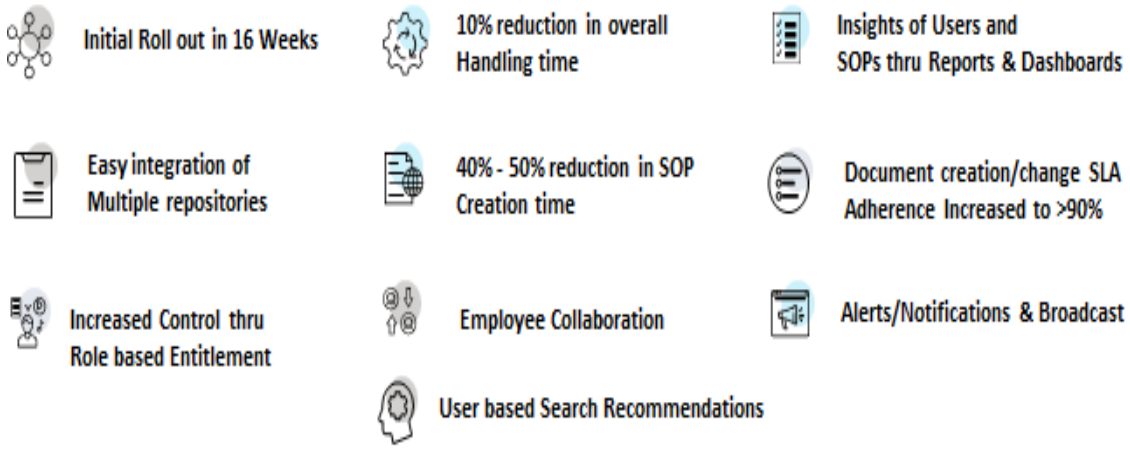


Figure 2: Key Highlights of the Implementation

7. Plans to further Develop the Initiative

TCS continues to invest in the evolution of this solution based on the industry, geo market and technology changes. This ensures that the solution remains relevant for customers and creates a win-win situation from both the solution and business delivery standpoint. The following (Figure 3) are some of the key feature enhancements that are part of high-level roadmap of AKB:

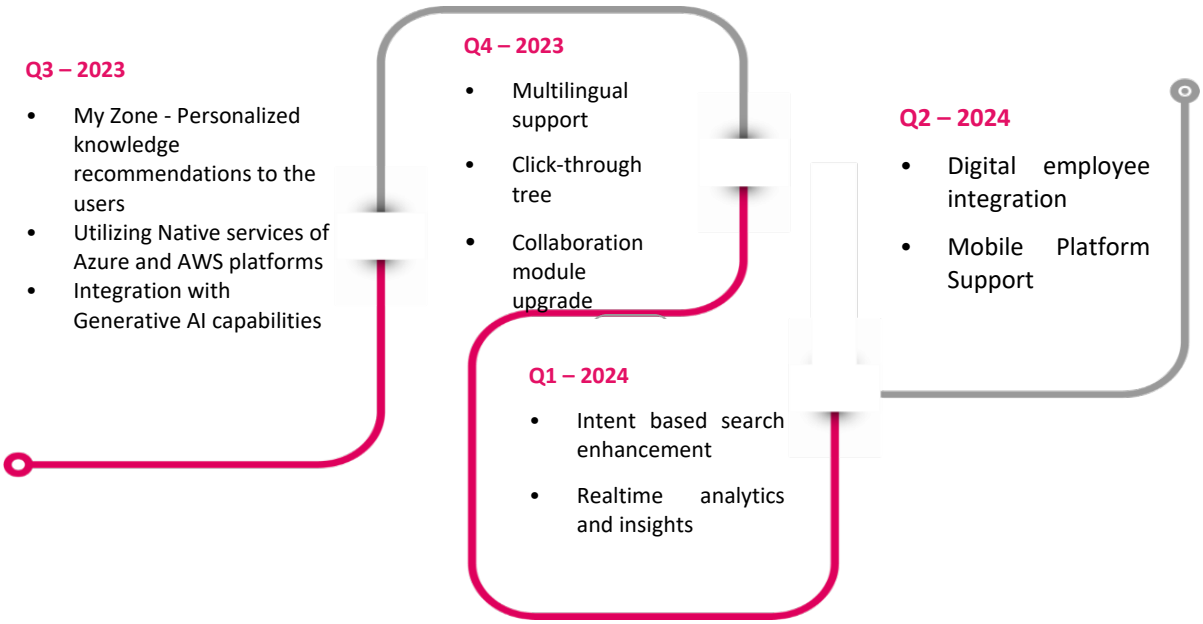


Figure3: AKB Solution Roadmap Ahead

8. Conclusion

TCS Adaptive Knowledge Bank (AKB), as an end-to-end knowledge management solution, has transformed the way Business operations team was able to streamline knowledge management lifecycle with flexible and templatised way to create new SOPs, manage the existing knowledge artefacts and deliver better value to the organization and to the end customer. With collaborative features, control measures, AI/ML driven search, metadata driven knowledge management and extensive Reports and dashboards, AKB was able to give all the critical capabilities needed for the Business Ops team to deliver better knowledge and in turn better experience to the end customers. This extremely flexible, governed and easy to replicate solution has been deployed at multiple other customers providing great benefits at each implementation.

The Agile Knowledge Projector: Enhancing the Adaptive Creation of Knowledge

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Abstract: Agile is knowledge-sensitive. Knowledge feeds the entire adaptive life cycle from envision to transition. Main agile frameworks (i.e., SAFe®), toolkits (i.e., DA® – Disciplined Agile) and standards (i.e., PMBOK® 7th Edition) underline in different ways and at different levels of detail the relevance of knowledge for generating business value. So, all right? Everything is fine? Are we on the same page? In principle yes, but there are three main knowledge lacks: implicit knowledge, knowledge framework, knowledge roles/responsibilities. Therefore, negative effects are determined at different ontological levels: project performance, team dynamics, personal development. Presently, the agile landscape shows a relevant awareness of the topic of knowledge. However, this awareness is fragmented, ambiguous in key concepts, poorly addressed, even misleading in some cases. Knowledge in the agile environment is too often a fuzzy topic. The self-dimension of an agile team (self-directing, self- organizing, self-learning, self-empowering) erroneously assumes that knowledge is well addressed, wasting time, money, resources, decreasing performance and results. This paper provides a practical framework and tips for avoiding these negative effects. The AKP® – Agile Knowledge Projector might be a practical solution for better addressing knowledge in an agile project environment, improving value. AKP® is an organizational framework that fosters the creation of a dynamic mix of knowledge, combining in a continuous way explicit organizational artifacts, implicit team patterns and tacit individual expertise, for the entire duration of the agile project. AKP® consists of nine processes, focused on main agile dynamics of a complex and innovative project. AKP® is a powerful but not self-regulated framework: thus, it needs to be carefully designed and administered, according to specific knowledge roles and rules.

Keywords: Agile, Self-organizing team, Knowledge framework, Implicit knowledge, Agile knowledge creation

1. Sketching the Scene

Agile is knowledge-sensitive. Knowledge feeds the entire adaptive life cycle from envision to transition. Main agile frameworks (i.e., SAFe®), toolkits (i.e., DA® – Disciplined Agile) and standards (i.e., PMBOK® 7th Edition) underline in different ways and at different levels of detail the relevance of knowledge for generating business value. The concept of knowledge is embedded in the definition of agile, in that agile is "The art and science of facilitating and managing the flow of thoughts, emotions and interactions in a way that produces value outcomes under turbulent and complex conditions" (De Carlo, 2004). And again, agile is "The work of energizing, empowering and enabling project teams to rapidly and reliably deliver business value by engaging customers and continuously learning and adapting to their changing needs and environments" (Augustine, 2005). Thus, knowledge is an essential ingredient of this flow towards value. A topic, commonly pointed out by all references, is the concept of tacit knowledge. Barry Boehm states that "Agile methods derive much of their agility by relying on the tacit knowledge embodied in the team, rather than writing the knowledge down in plans" (Bohem, 2002). According to PMBOK® "Tacit knowledge is comprised of experience, insights and practical knowledge or skill. Tacit knowledge is shared via networking, interviews, job shadowing, discussion forums, workshops" (PMI, 2021). As for many other topics, also for what concerns knowledge Agile draws from Lean. For example, DA® recalls the principle "Create Knowledge" of the Lean Mindset: "Planning is useful, but learning is essential. We want to promote strategies such as working iteratively, that help teams discover what stakeholders really want and act on that knowledge. It's also important for team members to regularly reflect on what they're doing and then act to improve their approach through experimentation" (Ambler Lines, 2020). Similarly, the Scrum Guide states that "Scrum is founded on empiricism and lean thinking. Empiricism asserts that knowledge comes from experience and making decisions based on what is observed. Scrum engages groups of people who collectively have all the skills and expertise to do the work and share or acquire such skills as needed" (Schwaber Sutherland, 2020). So, all right? Everything is fine? Are we on the same page? In principle yes, but there are some knowledge lacks.

2. Knowledge Lacks

Sketching the current scene of the agile landscape, there are three knowledge lacks.

2.1 The Lack of Implicit Knowledge

It is probably the most significant. The current focus is limited to the dichotomy “Explicit VS Tacit”, not taking into account the implicit dimension of knowledge. To clarify, it is worth briefly summarizing the profile of the three types of knowledge:

Explicit (represented). Ontological level: organization. Explicit Knowledge (EK) is based on formal logics, codified, written, context independent, asynchronous (who produces EK doesn't know in advance if it will be used, when, by whom, in which way), it's hard to modelize, easy to communicate and transfer. EK must considered as a stock, as a "universal rule" for the entire community. An example of EK is the formula for computing the area of a rectangle (width times length). Other examples of EK are documented best practices, formalized standards, codified rules by which a customer order must be processed by the company, the official theory test for car drivers, the PMBOK® 7th edition in the world of project management (from predictive to adaptive and everything in the between). EK is already available before its use (i.e., criteria for structuring the WBS - Work Breakdown Structure to be included into the scope management plan, or prioritization techniques such as WSJF - Weighted Shortest Job First for prioritizing the backlog), It formalizes the progressive outputs, produced during its use (i.e., scope baseline, including WBS and WBS dictionary of the specific project, or user story syntax “As a… I want… So that…”), it documents the final results after its use (i.e., formal documentation for accepted deliverables and user manuals of the new solution carried out by the project).

Implicit (embedded). Ontological level: team. IK - Implicit Knowledge (IK) is a collective interpretation of EK in a specific context by a specific community that share a common goal. For example, the community of car drivers is asked to put in action a collective IK for driving successfully in the traffic of a certain city at a certain time. Driving in the traffic of New Delhi at rush hours is quite different than driving in the traffic of Zurich at midnight. IK is less collective and more dynamic than EK. IK resides in systemic routines, organizational culture, codes of conduct, ethics, social behaviour, habits, social norms, heuristics. IK is a property of the system as a whole, rather than a personal feature of individuals belonging to the system. IK is a collective knowledgeable answer to a contextual challenge. It's an unwritten and unspoken agreement for coping with a shared situation or accomplishing a result together. According to an adaptive (agile) approach, for estimating user stories, development team and product owner play a planning poker session, starting from planning poker rules and Fibonacci sequence (EK). During the session, development team and product owner implement planning poker rules based on collective patterns (IK). If similar situations come into view, the same pattern of IK will be typically put in place. If project environment changes (i.e., less time for planning, unavailability of the scrum master, large compound stories), implicit practices change consequently.

Tacit (embodied). Ontological level: individual. Tacit Knowledge (TK) is personal in nature, subjective, intuitive, based on physical experiences ("flight time"). It's context dependent and emotional (beliefs, insights). It's a continuous flow, it's easy to protect, but hard to gain, tell, write down and transfer. TK bodily lives with the individual and is deeply embodied in it. Expert judgment is a classic example of TK, widely applied for managing a project. For example, a senior specialist will troubleshoot a big problem based mainly on his/her experience, insights, intuition and secondly on codified standards. At the same time, it would be quite difficult for him/her to translate his/her TK into a document (EK), to be shared with a junior specialist (the document is the top of the iceberg, the expertise is the iceberg). The amount of TK owned by an individual is directly proportional to the amount at stake (time, money, effort, trust) for replacing the individual. TK is fully contextual: it’s might come to mind only against an intentional need of knowledge. TK might be shared through physical proximity, F2F interactions, learning by intrusion, observation, imitation, joint practices, osmotic communication, but first of all through a real trust and willingness to live common situations closely together. TK is “in the doing”. Refer to the famous example of TK used by Polanyi “Being able to recognize a person’s face but being only vaguely able to describe how that is done” (Polanyi, 1966). TK cannot be articulated; it consists of a set of personal models, fully played, less told and more less written.

Summing-up, PK – Project Knowledge is “A dynamic combination of explicit artifacts, implicit patterns and tacit expertise, applied for developing options, taking decisions and implementing actions throughout the project life cycle" (Villa, 2015). This definition underlines the "contextual mix" of different types of knowledge, to be used intentionally to achieve project objectives. Four are the key features of an effective PK: a) contextual (tailored on project peculiarities, individuals and interactions included), b) intentional (focused on project options, decisions and actions), c) dynamic (progressively elaborated and shared within the project environment), d) combined (based on different project cognitive elements). Assuming that one of the four core values of Agile Manifesto is still valid, “Individuals and interactions over processes and tools”, then

implicit knowledge is essential in that agile team feeds on and thrives on implicit knowledge. Agile ceremonies are founded on implicit knowledge. For example, the effectiveness of the daily stand-up meeting depends only marginally on ground rules (EK) and number of daily meetings attended by each member of the agile team (TK). Effectiveness mainly depends on the implicitpattern that the team as a whole put in place collectively, adapting it from time to time to individual circumstances. Without implicit knowledge, the performance of the team is very similar to that of an organ in fibrillation, where each part moves uncoordinated from the others.

2.2 The lack of a Knowledge Framework

Agile movement has addressed the "knowledge" topic since its origins. Some examples:

referring to the Manifesto of Agile Software Development, 2001, the principle n.12 declares that "At regular intervals, the team reflects on how to become more effective, then tunes and adjusts its behaviour accordingly" (PMI, 2017). While the principle n.6 declares that "The most efficient and effective method of conveying information to and within a development team is face-to-face conversation" (Ibidem). Indeed, these principles provide clear guidelines on how to reserve spaces dedicated to the exchange of knowledge;

the Scrum method entails ceremonies focused on knowledge, that's to say "Daily Scrum" and "Sprint Retrospective" that must be performed regularly;

the Lean-Agile Principle #8 by SAFe® "Unlock the intrinsic motivation of knowledge workers" (Leffingwell, 2018) recommends to invest in enhancing the personal knowledge owned by knowledge workers, through their motivation for autonomy, mastery, mission and minimum possible constraints;

"Choose your Wow!" by DA® entails the specific Decision Point "Improve skills and knowledge", according to an extended version of the hierarchy of competence by Burch, based on five levels of a learning journey for a given skill or knowledge area.

However, a knowledge framework is missing. In other words, we have so many pieces of the puzzle without a frame. Which are the relationships among knowledge transfer, knowledge sharing and knowledge creation in an agile environment? How to link and mix the explicit, implicit and tacit dimensions of knowledge? The answer is excessively discharged on the discretion, on the maturity, on the self-regulation of individuals and teams. On the other hand, a shared knowledge framework could be the basis on which knowledge-centered behaviours and dynamics can be supported.

2.3 The lack of Knowledge Roles/Responsibilities

The agile environment is crowded with many roles. Different agile methods and scaled approaches entail different terms for the same role, such as scrum master, team lead, agile coach. Indeed, this proliferation of terms is consistent with the agile movement that in a spontaneous and uncoordinated way has come to converge on shared cornerstones. Some roles are focused on business (product owner – do the right solution), other ones on process (agile coach – do the solution fast), other ones on design (architecture owner – do the solution right), other ones on contents (development team – capability and capacity), other ones on governance (project sponsor – strategy). In a knowledge-sensitive agile environment, the lack of knowledge-focused roles is deafening. A knowledge role does not mean that this role must perform knowledge activities; it means that this role should act as a knowledge hub. If we have an architecture owner, why can't we have a knowledge architect? Similarly, if we have an agile coach, why can't we have a knowledge catalyst? Of course, these questions are not aimed at creating additional organizational bureaucracy, within an environment based on lean principles. The point under discussion is "how to lead knowledge in an agile project?" A tight option is to formalize specific knowledge roles within the agile environment. Thus, an enlargement of the agile team with people that are in charge of the topic "knowledge". A lightweight option is to assign to existing roles specific responsibilities and tasks about knowledge. In any case, taking the ownership of knowledge creation is an open challenge that must be addressed.

3. The Agile Knowledge Projector (AKP®)

AKP® is a knowledge framework focused on agile projects. It creates a dynamic mix of knowledge combining in a continuous way explicit organizational artifacts, implicit team patterns and tacit individual expertise, for the entire duration of the project. AKP® should make up to knowledge lacks described above. A proposal of AKP® is portrayed in Figure 1. Why a projector? A projector is an optical device that projects images mixing the shades of three primary colors (blue, yellow, red). Similarly. AKP® projects within the agile environment

knowledge items combining "three primary colors of knowledge". This way, the colored and changing light of knowledge pervades the agile project and illuminates its execution.

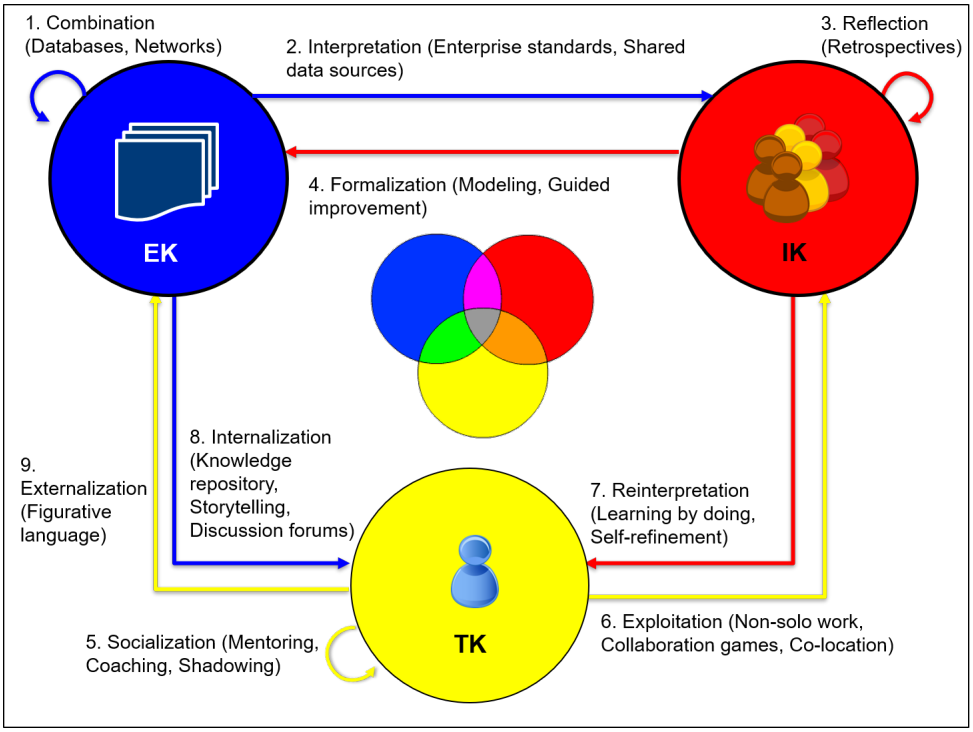


Figure 1: AKP® – Agile Knowledge Projector

AKP® entails three basic components. Each component is represented by a primary color: blue for EK (Explicit Knowledge), red for IK (Implicit Knowledge) and yellow for TK (Tacit Knowledge). The projector combines the basic colors to make a wide and useful spectrum of colors (knowledge). The primary colors are those which cannot be created by mixing other colors in a given color space. The purpose of an arrow is to create the knowledge on the arrow head using knowledge on the arrow base. The pre-existing knowledge on the arrow base is used and not consumed or modified. It must be pointed out that pre-existing chunks of knowledge, if well used, shared, combined, revised, can generate a new chunk of knowledge, that's to say something that is not the sum or the clone of previous ones. For example, the tacit knowledge personally owned by each member of the agile development team is used for creating a new implicit pattern, collectively owned by the team. An arrow may connect one type of knowledge with another type of knowledge, or it may be circular on the same type of knowledge. For example, pre-existing implicit knowledge collectively owned by the team may be used for creating additional team patterns. Each arrow refers to a specific knowledge process, such as "1-Combination of EK". The terms, one or more, written in brackets, such as (1- Databases, Networks) are the means by which knowledge is created. For example, a Mob Programming session, a type of non-solo work, during which "The team gathers around a single workstation, with one team member coding while others observe, discuss, and provide advice. The programmer is swapped our regularly and everyone codes at some point. The code is often projected onto a large screen" (Ambler Lines, 2020).

AKP® supports agile roles (i.e., Product Owner, Scrum Master, Development Team, etc.) to better set-up their agile environment and to better conduct agile ceremonies and agile work. For example, the Interpretation process may help the agile team to quickly agree its implicit WoW – Way of Working exploiting available explicit organizational artifacts. Similarly, the Reinterpretation process should allow the single agile team member to take the time to sort out the implicit experience gained working in team, and to refine his/her tacit agile way of thinking and acting. In summary, with AKP®, people called to work by projects on the basis of an agile framework have the opportunity to carry out their work more effectively, activating as needed knowledge management processes in a conscious and shared manner.

A brief comment for each of the proposed processes and means:

Combination (Databases, Networks). Regardless the specific agile project, a lot of explicit artifacts are available at the organizational level. They refer to databases that collect documentation from portfolios, programs and projects. For example, business cases, backlogs, lessons learned. Combination is the process that links and merges different bodies of explicit knowledge. Reconfiguration of existing artifacts can lead to create new explicit knowledge. For example, a central collection of risks encountered in agile projects for a specific industry or technology. Central functions, such as PMO, lead the combination, conversion, reconfiguration, creation of explicit knowledge.

Interpretation (Enterprise standards, Shared data sources). For managing a project with an agile approach, the team can count on a set of OPAs – Organizational Process Assets made available by the company. Particularly agile models (i.e., Gulf of evaluation), methods (i.e., Agile roles profiles, Value stream mapping, Story point estimating, Iteration planning, Iteration review), and artifacts (i.e., Information radiators, Team charter). Similarly, for Shared data sources, such as documentation from similar past projects. Using these explicit objects, the agile team can set-up its own implicit WoW - Way of Working.

Reflection (Retrospectives). Agile common experiences should be shared and improved. Retrospective is typically a two-hour meeting held at the end of each timeboxed iteration, during which the entire agile team (PO + SM + DT) reflects around processes (our way of working) and people (our behaviours and team dynamics). Retrospective is performed by the team for the team. Questions under discussion are: "What worked or went well? What caused problems, failed to work properly, or did not go well? What can be done differently in the next sprint?". Retrospectives improve implicit knowledge owned by agile team for the remaining part of the project. Some improvement work items might be added to the backlog.

Formalization (Modeling, Guided Improvement). Agile team implicit patterns are regularly evaluated in order to improve team performance, for example with sprint retrospectives. This local view might provide insights useful at a higher organizational level. Thus, Guided Improvement based on PDCA/PDSA/OODA loops, should be applied to create formal explicit knowledge reusable by other projects throughout the company. For example, more focused criteria for grooming the backlog or more effective ways for engaging key stakeholders. Similarly, for Modeling: agile team creates reusable representations of processes, ground rules, ceremonies, personas that feed the company knowledge base of explicit agile resources. This way, new agile OPA is created.

Socialization (Coaching, Mentoring, Shadowing). Tacit knowledge of an individual grows by sharing the tacit knowledge of another individual and vice versa. It happens through socialization, that's to say sharing mental models and technical skills. Not necessarily using language, but through observation, imitation, shadowing (forward and reverse). During "coach office hours" an experienced individual makes himself/herself available so that other individuals can drop in on him/her to get help on a specific topic. Similarly, the mentor supports the mentee, providing psychosocial support and role modeling, about how to develop oneself as a whole person, coping with personal challenges. Socialization entails spending time closely together, according to the famous quote by Polanyi "We know much more we can tell" …. "and we can tell more we can write".

Exploitation (Non-solo work, Collaboration games, Co-location). Agile is based on individuals with a T-shaped profile (generalizing specialist). Individuals as owners of a personal amount of tacit knowledge that can make the difference. A sum of excellent individuals does not necessarily make an excellent team. Implicit knowledge owned by the team is more than the sum of the individual expertise. Implicit knowledge is created through shared working spaces for emerging relationships. Non-solo work entails pairing and mob programming. Collaboration games are another shared space within which development team perform agile activities such as the construction of the product vision box, the DoD – Definition of Done, the planning poker session. Co-location, physical or virtual, fosters the creation of implicit knowledge through osmotic communication and learning by intrusion.

Reinterpretation (Learning by doing, Self-refinement). Working together, members of the agile team create and act implicit patterns. They live a bodily collective experience tailoring agile events (i.e., sprint planning) on project peculiarities. Individual should re-elaborate the implicit knowledge gained by the team to enrich his/her tacit knowledge. It could happen through private spaces of personal reflection during which making a summary of the time spent with others. Similarly, re-experiencing in a personal way what shared with the team. For example, writing user stories, addressing risks, acting as a generalizing specialist, taking ownership, managing conflicts. Internalization is the key that embodies implicit knowledge into tacit knowledge.

Internalization (Knowledge repository, Storytelling, Discussion forum). The bridge from explicit to tacit is asynchronous, in that explicit artifacts that are available in the company knowledge base can be brought into the individual space of knowledge at discretion of the individual. A collection of pre-registered project tales may be listened influencing the personal mental model. Similarly, an individual can attend a discussion forum where past experiences are shared and commented. In both cases codified past knowledge is reused. Moreover, individual can access other explicit artifacts such as case studies, articles, templates, knowledge checks, deciding when and how internalize them.

Externalization (Figurative language). Probably the arrow from tacit to explicit is the most difficult to put into practice. The point under discussion is externalization, that's to say the process of articulating tacit knowledge into explicit artifacts. Tacit knowledge, by its nature, it's hard to articulate through analytical methods of deduction and induction. Thus, nonanalytical methods should be used. Try to conceptualize an image, a chunk of tacit knowledge, through literal language leads to inconsistent results. Much better through figurative language. Metaphors and analogies are the pillars of figurative language. Hyperboles and other figures of speech might be very useful too. An agile individual should learn to use in figurative language better and better. "The product owner is Janus Bifrons" (metaphor); "Working in high-performing agile team it's like being in a beehive with so many other hardworking bees filling the cells with honey" (analogy); "Blood must flow during the sprint retrospective" (hyperbole). This way, personal experience gained in agile projects is conceptualized in a synthetic and incisive way. And, most importantly, in an immediately usable way by the organization.

To be truly effective, AKP® should be designed and administered properly. For a large project a knowledge architect might be appointed. Otherwise, the design of AKP®, customized on the peculiarities of the agile project taken into consideration, should be a responsibility of the agile coach (scrum master, team lead), in that the knowledge framework is a part of the overall agile framework that this role must however already set.

Once set up, AKP® must be carefully administered in order to ensure the continuous creation of the dynamic mix of knowledge which the project feeds on. Due to its conformation (width, interconnections, user's engagement), AKP® is unable to self-regulate by itself. Administering AKP® means to verify the correct application of knowledge tools, to evaluate the actual creation of new knowledge, to foster the connections between explicit, implicit and tacit dimensions of knowledge. Because of this, a clear responsibility must be assigned. Again, the role of knowledge catalyst might be appointed, or this responsibility might be assigned to pre-existing role, particularly to the agile coach.

4. Conclusion

Knowledge is a key driver for an added-value application of agile. Presently, the agile landscape shows a relevant awareness of the topic of knowledge. However, this awareness is fragmented, ambiguous in key concepts, poorly addressed, even misleading in some cases. Therefore, negative effects are determined at different ontological levels: project performance, team dynamics, personal development. The AKP® – Agile Knowledge Projector might be a practical solution for better addressing knowledge in an agile project environment, improving value. AKP® covers three main knowledge lacks: implicit knowledge, knowledge framework, knowledge roles/responsibilities. AKP® is not self-regulated framework, but instead needs to be carefully designed and administered.

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Work in Progress Papers

Female Academics' Knowledge Sharing Behaviour in a Gender Non-Mixed Work Environment

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Abstract: Universities are keen to improve the opportunities for knowledge sharing (KS) amongst the academics who are their cornerstone, by improving the connections between them. Creating and disseminating knowledge are fundamental academic activities and beneficial to the university. However, the actual KS behaviours of academics may be constrained by numerous factors. Previous KS research has focused on factors influencing KS in business or academic environments that are gender-mixed, i.e., males and females work alongside each other in offices or campuses. This study is unusual and may be unique as it addresses KS behaviours in the gender non-mixed academic environment of Saudi Arabia's King Saud University. This University has entirely separate campuses for males and females, conforming to national gender-segregation laws. Using widely accepted constructs of the Theory of Planned Behaviour, the study will examine the impacts of individual (reputation, rewards and self-efficacy), organisational (culture, top management support, trust, social networks and vision and goals) and technological (information technology infrastructure, applications) factors on intention to share knowledge among female academics. Quantitative, via questionnaires, and qualitative, via interviews, data will be collected to test proposed hypotheses regarding barriers and inducements to KS intentions. The value of this research will be to increase our understanding of the factors affecting KS in universities, specifically among female academics, in an environment that has its own specificity and to make appropriate recommendations to enhance participation in KS activities.

Keywords: Female academics, Gender segregation, Higher education, Knowledge sharing (KS), Organisational culture, Saudi University

1. Introduction, the Research Gaps

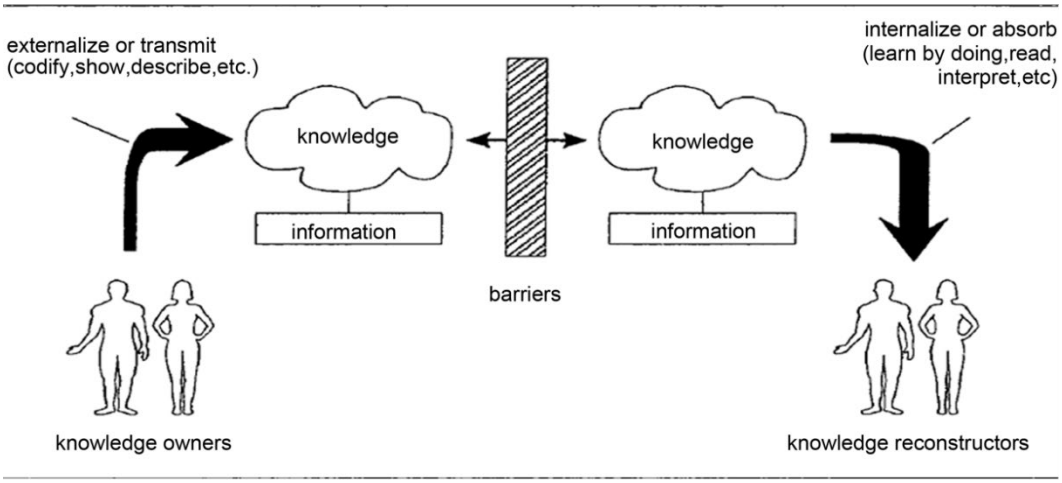
Knowledge management (KM) has been widely studied and is known to play an important role in the success of organisations (Beadles et al, 2005). Published research has focused mainly on the factors promoting or inhibiting KM and knowledge sharing (KS) in the public and commercial sectors (Hislop, 2013; Qureshi & Evans, 2005). Far fewer studies have explored KS in higher education (HE) environments. However, in HE, KS significantly affects performance, enhances innovation, and augments organisational knowledge (Charband & Navimipour, 2018). Academic staff are involved in KS when they teach, research, consult and publish, they are knowledge producers and disseminators, so better practices will develop better quality education and better organisational performance (Jolaee et al, 2014). HE organisations should, therefore, explore the ability and willingness of their members to engage in KS and emphasise the importance of spreading their knowledge and individual experiences (Kim & Lee, 2006; Jolaee et al, 2014). Many previous studies have, nevertheless, found that academics in HE institutions are idiosyncratic and unmotivated to share their knowledge, for various reasons, but often because of preoccupation with individual or discipline-orientated success, rather than the goals of their organisation (Tan, 2016; Fullwood & Rowley, 2017; Charband & Navimipour, 2018). Clearly there is a need to understand this issue and find evidentially based recommendations to ensure that such a valuable resource is fully engaged and contributing maximally to organisational goals.

Researchers have identified numerous barriers and inducements to the success of KS in academic environments and analysed them to greater or lesser extents (Howell & Annansingh, 2013; Fullwood & Rowley, 2017; Akosile & Olatokun, 2019; Hosen et al, 2022). Most studies are selective about the factors they examine for practical reasons, because the research reflects a particular focus, or because it addresses specific research gaps.

Research in this field to date has all been conducted in gender-mixed environments. Gender is often recorded as a demographic, useful to eliminate "noise" from results. I.e. any gender asymmetries in the results are treated as moderating the factors under consideration, with little analysis of their intrinsic value. This is because conditions in gender-mixed work environments are largely assumed to be equivalent for men and women. Heisig & Kannan (2020), following a systematic review, and Joshi et al (2015) both highlighted the need to include gender-related factors in KM research, to better establish if gender matters. They point out that gender asymmetry has been largely neglected in the KS and KM field. To fill this important gap, this paper outlines research to explore factors commonly held to enhance or inhibit KS, but uses a female only cohort, from the gender-unmixed academic environment of a female-only campus in a university that has a policy of gender segregation. The King Saud University has two campuses, each having academic staff, administrators, and students of one gender only.

2. Conceptual Context

There are many definitions of KM, one that is widely accepted from Beadles et al (2005) is that KM represents the full exploitation of an organisation's knowledge assets in pursuit of its goals. KS can be characterised as a social interaction between individuals or groups that results in the exchange of their experiences or knowledge (Lin, 2007). While KS is a conscious act, there are unconscious forces at play too, represented as barriers that prevent or inhibit it (Zheng, 2017), *Figure 1.*



Source: Zheng, 2017.

Figure 1. A Simplified Representation of KS Exchange

2.1 The Theory of Planned Behaviour

The Theory of Planned Behaviour (TPB) (Ajzen, 1991), and variants of it, are frequently used to analyse KS behaviours and the factors that affect them (Kuo & Young, 2008), including in HE. It posits that the best predictor of behaviour is intention, which is a product of three constructs, attitude toward the behaviour, subjective norms and perceived behavioural control (PBC). Attitude is the extent to which an individual is favourably or unfavourably disposed towards a particular action. Subjective norm is the product of a person's social and environmental surroundings and the perception of control an individual has: the expectations of important people or groups of people to the individual is central to this perception (Kuo & Young, 2008). PBC is about volitional control, i.e. the perceived difficulty of behaving in a particular way, it addresses an individual's concerns with wide-ranging factors including opportunities, skills, enough money, and information technology (Ajzen, 2020). The three constructs of the theory combined show that someone will have strong intentions to perform a given action if their attitude to it is positive, if they believe that important others think they should perform it and if they recognise that resources at their disposal are not limiting.

2.2 Conceptual Framework And Research Hypothesesa

Riege (2005, 2007), following an extensive review of business sector literature, identified and classified ~36 barriers to KS into three classes, individual (personal), organisational and technological, which have, before and since, by many authors, been treated as antecedents to the three constructs of the TPB. Following an extensive literature review, the most important, i.e., most likely to occur and most likely to be influential, of these barriers are identified and incorporated in a context-specific conceptual framework (*Figure 2*) conforming with the TPB.

The model presented here was designed for this research based on the TPB (Ajzen, 1991) and the work of Riege (2005; 2007). It hypothesises the antecedent factors likely to affect the three constructs predicted to influence KS intentions: 1. Individual (Reputation, Rewards and Self-Efficacy) antecedents to *Attitude*; 2. Organisational (Climate & Culture, Leadership/Top Management Support, Trust, Social Networks, Vision and Goals) antecedents to *Subjective Norm*; and 3. Technological (IT Infrastructure, IT Applications & Usage) antecedents to *Perceived Behavioural Control*. All three constructs affect *Intention* to act, which is the best predictor of behaviour (Ajzen, 1991).

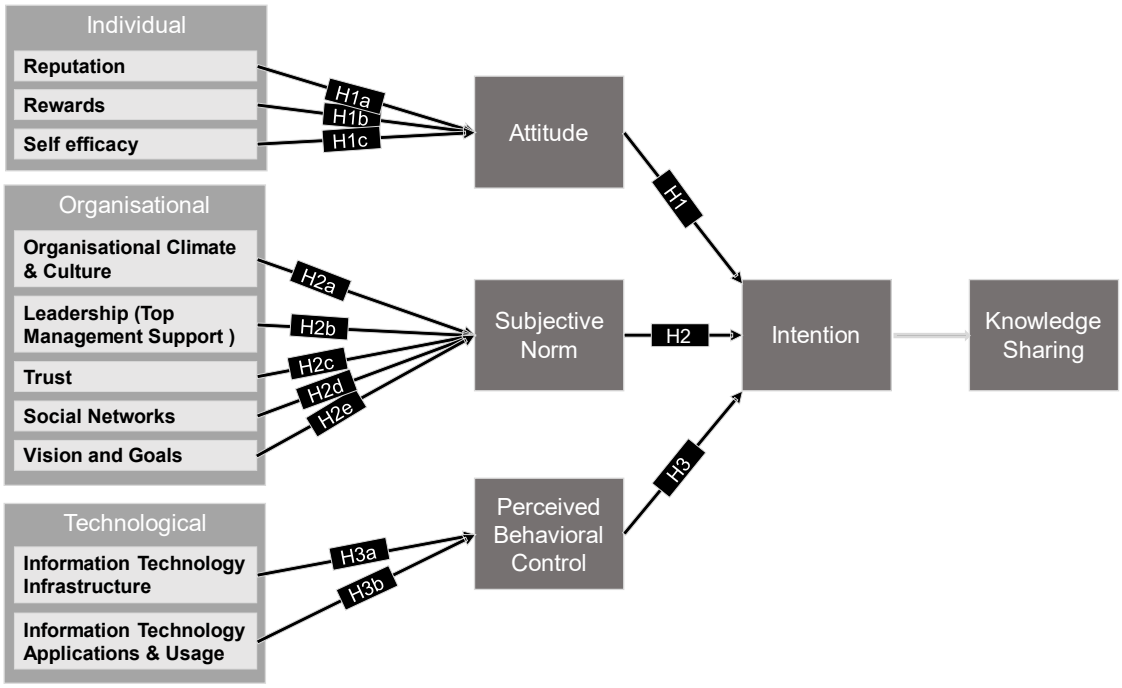


Figure 2: The Conceptual Framework

The research landscape for this research is the female-only campus of the King Saud University, Kingdom of Saudi Arabia. The hypotheses underpinning the conceptual framework, designed to statistically test the validity, direction and scale of each TPB construct and antecedent effect, are set out below.

2.2.1 Individual factors

Hypothesis 1 Attitude in female academics positively affects intention to KS.

An individual's attitude to KS is positively affected by the following antecedent factors in female academics.

H1a Reputation.

H1b Rewards.

H1c Self-efficacy.

2.2.2 Organisational factors

Hypothesis 2 Subjective Norm among female academics positively affects intention to KS.

An individual's subjective norm to KS is positively affected by the following antecedent factors.

H2a Organisational culture.

H2b Leadership/top management support.

H2c Trust.

H2d Social networks.

H2e Vision and goals.

2.2.3 Technological factors

Hypothesis 3 Technological factors experienced by female academics positively affect intention to KS.

An individual's perceived behavioural control (PBC) is positively affected by the following antecedent factors.

H3a IT infrastructure.

H3b IT applications and usage.

3. Methodology

The hypotheses will be tested by a mixed-method approach, considered most appropriate because it combines the strengths of qualitative and quantitative data while limiting their weaknesses (Creswell & Plano Clark, 2011). Quantitative data will be collected via a questionnaire survey, with the questions drawn from previously published studies and modified to suit this research landscape. Qualitative data will be elicited from in-depth interviews with female academics. Appropriate statistical analyses will be used to quantify the most important barriers and inducements to KS.

4. Expected Results and Benefits

This paper outlines a research project to establish the most important factors affecting KS between female academics at a university that systematically separates females from males.

Previous research has demonstrated that KS is vital to the success of KM in universities and that active KS can be encouraged. However, university administrators should identify and understand the obstacles to it, then work to enhance participation by using motivators which improve academics' intention to KS with colleagues. This study will identify the factors, whether individual, organisational, or technological, most likely to influence the KS of female university academics and determine if the influence is positive (inducement) or negative (barrier), and quantify the extent of the influence. Therefore, it will result in an evidential basis for administrators to act upon. The results will strengthen understandings of KS behaviour among female academics in an educational organisation implementing a policy of gender separation and, therefore, contribute to bridging the knowledge gap regarding differences in KS behaviours between men and women.

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Ecotourism Capital as an Enabler of Positive Change in Tourism Sustainability

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Abstract: Despite a global commitment to minimise the impact of tourism on the environment and maximise its benefits for local communities, the pressure of tourism on natural resources is still increasing. In this context, ecotourism becomes key to safeguarding the integrity of the ecosystem while producing economic benefits that can ultimately encourage the conservation of the environment. However, despite its benefits, there is still a need to develop the market presence of ecotourism strategies and initiatives. Thus, tourists' positive intention toward ecotourism and organisations that seek to meet the demand of the increasingly environmentally conscious market are key to the success of ecotourism initiatives. In the context of the information era, organisations may create a trustworthy relationship with ecotourists by providing them with accurate and engaging information on their environmental policies and actions. This relationship may result in the emergence of a critical intangible asset such as eco-tourism capital as tourists' decisions are based on image, perception and recommendations from social groups. For organisations to benefit from eco-tourism capital, they should use social media to generate opportunities for eco-tourists to experience and appreciate nature, respect local cultures, support local communities and minimise and mitigate their negative impact on the environment. Based on the above, the aim of this study is to explore, via a descriptive analysis of data collected from international ecotourists, how social media can be used to create eco-tourism capital. To that aim, we explore factors relating to ecotourism knowledge, green trust, and exposure to information on social media provided by ecotourism service providers.

Keywords: Knowledge management, Ecotourism, Social media, Ecotourism capital, Ecotourism knowledge, Green trust

1. Introduction

1.1 Ecotourism Capital and its Contribution to Literature

Literature agrees on the potential of a knowledge management (KM) approach to tourism management. In particular, KM strategies and tools can assist tourism organisations in their efforts to learn and address the challenges related to environmental change. In fact, KM is perceived as a key antecedent for the innovation capability of tourism organisations (Baker and Yusof 2017), whilst organisational learning can help tourism companies become more resilient and better able to cope with uncertainties derived from changes in environmental policies and regulations (Leta and Chan 2021).

The considerations above point towards the need for organisations to turn their knowledge assets into agile structures to respond to the socio-economic challenges that emerge as a result of current and future sustainability-related issues, increased business competition and continuous social changes. In the presence of a framework for its exploitation, the ability to generate knowledge of ecotourism as a result of interactions between trusted ecotourism stakeholders enables individuals and communities to drive positive environmental change. This paper understands this ability to generate knowledge of ecotourism as ecotourism capital.

Ecotourism capital is defined in the context of this research as the result of combining an individual's ecotourism background with access to trusted sources of environmental knowledge. Such knowledge could range from principles of environmental conservation to sustainable tourism practices. We argue that in the current socio-economic environment, ecotourism capital becomes a key driver for sustainable development, leading tourists to look for opportunities to experience and appreciate nature, wildlife and local cultures while supporting local communities and minimising their negative impact on the environment.

1.2 Components of Ecotourism Capital

In the last two decades, information and communication technologies have increasingly enabled social interactions and the sharing of information and knowledge among individuals and communities. Social media,

for example, have often become a source of inspiration and recommendation of tourism products and services (Osei, Mensah, and Amenumey 2018). In this context, we propose that ecotourism capital is defined by three main components, namely ecotourism knowledge, ecotourism information exposure on social media and green trust.

Ecotourism knowledge is a concept used in the literature but does not benefit from a clear definition (Björk 2004, Tian et al. 2016). Therefore, in the same way that environmental knowledge is defined as how somebody expresses concern about ecological issues (Cegarra-Navarro and Martinez 2010), this study proposes to define ecotourism knowledge as the expression of an individual's concern about ecotourism products and services and its impact on the environment. Thus, in this study, ecotourism knowledge is related to environmental issues derived from tourism, allowing ecotourists to understand the direct and indirect impact of their actions and those of the industry on the environment (Mondino and Beery 2019).

In addition, to allow the ecotourists to get a holistic perspective of the implications of ecotourism, we propose that ecotourism knowledge must be drawn from various sources and related to a broad range of ecotourism services and product types. Finally, in the context of social media, the addition and combination of individuals' ecotourism knowledge can generate collective ecotourism knowledge that can provide the ecotourists with in-depth and diverse information and activate knowledge structures supporting new understanding of the concept (Björk 2004, Kimmerle et al. 2015).

Based on the above, ecotourists can access broad and deep ecotourism knowledge via ecotourism information exposure on social media (Hudson and Thal 2013). Indeed, social media can be regarded as a hub of knowledge (Zareie and Jafari Navimipour 2016) that offers a public forum for travellers to engage with one another and other ecotourism stakeholders and exchange ideas and knowledge. Therefore, social media provides a platform for interaction and communication where ecotourists knowledge and ideas about specific ecotourism products and services are actively generated and exchanged (Lee, Park, and Nam 2020, Leung et al. 2013).

However, the amount of information to which an ecotourist can be exposed on social media can be overwhelming and consist of unwarranted, outdated, and erroneous information (Carpenter and Harvey 2019, Chen, Xiao, and Kumar 2023, Neo 2022). Therefore, to be valuable to ecotourists, the information found online must be trustworthy. According to (Nekmahmud, Ramkissoon, and Fekete-Farkas 2022), green trust can be defined as an individual's propensity to rely on environmentally sustainable products or services based on performance, reliability, efficacy, credibility, and previous qualities (p.3). Then, the information provided by the ecotourism stakeholders should meet ecotourists' expectations regarding environmental insights, credibility and warranty. Indeed, ecotourists may not trust a piece of information online due to excessive exaggeration and vagueness (Nekmahmud, Ramkissoon, and Fekete-Farkas 2022).

2. Methodology

Data was gathered using an online questionnaire developed with Google Forms tool. The questionnaire was distributed on Facebook, Instagram and LinkedIn. To ensure our sample was composed of ecotourists that use social media, we filter the questionnaire by adding the next question: Do you get information about ecotourism products and services on social media? (Commercials, posts of your friends, Facebook groups, influencers...). A total of 98 answers were received. After the responses of the participants who answered "no" to the question were excluded, we collected 67 valid questionnaires. Data were analysed using SPSS software.

The average age of the participants is 37 years old. 53.7% are female and 43.3% are male, identifying the rest as "other". Those with postgraduate studies represent almost 60% of the sample. The sample was international as the survey was distributed via social media (see Appendix). Finally, Facebook is the social network most used by the sample (80.6%), followed by Instagram (79.1%) and YouTube (70.1%).

The scales used to measure the variables were the next:

- Ecotourism knowledge was measured using the scale of Zhou and Li (2012) and Nekmahmud, Ramkissoon, and Fekete-Farkas (2022). The next four items were used: EKB1 - I am aware of different sources of information about eco-tourism; EKB2 - I know about a variety eco-tourism services and products types; ETK2 - I am very knowledgeable about environmental issues derived from tourism; and ETK3 - Using eco-tourism products/services is one of the most effective ways to reduce my environmental impact.
- The scale of Nekmahmud, Ramkissoon, and Fekete-Farkas (2022) was used to measure Green Trust: GT1 - Information about ecotourism products and services is generally reliable; GT3 - Information

about ecotourism products and services meets my expectations regarding environmental issues; and GT4 - Information about ecotourism products and services keeps promises and commitments for environmental protection.

- The Eco-information exposure variable was measured by adapting the scale of Lee, Park, and Nam (2020): EIE1 - I get a lot of ecotourism products/services information through social media; EIE2 - I frequently get tourist information about ecotourism products/services through social media; and EIE3 - I actively use social media to obtain tourist information about ecotourism products/services.

As we operationalised Eco-tourism capital as a second-order formative construct, we used the two-stage approach (Sarstedt et al. 2019). The first stage provided us with the score of ecotourism knowledge, green trust, and eco-information exposure without including the second-order construct in the model. The second stage uses these scores to measure the second-order construct (eco-tourism capital). Once the psychometric properties of the measures had been checked, the next step was the evaluation of both discriminant and convergent validity. Figure 1 summarises the results of the confirmatory factor analysis reflective-formative type.

As shown in Figure 1, the three first-order variables are composites, not factors. Indeed, when using the original scales, the indicators changed over time due to the passage of time and the dynamic of the companies, so the scales were converted from factors to composites (Cegarra-Navarro et al. 2021). For this reason, we have adapted the scales and the items to the current situation of companies in the eco-tourism sector (Cegarra-Navarro et al. 2021).

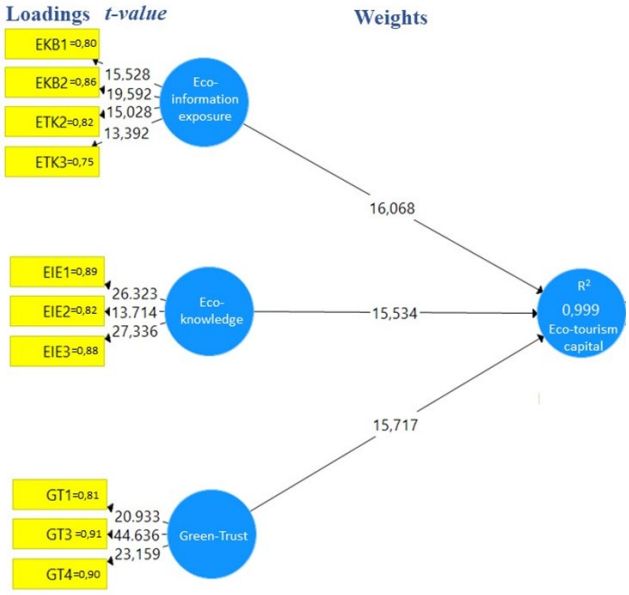


Figure 1: Research Model

3. Results

The initial results of the study allowed for the elaboration of a second-order factor leading to the creation of the "eco-tourism capital" variable. Indeed, the data analysis allowed to consider eco-tourism knowledge, exposure to eco-tourism information and green trust formative constructs of Eco-tourism capital. Therefore, accessing and sharing trusted sources of ecotourism information online potentially leads individuals to use their knowledge of the environment to become agents of positive change in sustainability efforts.

According to our results, we can consider eco-tourism capital as the result of the abilities of social media users concerned with reducing their tourism environmental footprint to find, sort, discern, trust and understand the information they are exposed to online and transform it into valuable knowledge.

Social media is used by all tourism stakeholders to share ecotourism information. For instance, travellers use social media before (e.g., to choose their destination and accommodations), during (e.g., for orientation and navigation, to determine attractions to visit) and after their trip (to share their experiences and to post reviews). Therefore, from a collective perspective, social media allowing for the dissemination and sharing of this

information act as an instrument for the development of eco-tourism capital and thus support the generation of valuable knowledge related to the mitigation of tourism's environmental footprint.

4. Conclusions

This paper has described the fundamentals of a research that is currently in progress. Its aim is to contribute to the literature on the potential relationships between technology developments and tourism sustainability, with emphasis on the role of knowledge management. In this regard, the results of this study contribute to knowledge management field showing that eco-tourism capital is the result of a process of continuous learning that derives from the trust of tourists, previous green knowledge and exposure to information. By exploring how social media affect individuals' behavioural intentions towards the environment, our future efforts will first seek to inform the potential of social technologies to lead sustainability practices. In particular, we are interested in informing theory, practice and policies that support environmental education while promoting opportunities for tourists to experience and appreciate Nature, wildlife and local cultures while minimising their negative impact on the environment. Afterwards, we will focus on validating the proposed new construct of ecotourism capital through research aimed at a larger sample of the ecotourism population. We will also test new elements influencing the concept of ecotourism capital.

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Appendix 1: Country Where the Participants Live

Country	Absolute value	Percentage
Spain	12	17.9%
France	24	35.8%
United Kingdom	17	25.4%
Poland	1	1.5%
Saudi Arabia	1	1.5%
United States of America	2	2.9%
Chile	1	1.5%
Algeria	4	6%
New Zealand	1	1.5%
Portugal	1	1.5%
India	1	1.5%
Netherlands	1	1.5%
Italy	1	1.5%

Navigating the Challenges of Deduplicating Actors in Historical Letter Exchanges

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Abstract: This paper outlines ongoing research to standardize the metadata of letters from Finnish cultural heritage organizations to build a comprehensive archive for studying 19th-century epistolary culture in the Grand Duchy of Finland (1808/09-1917), as a part of the Constellations of Correspondence (CoCo) project. The challenge of deduplicating and reconciling actors and their associated information is an important problem faced in historical knowledge databases. The actors, e.g., senders and recipients of letters, can be individual people, couples, or families as well as organizations like institutions or companies. The deduplication described in this article has its focus on the individual people. The solutions we propose in this paper are significant for the development of the efficient and accurate approaches in this field.

Keywords: Actor deduplication, Historical correspondence, Epistolary data, Semantic web, Knowledge graphs

1. Introduction

The initial phase of the Constellations of Correspondence (CoCo) consortium (Tuominen et al, 2022) has involved collecting metadata on 19th-century correspondence from different institutions across Finland. This data was generated in various formats and is currently undergoing standardization, as outlined in Drobac et al (2023), to conform to a unified data model. Once the data has been harmonized, it will be possible to publish it as a consistent dataset on the Semantic Web.

The critical component of the harmonization process is the deduplication and consolidation of actors, a challenging task due to the frequent occurrence of spelling variations, abbreviations, or errors in data. In historical material people can be referred to using multiple name variations: for example, Georg Zacharias Forsman was later known as Yrjö Sakari Yrjö-Koskinen. Furthermore, the existence of multiple individuals with identical names (e.g., cousins often had the same names) requires considering biographical information to disambiguate them. The completeness of such information varies between the data sources and actors, where we have plenty of information for prominent historical figures, but little for others.

In Europe, there exist numerous digital humanities initiatives that gather well-curated metadata (i.e., detailed information regarding senders, recipients, dates, and locations) from edited letter collections, including Europeana[1] (Doerr, 2010), ePistolarium[2] (Ravenek et al., 2017), SKILLNET[3], correspSearch (Dumont S. et al 2021), NorKorr (Rockenberger et al, 2019), and EMLO (Hotson et al., 2019). Although the mentioned projects provide valuable insights on actor deduplication, our task with unedited collections poses significant challenges as a substantial proportion of actors lack information beyond their correspondence. Thus, it is crucial for us to use available data on actors' social circle to develop accurate deduplication and reconciliation models. Our pioneering work presents unique challenges that have yet to be tackled in the field.

2. Data

The CoCo dataset primarily includes information about the sender, recipient, date of sending, and the number of letters exchanged. Supplementary details, such as the place of sending, language used, or people mentioned in the letter content, may also be provided. The dataset currently contains 359,246 letters and 39,884 actors, of which 6,376 (16%) have been linked to external sources.

To facilitate the information comparison process, we have two pools of actor information: the *CoCo Pool*, which comes from our source data, and the *CSV Pool*, which comes from external databases. These pools offer

[1]http://www.europeana.eu

[2]http://ckcc.huygens.knaw.nl/epistolarium/

[3]https://skillnet.nl

two main benefits: they save computing time by reducing the need for external database requests and allow us to take advantage of existing information comparison tools while optimizing our system development resources.

The CSV pool is generated to facilitate the disambiguation task, collecting external biographical information for historical actors from databases like Wikidata and Finnish actor ontologies like AcademySampo[4], BiographySampo[5], and Kanto[6]. This information includes the years of living, gender, place of birth, residence, death, variations of names, and IDs in external databases. The actors in the collection are limited to those living during the so-called *Long 19th century*, matching the main temporal period of correspondences in CoCo. Furthermore, when choosing a candidate entry from Wikidata, we prioritize actors with connections to Nordic countries, e.g., having entries in Nordic databases, or having lifetime activities or family relations related to Finland. The amount of data available for a single actor can vary between external sources, so the idea behind using an assembled database gathers and completes information from various available sources.

3. Deduplication Methods

The process of deduplication can be divided into a series of steps. First, we identify potential matching candidates. Next, we assign a confidence score to each potential match. Finally, we decide on whether to merge the records or not.

3.1 Candidate Matching

When it comes to candidate matching, we can compare candidates from the *CoCo Pool* and the *CSV Pool*. Since our data is limited in terms of actor information, matches with actors from the *CSV Pool* can help us identify duplicates. For example, if we have one person with two names in *CoCo Pool*, we can match each of the names with the same record in the *CSV Pool* to deduce that both names belong to the same person, as shown in Figure 1.

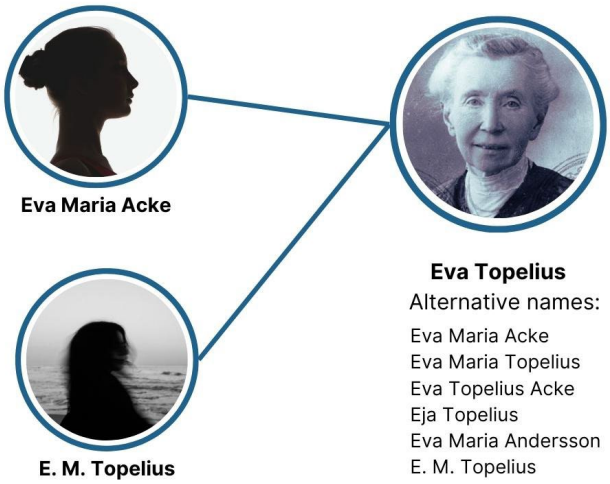


Figure 1: Eva Maria Acke and E. M. Topelius are the Same Person as They Both Correspond to an External Source Named Eva Topelius, Albeit Under Different Names. Eva's Picture Credit: Wikipedia

We can use various methods for candidate matching, with the most straightforward being name string matching and time matching.

String matching includes rules where we compare two strings and look for similarity. To accommodate expected irregularities, we incorporate a fuzzy string match by using the Jaro-Winkler score to determine the similarity of two strings. We define a threshold score for each rule to determine whether two names are the same. Another approach is described by Ulfves (2022), who has explored matching names by their phonetic

[4] https://akatemiasampo.fi/en/

[5] http://biografiasampo.fi/

[6] https://www.kiwi.fi/display/Toimijakuvailupalvelu/About+Kanto+in+English

similarity, which is particularly useful for historical records from a time when there was not standardized writing practice.

For time matching, we compare a time relative position to another time window. For example, we compare the start of active correspondence and the date of birth. In this rule, if the actor's active correspondence start time is earlier or too close to the actor's date of birth, then it is less likely that the match is accurate.

The final approach that we have explored to create matching candidates is a machine learning approach. We have trained word embeddings on the combined *CoCo Pool* and *CSV Pool* datasets. Then, we have computed cosine similarity of the name vectors, which gives us a distance score of different names in the vector space. This method works very well to identify potential matches; however, it gives wide results that need to be further filtered with other scoring methods.

3.2 Scoring

After identifying potential matches, it is crucial to score them to decide whether they are duplicate names of the same person or not. A higher matching score indicates greater accuracy in matching. We obtain confidence scores from the process of creating matching candidates using similarity measures, both for strings and vectors. Additionally, time matching can also provide a defined score based on overlap. However, to improve the system's accuracy, we've explored additional methods to score matches. These scores can be combined with the initial ones for a more comprehensive measure.

One of the additional scoring methods is the name frequency. Candidates with uncommon names are more likely to be the same person. Name frequency can be calculated from our datasets or historical person registers.

Another useful scoring method is derived from the correspondence network of first and second-degree connections. If candidates have not exchanged letters with each other or have overlapping social circles, there is a higher probability that they are the same person. For example, by examining the correspondence network in Figure 2, we can determine that Eljas Lönnrot (1822-1883) is not the same person as the famous Elias Lönnrot (1822-1884) since he sent a letter to him. On the other hand, Elias Lönnroth (bottom right) is likely the famous writer since he corresponded with members of the Fellman family, like the famous Elias. The fourth actor, Eljas Lönnrot (1895-1924), has a different correspondence circle and is a different person.

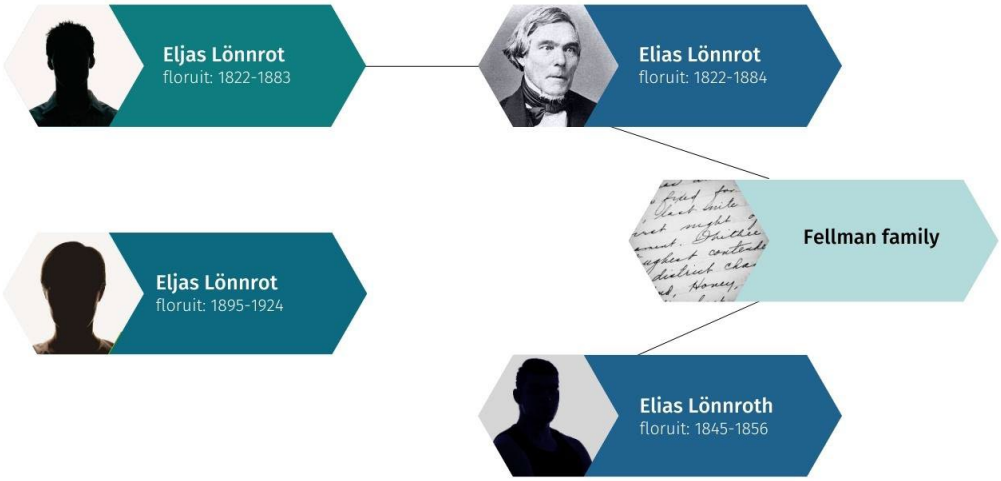


Figure 2: An Example of Four Actors who Share Similar or Identical Names and Have Matching Floruit Years. In This Scenario, the two Actors on the Right-Hand Side of the Image Were Identified as the Same Person. Elias' picture credit: Wikipedia

To get the social network scores, we have transformed correspondence metadata into vector space to measure the distance between persons who have conversed in similar social circles. The smaller the distance between matching candidates in vector space, the closer they were in the social circle.

Finally, by combining scores from different comparison methods, we obtain a scored list of deduplication candidates that can either be automatically accepted if the score is above a certain threshold or further manually checked by an expert.

3.3 Decision on Merging

To determine whether to combine two actors or not, we must rely on scores and a predefined threshold. If the level of confidence is remarkably high, the merging decision can be automated, or else a human expert can assess the matching candidates above a particular threshold and make a judgment. Alternatively, a neural classifier can be trained, which would utilize various scores and training data from prior manual decision-making to make informed predictions.

It is crucial to maintain a high level of accuracy while merging records, as well as to preserve provenance, which includes information about all the actions taken and the original data. Historians are the ultimate end-users, and it is vital to provide them with reliable information sources for their historical research. Consequently, the threshold for automated merging should be highly certain, and human decision-making must be cautious and precise, with no uncertain merging.

4. Discussion and Conclusions

This paper outlines the practices to create a strong and efficient process for removing duplicate person names. We employ a combination of string-matching algorithms, rule-based approaches, and machine learning techniques to generate a precise and scalable deduplication method.

Two critical aspects of our work are still under development. The first is how to utilize the scoring information to determine which match is accurate. While the intuitive approach is to sum all the scores and establish a threshold for the sum to qualify as a match, we need to explore alternative processing methods, such as a weighted scoring system, where certain scores are given greater importance.

The second issue is measuring the quality of the matching results. We must find an optimal balance between precision and completeness and evaluate the matching result accurately. At present, we rely on expert human evaluators to assess the results, which is time-consuming and limits the number of linkages evaluated. Additionally, we must re-evaluate results every time we modify the process, and this would be more convenient if we had a golden standard in place, which we are yet to develop.

Finally, to achieve maximum impact and facilitate the adoption of this deduplication method in future projects, it is crucial to develop a scalable and easily reusable method that can be easily applied to other datasets.

Acknowledgements

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Bringing Novices From the Passive Role in Knowledge Sharing to the Active Role

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Abstract: Purpose: The nature of firm competition between firms and the source of competitive advantage in many industries has shifted toward a knowledge-based economy. This is particularly the case in knowledge intensive industries, wherein a firm's competitive advantage is highly dependent on its ability to generate and deploy new knowledge solutions. Although knowledge management (KM) is relevant to all organizations, it is likely that its importance is higher at some functional units like maintenance. The field of industrial maintenance is complex and knowledge-intensive. Typically, industrial maintenance knowledge is inaccessible due to industry policies and practices; furthermore, motivation to share knowledge is low or inexistent, due to its tacit and complex nature. Despite these difficulties, sharing knowledge between experienced workers and managers, on one hand, and novices and new comers, on the other hand, is a fundamental problem in industrial maintenance settings, and about which there is still much to be known. The current research reports an investigation aimed at increasing knowledge sharing (KS) between novices and other workers in industrial maintenance. Design/Methodology/Approach: A quantitative field longitudinal research was carried out at a maintenance department of a high-tech company. The research included three steps: the first one assessed the current situation of KM and KS in the department; the second one implemented a number of training programs aimed to increase KS between novices and the rest of the department; and the third one collected information about KM and KS, to assess changes between the two observation moments. Findings: Novices can take an active role in KM and KS in maintenance departments of high-tech industries, rather than a passive role, which can significantly facilitate and improve their own and other employees' knowledge while moderately enhancing the culture of knowledge sharing. Practical Implications: sharing knowledge is a very challenging issue to maintenance managers, faced with risks and problems that need to be acquired by novices. The current research helps knowledge-intensive companies by highlighting solutions that can be designed and adapted to improve employees' knowledge and also KS. Originality/Value: Empowering novices to transition from a passive role in knowledge sharing to an active one, while simultaneously improving their knowledge and also KS practices in industrial maintenance through their involvement.

Keywords: Knowledge management, Knowledge sharing, Industrial maintenance, Novices, Physical asset management, Knowledge sharing barriers

1. Introduction

In today's fast-paced and competitive industrial environment, the importance of KM and KS cannot be overstated (Iheukwumere-Esotu and Yunusa Kaltungo, 2020). Effective KM and KS can help organizations to reduce costs, increase efficiency, improve performance, and achieve a competitive advantage. KM is viewed as an increasingly important discipline that promotes the creation, sharing, and leveraging of the corporation's knowledge (Becerra-Fernandez and Sabherwal, 2014). KM was initially defined as the process of applying a systematic approach to the capture, structuring, management, and dissemination of knowledge throughout an organization to work faster, reuse best practices, and reduce costly rework from project to project (Nonaka and Takeuchi, 1995). Knowledge has been classified and characterized from several points of view to individual, social, causal, conditional, relational, tacit, explicit, pragmatic (Alavi and Leidner, 2001) embodied, encoded, and procedural (Venzin et al., 1998). An important classification of knowledge views it as tacit or explicit (Polanyi and Sen, 2009). Explicit knowledge is knowledge that has been expressed into words and can be shared formally and systematically in the form of data, specifications, manuals, drawings, audio and video, computer programs, patents, and so on (Becerra-Fernandez and Sabherwal, 2014). Among processes of KM, KS has been identified as the most vital one (Asrar-ul-Haq and Anwar, 2016). KS has been identified as the most important process for facilitating organizational learning and innovation and is critical to organizations that wish to use their knowledge as an asset to achieve competitive advantage. The major focus of KS is on the individual who can explicate, encode, and communicate knowledge to other individuals, groups, and organizations (King, 2011).

In the context of industrial maintenance, KM and KS are critical for ensuring optimal performance, safety, and reliability of equipment and systems (Cárcel-Carrasco and Cárcel-Carrasco, 2021). Maintenance is defined as "the combination of all of technical, administrative and managerial actions performed during life cycle of an item intended to retain it in, or restore it to, a state in which it can perform the required function" (Márquez, 2007). The field of industrial maintenance is complex and knowledge-intensive (Aromaa et al., 2015). However,

despite the recognized importance of KM and KS, many organizations struggle to implement effective KS practices, particularly when it comes to new or inexperienced employees. Maintenance managers must strongly consider how to transfer expertise and knowledge from experts who have it to novices who need to know (Hinds et al., 2001). An important effect of maintenance KS is that it will transfer maintenance expertise between experts and novices. Novices and newcomers often have valuable insights and fresh perspectives that can contribute to the organization's overall knowledge base, but they may not have the same level of expertise and experience as their more experienced colleagues.

Difficulty in educating and training novices has been identified as one of the most important barriers of KS at maintenance (Chirumalla et al., 2015). To address this challenge, this paper explores a novel approach to KM and KS in an industrial maintenance setting. Specifically, this study has involved novices and newcomers in the KS process by assigning them tasks and using them as lecturers in the presence of experienced colleagues. By doing so, this study aims to facilitate KS between novice employees and their more experienced colleagues.

The paper describes the methodology used to implement this approach, as well as the results and outcomes achieved. It also discusses the implications of this approach for KM and KS in industrial maintenance settings, and provide recommendations for organizations seeking to improve their KS practices. Overall, this paper highlights the importance of involving novices and newcomers in the KS process, and demonstrates a practical and effective approach for facilitating KS in industrial maintenance settings.

2. Method

For this study, a quantitative approach was utilized, and a questionnaire was administered. The questionnaire used in this study is a combination of four previously developed and utilized questionnaires by researchers. A quantitative approach was employed, utilizing a questionnaire with closed-ended questions. The study was conducted at a high-tech industry's maintenance department, which employs 103 personnel among the company's 1250 employees. To collect data, a questionnaire with 66 closed-ended questions that measure KM and KS related variables was distributed among the maintenance personnel. Next, 14 novices and new comers were selected, and new and challenging tasks were assigned to them, which they were not experts in. They were given two months to prepare training content and materials in whatever format they wanted, such as Word documents, PDFs, PowerPoint presentations, and videos. During this period, four follow-up meetings were held with the novices to facilitate document preparation and remove any obstacles, and the novices presented their progress.

After two months, experts on the selected topics and employees who needed to know about the topics were selected by the sub-department managers. Then semi-formal training sessions were conducted, in which the novices taught the topics and experts were present to correct any misinformation in this semi-formal atmosphere. The teachers who taught in the program were novices and lacked expertise in the topic they taught. Similarly, the learners who participated in the program were not experts in the topic they learned. On the other hand, the experts who participated in the program were specialists in the topic they were assigned. It is important to note that some participants had multiple roles. For instance, a teacher who taught one topic also participated as a learner in another topic. To have a control group, 21.3% of employees were excluded from the program.

After the program was completed (which lasted for five months), the same questionnaire was distributed to measure the current level of knowledge, as well as the KM and KS variables. Furthermore, additional questions were added to the questionnaire for the second round of data collection. Finally, the data was analyzed using descriptive statistics to assess the impact of the training program on KS and knowledge of participants.

3. Findings and Discussion

The study categorized participants based on their job level, education level, and responsibilities. It investigated the extent to which participants' knowledge improved during the program and the effectiveness of the program in the opinion of various participant categories. The study also examined whether participants across different categories agreed to extend the program. Additionally, the study explored the desired roles of participants in the program, including that of teacher, learner, expert, or a combination of roles.

3.1 Improvement in Knowledge

According to the questionnaire, 67% of learners who attended the program reported an improvement in their knowledge. In addition, 77% of experts and 90% of teachers reported an improvement in their knowledge.

Overall, 71% of all participants reported an improvement in their knowledge, and the level of knowledge among participants in the program improved by 43.9%. All participants, regardless of their role (learner, expert, teacher (novice or newcomer)), reported an improvement in their knowledge as a result of their participation in the program. This is particularly noteworthy considering the short duration of the program and the fact that the training was provided by novices. Table 1 presents the percentage of participants who reported an improvement in their knowledge, categorized by the role they played in the program.

Table 1: Knowledge Improvement Base on the Role in the Program

Role in the program	Learners	Experts	Teachers (novices and new comers)	Overall
Percentage of participants reporting improvement in knowledge	67%	77%	90%	71%

Table 2 displays the knowledge levels of participants in the taught topic before and after the training by novices. The table is categorized by education level and also presents the percentage of change in knowledge and table 3 shows improvement in knowledge based on position level.

Table 2: Improvement in Knowledge Based on Education Level

Education level	Diploma	Associate	Bachelor	Master	PhD	Overall
Average knowledge level prior to Program (scored out of 7)	3.53	3.39	3.52	2.5	6	3.46
Average knowledge level after program completion (scored out of 7)	5.3	5.09	4.86	4.82	7	4.98
Percentage of change	+50%	+50%	+75.5%	+92.5%	+16.6%	43.9%

Table 3: Improvement in Knowledge Based on Position Level

Job level (position)	Technician	Foreman	Expert	Boss	Manager	Director
Average knowledge level prior to program (scored out of 7)	3.34	4.4	3.09	4.37	3.5	2
Average knowledge level after program completion (scored out of 7)	5	5.8	4.27	5	6	6
Percentage of change	+49.7%	+31.8%	+38.1%	+14.4%	+71.4%	+200%

3.2 Effectiveness of the Program (Training by Novices)

Participants were asked to provide feedback on the effectiveness of the program. Table 4 displays the effectiveness of the program based on the job level of the participants, while Table 5 presents the effectiveness of the program based on their education level.

Table 4: Effectiveness of Program Based on job Level (Position)

Job level (position)	Technician	Foreman	Expert	Boss	Manager	Director	overall
Percentage of participants who found the program effective	55.1%	80 %	57.1%	62.5%	100%	100%	58.5%

Table 5: Effectiveness of Program Based on Education

Education level	Diploma	Associate	Bachelor	Master	PhD
Percentage of participants who found the program effective	63.6%	56.3%	56.4%	60%	100%

3.3 Agree to Extend (Continuation of) the Program

Participants were asked another question regarding their agreement with extending the program. Table 6 shows the percentage of participants who agreed with extending the program based on their job level (position), while Table 7 presents the percentage of those who agreed based on their education levels.

Table 6: Agree to Extend the Program Based on Position

Job level (Position)	Technician	Forman	Expert	Boss	Manager	Director	Overall
Agree to extend the program	56.5%	60%	57.1%	62.5%	100%	100%	58%

Table 7: Agree to Continue the Program Based on Education

Education level	Diploma	Associate	Bachelor	Master	PhD
Agree to continue the program	77.3%	59.4%	48.7%	40%	100%

3.4 Desired Roles

Participants were also asked to indicate their preferred role in the program, which included being a teacher, a learner, an expert, or a combination of these roles. Table 8 shows the results for each role.

Table 8: Desired Role of Participants

Desired role in KM and KS program	Teacher	Leaner	Expert	Teacher and Learner	Teacher and Expert	Learner and Expert	Teacher and (Learner or Expert)	Not answered
percentage	9.7%	50.5%	12.6%	6.8%	1.9%	1.9%	7.8%	8.7%

3.5 Other Findings

The findings of this study indicate that the program has resulted in a modest increase of 3.9% in KS among participants. Additionally, the participants' perception of the culture of KS has increased by 4.6%, but statistically, the difference is not significant. According to the results from the additional questions in the second round of data collection, participants have stated that the main problem with the program has been a lack of motivation. They suggested that the program should be connected and related to their career promotion as an improvement. Interestingly, the control group, who did not participate but were aware of the program, reported an increase in barriers to KS by 12.3%. These results suggest that while the program may have had some positive impact on KS, it may also have inadvertently created new barriers for non-participants.

4. Conclusion

There have been numerous studies on KM in various industrial and service sectors, but typically the focus is on general management, accounting, R&D, development activities, information technology (IT), and similar areas, with less attention given to maintenance units (Cárcel-Carrasco et al., 2020). Within maintenance departments of companies, KM can be challenging due to the tendency of technicians to rely on their own experience rather than sharing and explaining their knowledge of operations (Cárcel-Carrasco et al., 2020).

In this study, the high levels of reported knowledge improvement among learners, experts, and teachers (67%, 77%, and 90%, respectively) suggest that this approach has been effective for a wide range of participants, regardless of their level of experience. This approach has the potential to foster a culture of continuous learning and development, where all employees are empowered to share their knowledge and expertise. Utilizing novices and newcomers as trainers in an industrial maintenance setting has proven to be an effective means of enhancing KM and KS among colleagues. Despite being conducted by novices and newcomers, the trainings have resulted in a significant increase in knowledge for experts, learners, and novices alike, specifically in the area being taught. Moreover, the increase in knowledge is substantial, even though the training was conducted over a short period of time. The findings of this study demonstrate that this approach has resulted in noteworthy improvements in the participants' knowledge, with an overall increase of 43.9% in knowledge improvement. The findings of this study also indicate that the use of novices as trainers has been

particularly effective for novices and new comers, with a knowledge improvement rate of 56.52%. This suggests that this approach may be particularly beneficial for organizations that are looking to support the onboarding and development of their new employees. It is also important that most participants preferred to have the role of learner, indicating a need for further investigation to change their attitudes and make them more willing to take on other roles.

One of the most effective ways to learn is by adopting a mindset that allows the learner to teach the material to others. This approach not only helps learners to deepen their understanding of the subject matter, but it also helps them to retain the information more effectively. When learners attempt to teach a concept to someone else, they must organize the material in a way that is easy to understand and follow. This process forces them to break down complex ideas into simple, digestible parts, and helps them to identify any gaps in their knowledge or areas where they need more practice. Moreover, teaching others also requires learners to think critically about the material and consider different perspectives and approaches to the subject matter. By doing so, they gain a more comprehensive understanding of the material and are better equipped to apply their knowledge in practical settings.

In conclusion, the findings of this study suggest that the implemented program has had a meaningful positive impact on the participants' knowledge. Although the increase in KS and culture of KS was not statistically significant, participants reported finding the program effective and agreed to continue it. AS KS is a cultural and multidimensional subject, longer-term implementation of the program may be needed for more significant improvement in KS and its culture. Overall, this study has demonstrated the potential benefits of using novices and new comers as trainers in an industrial maintenance setting. By embracing this approach, organizations can enhance their KM and KS practices, promote a culture of continuous learning, and support the development of their employees.

Implications of the research to the theory and to the practice: This research makes a significant contribution to the theory of KM by emphasizing the importance of KS in knowledge-intensive departments like industrial maintenance, specifically highlighting the involvement of novices in the KM process. By empowering novices to actively participate in KS, the research enhances the culture of KS, improves employees' knowledge, and offers practical solutions for maintenance managers in knowledge-intensive industries. This contribution expands upon existing knowledge by highlighting the active role that novices can play in KS practices.

Limitation: The findings of this study are limited by the fact that data were collected from only one company, thus limiting the generalizability of the results. Future research should aim to replicate these findings in other companies to enhance the external validity of the study.

Managerial Implication: Managers can utilize this approach to empower novices by shifting them from the passive side of KM and KS to the active side, while also increasing the knowledge of their employees and enhancing KS.

Future Works: While the results of this study are promising, there are still areas for future research. One key area for future research is to investigate how to scale this approach across other departments and larger organizations and explore the potential barriers to implementing this approach on a larger scale. Additionally, more research is needed to explore the long-term impact of this approach on employee development and organizational performance. Also in order to further advance this research, future studies could focus on identifying the issues or limitations of the program. This could be achieved through conducting interviews or questionnaires with participants to gather feedback and suggestions for improvement. Additionally, exploring the long-term effectiveness and sustainability of the program could also be a valuable area for future research.

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Renewal Capital Matters: Comparison Between Lithuania and Taiwan

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Abstract: In a hyper-competition era with the shadows by COVID-19 pandemic, nations as well as companies are competing for talents, high-technologies and innovations to sustain the economic performance and competitiveness. This study compares the NIC of two small economies, Lithuania and Taiwan, that both perform better than most countries during the pandemic, aiming to understand their next steps to sustain the successfulness after the pandemic. The study utilized the ELSS (Edvinsson, Lin, Stahle and Stahle) model (Stahle et al., 2015) with 48 indicators collected from the World Competitiveness Yearbook to measure the degree of NIC. Based on 20 years (2001-2020) national intellectual capital (NIC) panel data, the descriptive analysis reveals that Lithuania lags behind Taiwan renewal capital. However, Lithuania's market capital and process capital have great improvement over the past 20 years and are catching up with those of Taiwan. The renewal capital mainly consists of R&D spending/GDP, business R&D spending, cooperation between corporations and universities, venture capital, entrepreneurship, development and application of technology and 6 other renewal relevant indicators. From the perspective of NIC, the gap of GDP per capita between Lithuania and Taiwan corresponds to the difference of renewal capital between these two countries. The results show the significance of renewal capital. Those who are unable to attract, retain talents and slow in technology renewal will not be competitive and sustainable. We suggest that Lithuania utilize its short-term NIC to boost up economic development, then invest more in talent development and technology advancement to ensure its sustainability.

Keywords: National intellectual capital, Renewal capital, Technology advancement, Competitiveness, Panel data

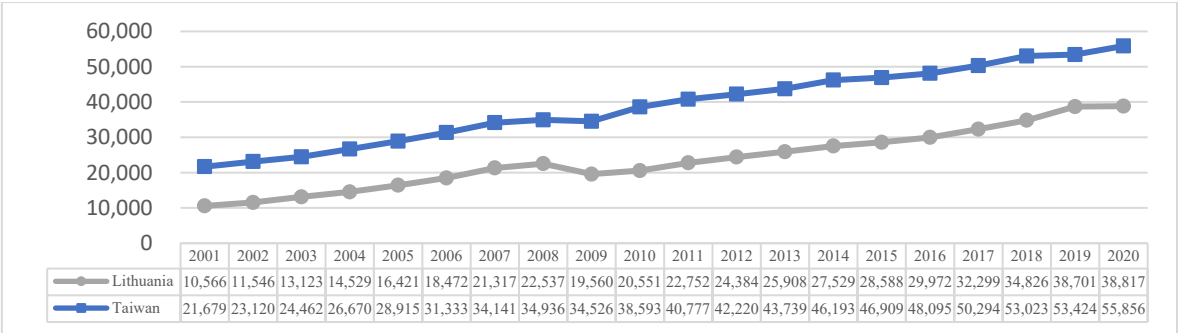
1. Introduction

The COVID-19 pandemic has impacted the global economy and led to a global economic downturn, with many countries experiencing recessions or significant slowdowns in economic growth. However, some countries performed better than others during the pandemic, such as Taiwan and Lithuania (Lee, Hu, & Kung, 2022; Martinho, 2021). This study compares and analyzes Lithuania and Taiwan's national intellectual capital performance to find out the next steps to sustain their economic performance after the pandemic.

Taiwan's economic performance during the COVID-19 pandemic has been relatively robust compared to many other countries. The government's effective response to the pandemic, strong healthcare system, resilient export-oriented economy, strong manufacturing sector, and digital transformation efforts played significant roles in mitigating the economic impact and contributed to its relatively strong economic performance during the COVID-19 pandemic.

Lithuania experienced significant economic challenges during the COVID-19 pandemic. The pandemic profoundly impacted various sectors of the economy, but Lithuania managed to navigate through the crisis relatively well compared to some other European countries. While Lithuania experienced an economic contraction during the pandemic, the country's resilient export sector, government support measures, and the gradual recovery of economic activities have helped mitigate the impact (Nakrošis & Bortkevičiūtė, 2022). Lithuania remains focused on promoting economic growth, attracting investments, and enhancing its competitiveness as it emerges from the pandemic

Figure 1 shows the progression of GDP per capita. Taiwan's GDP per capita remains higher than that of Lithuania and the gap keeps growing slowly from 2001 to 2018. Both Taiwan and Lithuania show continuous improvements in GDP per capita despite the drop from the financial crisis in 2009. Taiwan's GDP per capita remains almost unchanged in 2009, followed by a great increase in 2010 and then shows steady progression until 2020. Lithuania's GDP per capita dropped severely in 2009 and kept a slow growth until 2019.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Lithuania	10,566	11,546	13,123	14,529	16,421	18,472	21,317	22,537	19,560	20,551	22,752	24,384	25,908	27,529	28,588	29,972	32,299	34,826	38,701	38,817
Taiwan	21,679	23,120	24,462	26,670	28,915	31,333	34,141	34,936	34,526	38,593	40,777	42,220	43,739	46,193	46,909	48,095	50,294	53,023	53,424	55,856

Figure 1: GDP per Capital from 2001 to 2020

2. Intellectual Capital

Initially considered as the difference between a firm's market value and the book value, intellectual capital is defined as "intellectual material-knowledge, information, intellectual property, experience- that can be put to use to create wealth" (Stewart, 1997). It gives a country a competitive advantage and is widely recognized as a critical force driving economic growth (Lin, 2018). The NIC mainly consists of four subcategories: human capital (HC), market capital (MC), process capital (PC) and renewal capital (RC) (Bontis, 2004; Lee, Lin & Lin, 2017; Lin, 2018), described hereunder.

Human capital represents individuals' knowledge, expertise, competencies, skills, intuition, wisdom, and ability to achieve national tasks and goals (Bontis, 2004; Lin and Edvinsson, 2011). Typically considered as the most essential link in the value creation process, human capital is a source of innovation, strategic renewal, and a resource for developing and cultivating other intellectual assets (Curado, Henriques & Bontis, 2011).

Market capital refers to the assets in a nation's relationship with international markets (Lin and Edvinsson, 2011) and its capability to provide a desirable, competitive solution to its international clients' needs (Bontis, 2004). As a type of social intelligence in national intra-interrelationships, the focal area entails legal relationships, market mechanisms, social networks, customer or national loyalty, flexibility and adaptability, resilience of the economy (Lee *et al*., 2017; Lin, 2018).

As the non-human reservoir of knowledge embedded in a nation's technological, information, and communication systems (Bontis, 2004), process capital is the cooperation and flow of knowledge requiring structural intellectual assets (Lin and Edvinsson, 2011). The assets in the focal point include information systems, laboratories, national infrastructure, quality scientific research institutions, and a legal environment for entrepreneurship (Lin, 2018).

Renewal capital is a nation's capability and investments in increasing its competitive advantage for future growth and intellectual wealth. As a country's ability to create, sustain and develop competitive strength, renewal capital includes investments in novel, innovative entrepreneurship activities (Lee *et al*., 2017); some assets include investments in research and developments, patents, the number of scientific publications, total expenditure on R&D and capacity for innovation (Lin, 2018).

3. NIC of the two Countries

This section introduces the data collected and methods, the NIC profile of Lithuania and Taiwan, and the correlation of each dimension of NIC with GDP per capita (PPP).

3.1 Data and Methods

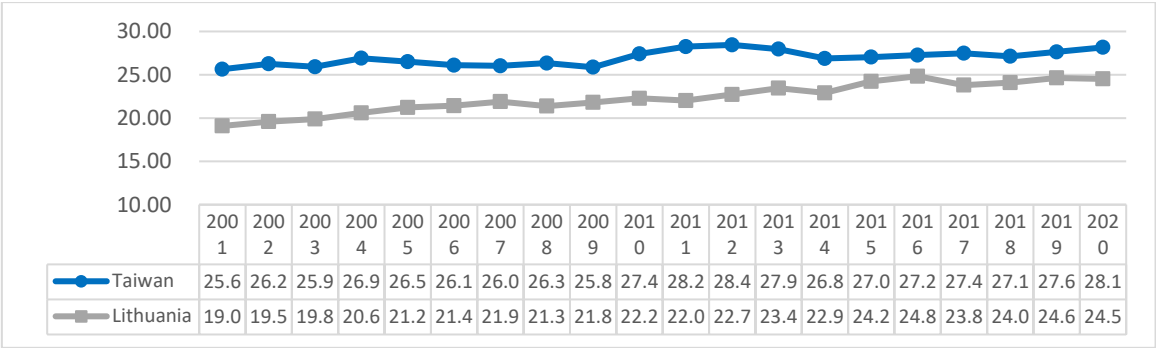
This study utilized the ELSS model which contains 48 indicators (Stahle, Stahle and Lin, 2015) to measure NIC. Table 2 shows the indicators in the model. Based on the model, we collected the data from World Competitiveness Yearbook from 2001 to 2020.

Two types of data are provided in the database: absolute value data, such as "patents per capita" and qualitative rating data based on a scale of 1 to 10, such as "image of country". To integrate the absolute data and qualitative rating, each absolute data is transformed to the number into a 1-10 score by dividing to the highest value of each variable and multiplied by 10. We repeat the data transformation procedures for all absolute value indicators of all four component capitals. We average the 12 indicators to form the score of each component capital and sum up the four component capitals to measure the overall NIC.

This study uses descriptive analysis from the data ranging from 2001 to 2020 to compare each dimension of NIC of Lithuania and Taiwan and the correlations among the dimensions and GDP per capital (ppp).

3.2 NIC Profile of the two Countries

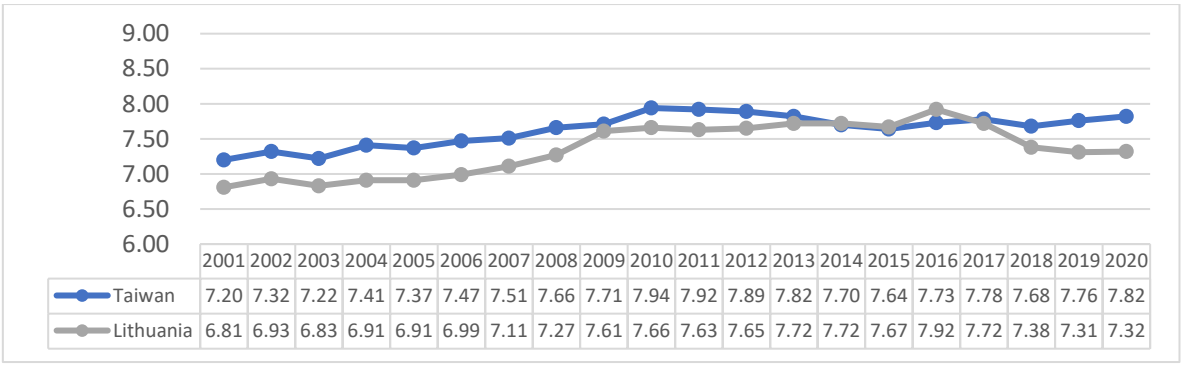
Figures 2-6 show Lithuania and Taiwan's overall NIC, HC, MC, PC and RC trends. Figure 2 shows that Lithuania remains lower in NIC level but the gap continues to narrow. Lithuania has greatly improved during the 20 years from NIC degree of 19.09 to 24.52. On the contrary, despite the higher degree of NIC, Taiwan only shows limited progress.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Taiwan	25.6	26.2	25.9	26.9	26.5	26.1	26.0	26.3	25.8	27.4	28.2	28.4	27.9	26.8	27.0	27.2	27.4	27.1	27.6	28.1
Lithuania	19.0	19.5	19.8	20.6	21.2	21.4	21.9	21.3	21.8	22.2	22.0	22.7	23.4	22.9	24.2	24.8	23.8	24.0	24.6	24.5

Figure 2: Overall NIC from 2001 to 2020

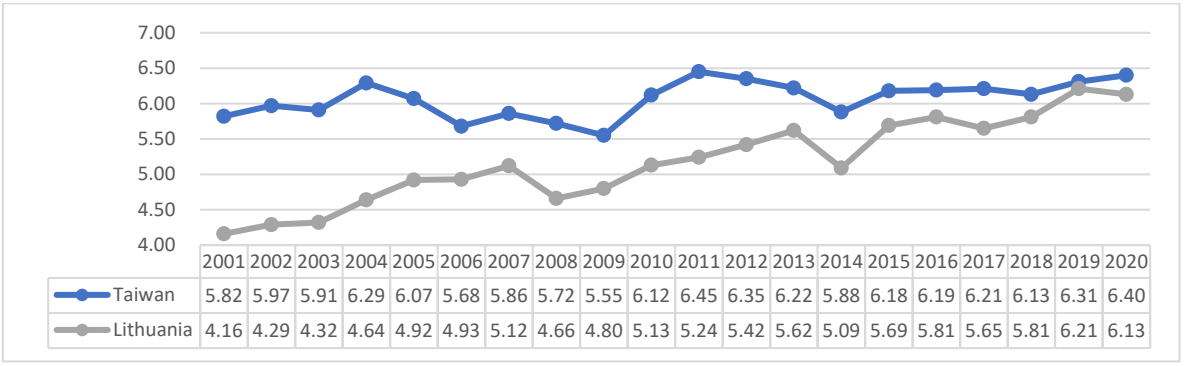
Figure 3 shows that Taiwan and Lithuania experienced HC improvements over this period. Taiwan generally had a higher HC than Lithuania throughout these years. From 2014 to 2016, Lithuania caught up with Taiwan, even higher than Taiwan. However, after 2017, Lithuania's HC lagged behind Taiwan and regressed to the same level in 2008.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Taiwan	7.20	7.32	7.22	7.41	7.37	7.47	7.51	7.66	7.71	7.94	7.92	7.89	7.82	7.70	7.64	7.73	7.78	7.68	7.76	7.82
Lithuania	6.81	6.93	6.83	6.91	6.91	6.99	7.11	7.27	7.61	7.66	7.63	7.65	7.72	7.72	7.67	7.92	7.72	7.38	7.31	7.32

Figure 3: HC from 2001 to 2020

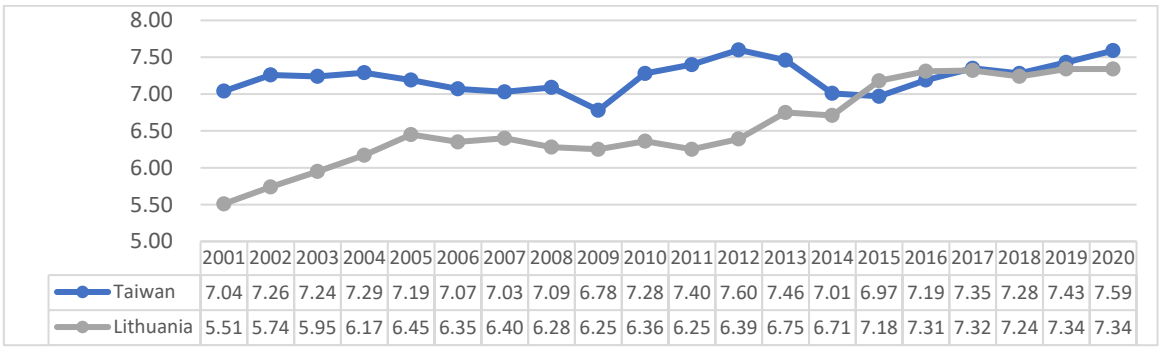
Figure 4 shows that although Lithuania's MC lagged largely behind Taiwan in 2001, it continued to catch up afterward. Taiwan and Lithuania have had similar fluctuations within the 20 years, but Lithuania has made much progress and finally reached a similar level with Taiwan.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Taiwan	5.82	5.97	5.91	6.29	6.07	5.68	5.86	5.72	5.55	6.12	6.45	6.35	6.22	5.88	6.18	6.19	6.21	6.13	6.31	6.40
Lithuania	4.16	4.29	4.32	4.64	4.92	4.93	5.12	4.66	4.80	5.13	5.24	5.42	5.62	5.09	5.69	5.81	5.65	5.81	6.21	6.13

Figure 4: MC from 2001 to 2020

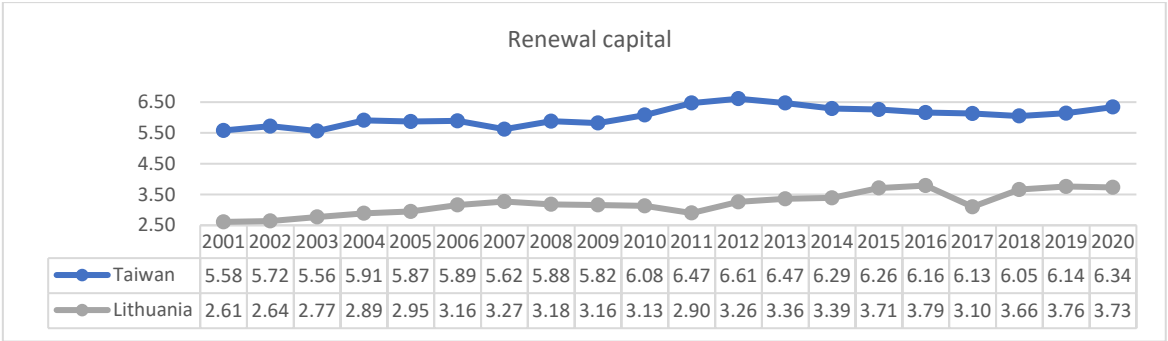
Figure 5 shows a similar pattern with MC. Lithuania lagged largely behind Taiwan in 2001 but showed steady progress afterward and reached almost the same level as Taiwan. On the contrary, Taiwan exhibits fluctuations and shows only a tiny improvement during these 20 years.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Taiwan	7.04	7.26	7.24	7.29	7.19	7.07	7.03	7.09	6.78	7.28	7.40	7.60	7.46	7.01	6.97	7.19	7.35	7.28	7.43	7.59
Lithuania	5.51	5.74	5.95	6.17	6.45	6.35	6.40	6.28	6.25	6.36	6.25	6.39	6.75	6.71	7.18	7.31	7.32	7.24	7.34	7.34

Figure 5: PC from 2001 to 2020

Figure 6 shows a considerable gap between Taiwan and Lithuania regarding RC. Both Taiwan and Lithuania have shown slow improvement during these 20 years. Although Lithuania exhibits a greater increase in RC than Taiwan, it still largely falls behind Taiwan.



	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Taiwan	5.58	5.72	5.56	5.91	5.87	5.89	5.62	5.88	5.82	6.08	6.47	6.61	6.47	6.29	6.26	6.16	6.13	6.05	6.14	6.34
Lithuania	2.61	2.64	2.77	2.89	2.95	3.16	3.27	3.18	3.16	3.13	2.90	3.26	3.36	3.39	3.71	3.79	3.10	3.66	3.76	3.73

Figure 6: RC from 2001 to 2020

4. Conclusion

From the comparison of overall NIC and each dimension of NIC, Lithuania shows generally steady improvement for most of the NIC dimensions, and its HC, MC, and PC even once had similar levels with Taiwan or higher than Taiwan. The only significant gap appears in its RC. The apparent difference in RC results in the remaining gap of NIC between Lithuania and Taiwan.

The comparison of the NIC's four components and GDP per capita indicates that the disparity between GDP per capita of Lithuania and Taiwan may result from the gap in RC. In other words, the difference in RC explains the difference in GDP per capita between the two countries. Innovation, the ratio of business enterprises' R&D expenditures to GDP and the share of R&D investment in the high-tech sector are all testified to directly increase GDP (Acheampong, Dzator, Dzator, & Salim, 2022; Falk, 2007). Moreover, this study finds that the impact of renewal capital on GDP per capita may be so critical. Even Lithuania's HC, MC and PC reach the same levels with Taiwan's, its GDP per capita still lags behind Taiwan because of the gap of RC.

Therefore, for Lithuania to increase its GDP per capita, it can increase its RC and HC in the long term and try to maintain the MC and PC in the short term. Lithuania's MC and PC become lower than Taiwan's after 2018 and indicates a warning for Lithuania to maintain the investment in MC and PC to support the long-term improvement of HC and RC. With the investment in MC and PC to build a competitive, sound and welcoming environment, HC and RC could thus be developed and accumulated based on the environments. It might take continuous and enormous investment to improve HC and RC in Lithuania. Nevertheless, due to the significant impacts of RC on GDP per capita, it is crucial for Lithuania to invest in RC in pursuing national economic development.

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Understanding Organizational Knowledge Loss (OKL): A Bibliometric Analysis

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Abstract: *Purpose* – Organizational knowledge loss (OKL) is an urgent problem in the field of knowledge management because it can have a negative impact on intellectual capital and leads to significant competitive disadvantages for the companies concerned. In academic research, this phenomenon is considered a consequence of knowledge risks, especially when experts possess valuable knowledge and leave a knowledge-intensive organization. However, a basic understanding of the conceptual structure of OKL remains elusive. *Methodology* – To address the existing knowledge gap, we conducted a bibliometric analysis based on a network and factor-oriented approach to identify the key themes, contexts, and patterns of OKL. For this purpose, we obtained bibliometric data from the Web of Science and the Scopus databases. Using the advanced bibliometrics package Biblioshiny in R, we conducted performance analysis and science mapping. *Findings* – Based on our four research questions, we present the following key findings: First, we find that annual science production in the field of OKL research over the period 2004 to 2023 peaks in 2022. Second, we found that absorptive capacity (AC) is increasingly becoming a central theme in OKL research. Third, the average citation rate per year for OKL research has declined noticeably since 2020. Fourth, the most influential publications in OKL research deal with AC in the context of strategic alliances. *Research limitations* – This study focuses solely on researching the conceptual structure and thus does not consider the intellectual and social structure of OKL. *Practical implications* – In view of the results obtained, we recommend that future research work should further investigate the relationship between OKL as a focus of organizational forgetting and AC as a learning ability in an innovation environment. *Originality/value* – This paper is insightful, as it reveals the conceptual structure and thematic evolution of OKL and directs research interest to the field of learning organizations.

Keywords: Bibliometric analysis, Organizational knowledge loss, Knowledge management, Absorptive capacity, Intellectual capital, Strategic alliances

1. Introduction

Taxonomically, OKL can be seen as a focus of organizational forgetting caused accidentally by human-based risks (Mariano, Casey and Olivera, 2020, p. 197). For example, an age-related retirement of employees can lead to OKL (Levallet and Chan, 2019; Massingham, 2018). Otherwise, OKL can be caused by a technical fault, such as a computer breakdown (Durst and Zieba, 2019, p. 8). As an outcome of knowledge risks, OKL negatively impacts intellectual capital, causing competency gaps, lower productivity, poor decision-making, and difficulties addressing challenges or adapting to market changes (Massingham, 2018, p. 755). The majority of the studies focus on OKL's taxonomy and its impact on intellectual capital. In this investigation, we explore OKL's conceptual structure and thematic evolution, aiming to identify areas requiring more research attention. We seek to provide organizations and researchers insights into this relevant topic by examining four research questions:

RQ1. How has OKL research's annual scientific production evolved over time?

RQ2. How have the main themes and patterns in OKL research evolved over time?

RQ3. How has the average citation rate per year of OKL research evolved over time?

RQ4. What are the most influential publications in OKL research?

2. Methodology

Our research approach combines performance analysis and science mapping to identify and visualize the conceptual structure of OKL (Di Vaio et al., 2021; Donthu et al., 2021). In our approach, we conducted a descriptive and trend, a co-word, and a citation analysis (Di Vaio et al., 2021). By applying inclusion and exclusion criteria, we selected relevant publications from the Scopus and Web of Science databases, resulting in 594 publications. The data preparation process involved refining the dataset by removing publications not thematically connected to our research focus. This yielded 146 publications from the fields of management

and business available for analysis. In the final stage of our investigation, we utilized the Biblioshiny tool in R for visualization purposes. This tool is widely accepted within the research community and offers a specialized application area for conceptual analyses, proving useful for our research focus (Aria and Cuccurullo, 2017).

3. Findings

3.1 RQ1: Annual Scientific Production in OKL Research from 2004 to 2023

Figure 1 illustrates that our dataset contains publications spanning 19 years, specifically from 2004 to 2023. The lowest publication rate is observed from 2004 to 2014, with fewer than ten publications per year. However, there is only a minimal upward trend from 2015 to 2018. Interestingly, research on OKL studies has been rapidly increasing since 2022. Namely, 25 studies were published during this year. A sharp decline in 2023 can be attributed to the fact that the sample was collected in the first quarter of 2023, so there are fewer publications to analyse.

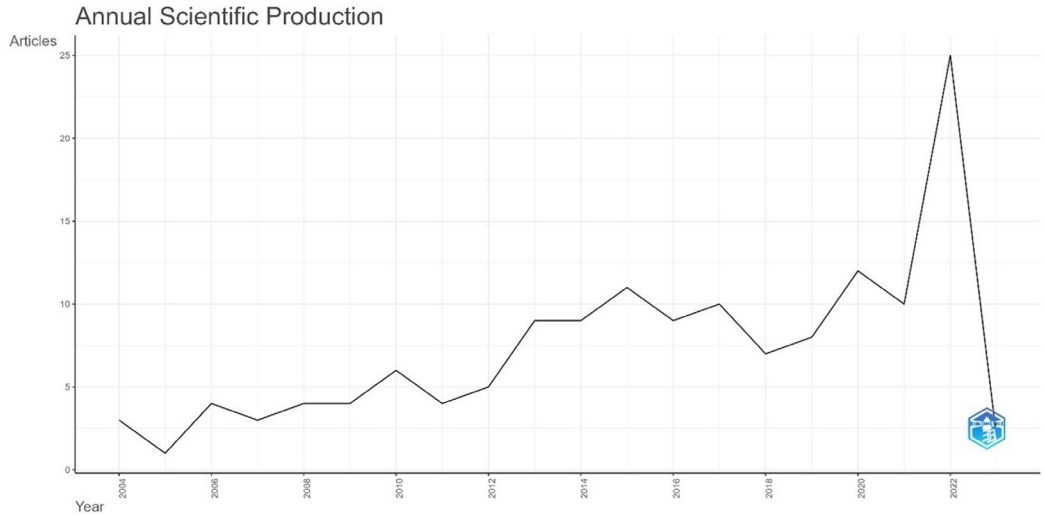


Figure 1: Annual Scientific Production in OKL Research from 2004 to 2023 (Generated by Biblioshiny)

3.2 RQ2: Thematic Evolution of OKL

3.2.1 Thematic Evolution Map of Author Keywords in OKL Research in Three Periods

The thematic evolution map of author keywords presented in Figure 2 indicates that during the first period (2004-2014), three thick edges from the keyword OKL are connected to the nodes "knowledge transfer", "knowledge sharing", and "tacit knowledge". Additionally, a thinner edge is connected to the node "knowledge management". Notably, in the second period (2015-2018), "absorptive capacity (AC)" emerged as a new keyword, and its thin edges extended to the nodes "AC" and "innovation" in the third period (2019-2023). While thick edges from the nodes "tacit knowledge", "knowledge sharing", and "knowledge management" are connected to the same nodes, a transition from the node "knowledge transfer" to "knowledge management" can be observed in the third period.

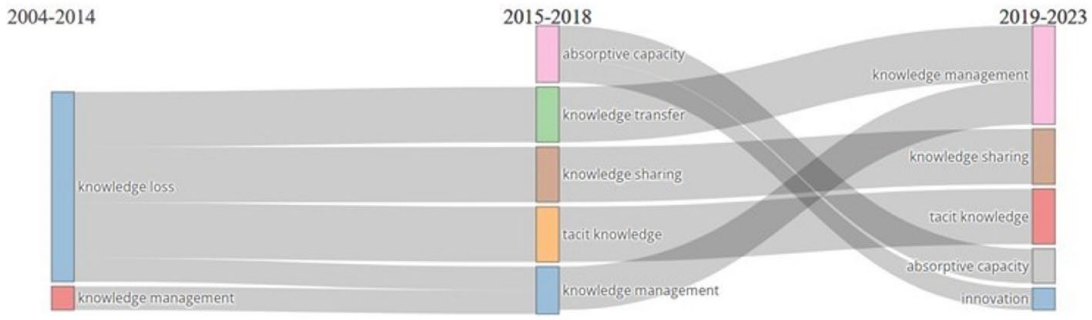


Figure 2: Thematic Evolution Map of Author Keywords in OKL Research in Three Periods (Generated by Biblioshiny)

3.2.2 Thematic map from 2015 to 2023

As seen in Figure 3, the second period, "AC" emerges as a niche theme related to "innovation", "unlearning", and "organizational forgetting". In the third period, "AC" is portrayed as a core theme in connection with "organizational forgetting" and "turnover" (Figure 4). In addition, "innovation", as an emerging keyword of AC, is depicted in the third period as a niche theme in relation to organizational unlearning.

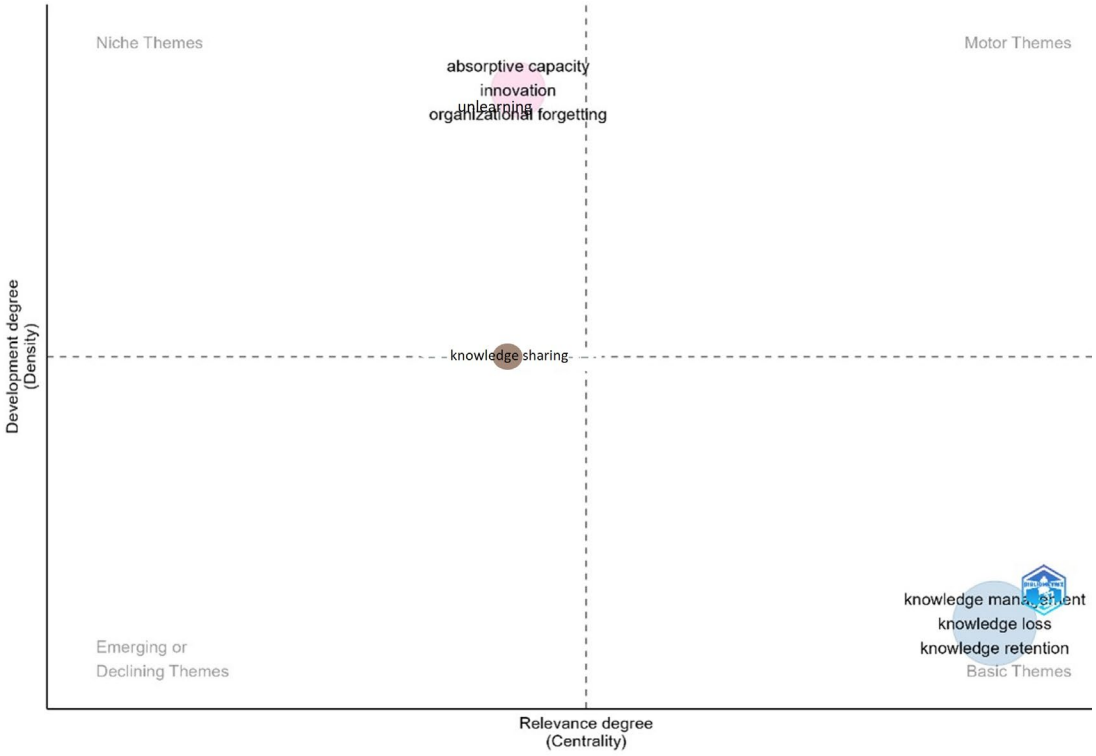


Figure 3: Thematic Map from 2015 to 2018 (Generated by Biblioshiny)

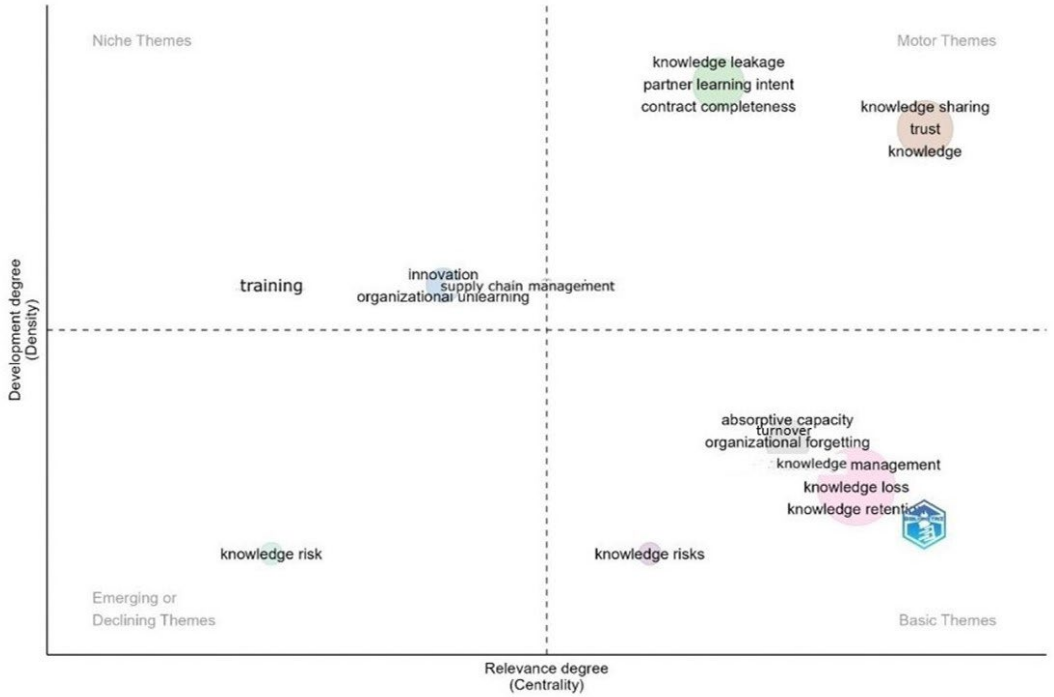


Figure 4: Thematic Map from 2019 to 2023 (generated by Biblioshiny)

3.2.3 Thematic evolution of Author Keywords on AC in OKL Research

As illustrated in Table 1, both components of the topic "AC" (absorptive capacity) have a low stability index (< 0.50), which may be due to the division into "AC" and "innovation" in the third period (2019-2023). The weighted inclusion index of 0.63 relating to "AC" highlights its thematic focus on AC. However, the inclusion index is 0.50, indicating a more robust connection of AC to the innovative environment.

Table 1: Thematic Evolution of Author Keywords on AC in OKL Research

From	To	Words	WII	II	O	SI
AC --2015-2018	innovation --2019-2023	innovation	0.40	0.50	2	0.20
AC --2015-2018	AC --2019-2023	AC; organizational forgetting	0.63	0.33	3	0.17

Note: WII= Weighted Inclusion Index, II=Inclusion Index, O=Occurrences, SI=Stability Index

3.3 RQ3: Average Citations per Year in OKL Research from 2004 to 2023

Figure 5 shows that the average citation frequency of publications fluctuates significantly over time. In 2004, the average citation frequency was above four and substantially decreased. The lowest citation rate was reached in 2007. In contrast, the citation rate increased sharply in 2010 and reached its peak in 2019, with an average of over seven citations. Contrary to our expectations, this trend has been declining since 2020. The low citation rate in 2023 corresponds to the citation rate for the first quarter and can only be assessed for this period.

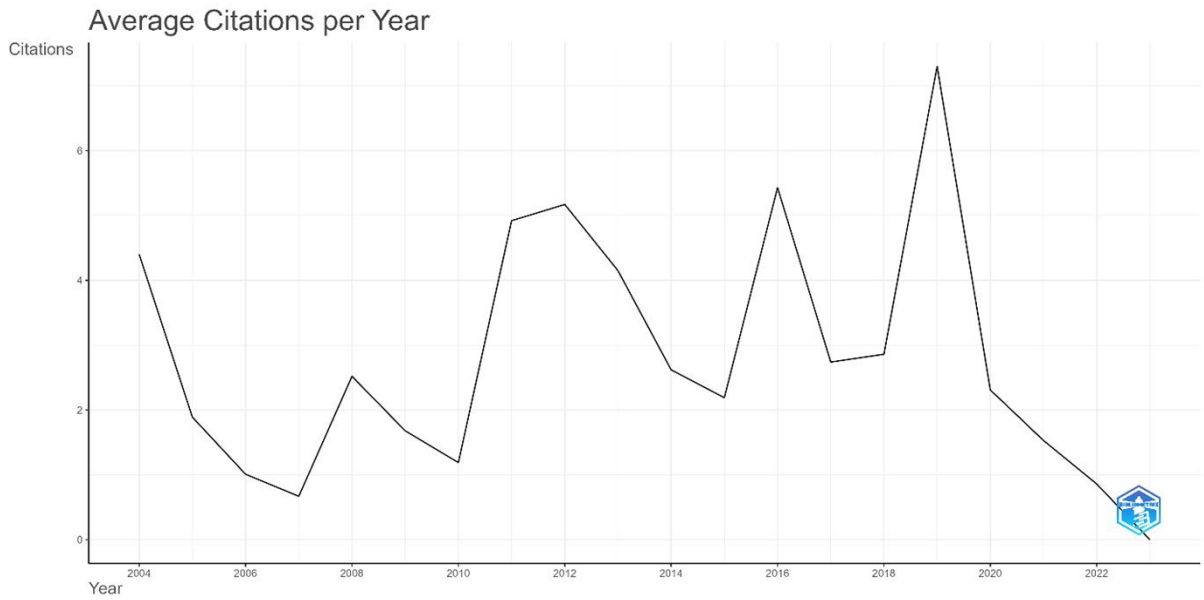


Figure 5: Average Citations per Year in OKL Research from 2004 to 2023 (Generated by Biblioshiny)

3.4 RQ4: Most Influential Publications in OKL Research from 2004 to 2023

Table 2 presents the results of the factorial analysis. Our factorial analysis reveals that Buckley (2004), Norman (2004), and Jiang et al. (2013) are the three most frequently cited publications on OKL. The studies listed in Table 2 all address various aspects of knowledge management and knowledge transfer in organizations. A core theme emerges from OKL in connection with strategic alliances and AC. The studies by Buckley (2004), Norman (2004), and Jiang et al. (2013) investigate OKL and strategic alliances. In Norman's (2004) study, an organization's AC is captured under the term of learning ability. Norman examined the relationship between a partner's learning ability and knowledge protection by the focal firm in high-technology product development alliances. Norman (2014) posited that a higher learning ability of the partner leads to higher knowledge protection of the focal firm. However, this relationship could not be verified. Jiang et al. (2013) found a positive relationship between the focal firm's competence trust and the partner firm's AC in alliance firms.

Buckley (2004) emphasized the importance of a "community of practice" to enhance AC at the group level in multinational enterprises.

Table 2: Most Influential Publications in OKL Research from 2004 to 2023

Paper	Total Citation	Findings
Norman (2004)	152	negative relationship between the learning capability of the partner firm and the knowledge protection in strategic alliances
Jiang et al. (2013)	140	positive relationship between competency trust and AC in strategic alliances
Buckley (2004)	108	positive relationship between the community of practice and AC in multinational enterprises

4. Conclusion

In examining the thematic evolution in the field of OKL research, three periods were identified (2004-2014, 2015-2018, and 2019-2023) based on the annual scientific production of OKL research. In the second period, the development of an organization's AC emerged as a niche topic and evolved into a foundational theme in the third period. The most influential publications in the first period on this topic demonstrate its relevance in minimizing OKL. In Norman's (2004) study, the concept is subsumed under an organization's learning ability, and there is a link to OKL through the topic of organizational forgetting. The context can be seen in an innovative environment within the framework of strategic alliances. The decline in the average citations per year in OKL research suggests that the focus in the field of innovation should concentrate on the relationship between OKL as a focus of organizational forgetting and AC as a learning ability. We predict that this topic will become a motor theme in the coming years, and research should focus on this area.

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The Workplace Podcast: Expanding Intraorganizational Knowledge Capacity

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Abstract: The capturing and the sharing of people's experiences, reflections, and learning can create value within any firm where knowledge is a regarded as a primary asset. Intraorganizational benefits of conversations captured via podcast-style recording and sharing have the potential to be a major facet of the modern art of knowledge management. Knowledge capture and sharing between members of an organization therefore may be able to create new capabilities for engagement that lead to useful knowledge resources. This paper will explore whether a designed conversation captured and shared through the podcast format and distribution method is more than just storytelling or experience sharing. It will then go on to assert that a designed method of creating this contextual knowledge artifact that is aligned to the organizational values and direction can contribute to an ingrained knowledge sharing disposition (i.e., a fundamental cultural shift). This designed conversation approach proves a dependable and scalable method to the elucidation of know how. Consider this structure being a tin-opener. It is a tool designed to open and get inside to the "canned" tacit knowledge. The resulting conversation could be knowledge of high value to the firm that is released from the minds of personnel. This paper will conclude by proposing a structure for a conversational podcast-like artifact designed to develop intraorganizational knowledge leading to organizational value.

Keywords: Knowledge management, Conversation theory, Intraorganizational knowledge, Organizational culture, Designing contextual knowledge, Podcast

1. Introduction

The problem is organizational knowledge loss caused by retirements, turnover, epidemics, lack of sharing, system errors, transfer, or forgetfulness. This loss can affect an organization's resilience (Zenk et al., 2021, Calnan et al., 2017, Dalkir, 2017). The central question of this paper is, "Can a designed contextual knowledge elicitation, via podcast format, help to address this concern?". An experiment leveraging qualitative research based on Conversation Theory will be conducted. This experiment will measure the value of elucidation and transference of codified, uncodified, and tacit knowledge intra-organizationally. This "work in progress" is an amalgamation of podcast conversation best practices conducted by Pioneer Knowledge Services which has conducted more than 300 podcasts.

The authors suggest organizations should consider nurturing a thriving work culture of knowledge exchange. This knowledge management approach can be aided by intentional conversations. According to the International Standards Organization, "A knowledge management culture acknowledges the value of individual and shared knowledge, as it benefits the organization" (Standardization, 2018). The problem of not having an effective knowledge sharing culture and a dearth of proven, modern methods to strengthen that culture. A 2021 survey of 39 organizations in 16 different countries concerning their use of social communications and collaboration technologies found, "… [an] average of 54% of communities do not use social technology to connect, share knowledge, and learn together" (Orangetrail, 2022). Opting out of social platforms seems implausible when such platforms are a part of our daily lives. This kind of mismatch between the sharing technologies that people use in their personal lives versus the ones they use at work has contributed to a lagging knowledge sharing disposition. The knowledge targeted in our approach is knowledge that is often not otherwise captured, created, tracked, or leveraged. This uncodified knowledge can be better leveraged toward organizational objectives by transforming it into codified knowledge (Standardization, 2018). The action of transforming this is the power behind intentional conversations. The process is to capture through the podcast method, then stored and shared using organizational procedures and information distribution channels.

An organizational example that directs the work culture to engage in knowledge development is the Asian Development Bank (ADB). ADB implemented a formal knowledge management attitude stating that, "…the importance of organizational culture and learning is recognized and is reflected in all process and systems in the organization" (2021). ADB sets the expectation that their culture is to conduct work under a learning ethos

that empowers good knowledge flow and development. The elicitation via conversation and capture and distribution via podcast fits that purpose.

2. Transdisciplinary Conversation

Transdisciplinary conversation is viewed as an active process that creates, "…participatory and stakeholder-based forms of knowledge production that are characterized by the inclusion of both multiple disciplines and practice-based knowledge and expertise in the knowledge production process" (Polk, 2015). The practicality and action orientation this definition presents is what cocreated conversations that are designed to elicit can be to members of the organization. This conversion of knowledge enables a journey to the deeper layer of knowing, that of the tacit (Nonaka et al., 2000). Tacit knowledge is considered what is harder to share, that being intuitions, insights, and hunches (Becerra-Fernandez and Sabherwal, 2014).

With a transdisciplinary framework in mind, we go back to 1727. U.S. founding father, statesman and inventor Benjamin Franklin created the Junto Club. This club convened tradesmen and artisans of diverse perspectives and political persuasions each week for the purpose of discussing morals, politics, and natural philosophy. The convenings followed a prescribed format. It structured focused questions with behavioural group agreements to guide conversations to advance opportunities for societal improvements (Society). The Junto Club is credited with fostering many innovations and novel approaches to American culture (Aliff, 1999). While this may not have been the first such effort to convene conversations with a purpose, it points to the longevity of the idea that conversation is a valuable form of discourse than can produce powerful outcomes.

2.1 Conversation is the Key

Perhaps Benjamin Franklin understood that human beings start their learning journey by listening to conversation; it's how we learn our native language and is considered "natural learning". According to Frank, "When we learn naturally, we have an intrinsic motivation to learn. The desire begins from inside of us rather than in someone else who is desiring us to learn" (2020). Senge proclaims that organizational learning is most effective when mirroring nature and human nature (2006). Conversation, then, is arguably the most natural way humans learn; yet in organizational settings, conversation as a formal tool for employee training, development and knowledge management may be under-utilized. According to Gallup, "…the world is closer to colonizing Mars than it is to fixing the world's broken workplaces"(2022). The "brokenness" they speak to refers to employee disengagement, which they say can be remedied, in part, through better listening. Conversation may not be able to fix the world's employee engagement crisis alone, but we suggest conversation is an under-utilized tool in the workplace, particularly to building the usefulness and integration of uncodified and tacit knowledge.

Podcast conversations are language based. Conversation is fundamental to human learning (Frank, 2020) and prioritizing knowledge sharing and exchange via conversation is a fundamental principle of the field of knowledge management (Milton, 2015). As a tool, conversation can elicit knowledge that may not otherwise be discovered, created, or accessed (Ueda, 1998, Pollitt and Overton, 2013). The podcast as a medium is uniquely suited for both the capture and delivery of conversation in the workplace (Pollitt & Overton 2013). The benefits of leveraging conversation via podcast as a knowledge management practice are multi-dimensional and yet to be fully identified. Conversation Theory supports this podcast conversation design as it provides participants a sharing learning paradigm with agreements (Pask, 1980).

2.2 Co-Created Conversation

Conversations are unfolded and created by the participants. Creativity is defined as, "An Application of imagination to finding solutions to problems and decision making" (Kurian, 2013). The spark of what is behind this paper is to the synergy in co-creativity. The conversation that is cocreated is in essence the Chinese view of co-creativity as a contextual interaction (Niu, 2020). Creating ways to embrace and modify according to and reacting from environment transformations can be attributed to the human imagination.

Pask, the originator of the Conversation Theory, claims that conversation is concept sharing and will, "…manifest in detailed transactions…"(Pask, 1976). Figure 1 depicts an adapted version of Pask's Conversation Theory flow and the environmental factors of conversation (Pangaro, 2017). The engagement is more than communicating messages or transacting. The conversation frame, like the Junto Club, has factors that are conveyed such as the participants agreement, shared language, and active (listening) participation. This conversation exchange targets the participants to be engaging, learning, and evaluating. From this exchange something has been created in each other by the conversation itself (Pask, 1980). The conversation sparks

experiential knowledge, a transdisciplinary encounter, and can be considered a new integrative shared knowledge asset (Nimkulrat et al., 2020).

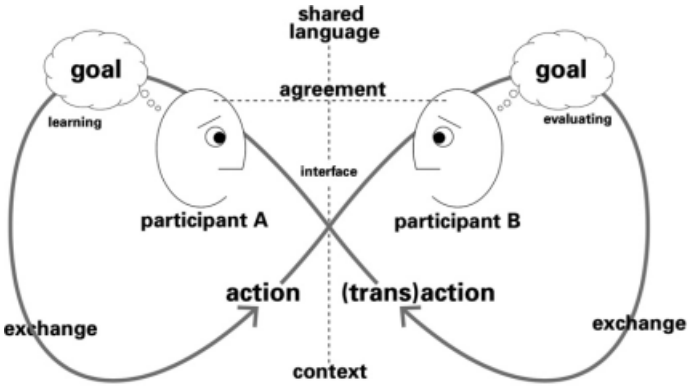


Figure 1: Simplified View of Pask's View of Conversation

3. A Disciplined Knowledge Sharing Workforce

An organization's workforce is the container in which much of an organization's knowledge is held, which may also compose much of an organization's culture. Organizational culture reflects what is and what is not important in the performance of business. A *culture* is composed of beliefs, values, norms, symbols, etc. (Northouse, 2018). Specifically, to *organizational culture*, it is defined by the American Management Association as, "…protocols by which an organization conducts business and the codes of communication and behaviour that govern interpersonal relations and individual responses to corporate values" (Kurian, 2013). Developing a practice of podcast elucidation of tacit knowledge with enterprise level endorsement/support can help organizations to better articulate and intentionally shape or re-shape culture. Further, the practice mitigates the risk of knowledge loss. According to Zenk et al. (2021), "Intraorganizational knowledge sharing is regarded as vital [and allows for] a supportive knowledge organization to be a powerful system that, through appropriate interventions and innovations, is able to respond to crisis-related system disruptions such as epidemics or massive knowledge loss" (p.28). The responsibility of culture can be viewed as, "…the values that manifest themselves in an organization in the form of action" (Selart & Schei, 2016). The consequence here is that the culture can and does effect knowledge handling action, creation, or exchange. The intentional conversation design via podcast may well increase the knowledge engagement that institutes effective knowledge flow. Behaviours that can foster a rich knowledge development environment best are guided by setting a positive environment, allowing individual empowerment, and having an integrated and shared vison (Selart & Schei, 2016).

4. Knowledge Characteristics and Flow

Knowledge and its management are the subject of many interpretations and definitions. For clarity we adopt Camille Mathieu's definition: "Knowledge management is a field which seeks to unite people, process, and technology to accomplish some specific measurable outcome for innovation and learning" (Services, 2022). Contextual knowledge building efforts in podcast style conversations provide a useful instrument to strengthen social avenues that unite the learning enterprise.

Two primary types of knowledge to consider are: explicit and uncodified (Becerra-Fernandez and Sabherwal, 2014). Similarly there are the terms of codified and uncodified knowledge (Standardization, 2018). Fundamental to both former identified types of knowledge categories is that of tacit knowledge. The authors posit tacit knowledge can support a cohesion and valuable resource for the work force. We suggest conversation is the best tool for capturing and elucidating tacit and uncodified knowledge. According to Dixon, "tacit knowledge is drawn from our experience as well as our years of study and is stored in bits and pieces in our brain, that is, it is not stored as answers or explanations but as fragments" (Dixon, 2011). The ability to convene those fragments to construct an intraorganizational knowledge asset is the role of intentional conversation design. It is the instrument, otherwise considered, the can opener tool that releases tacit and uncodified knowledge.

As powerful a tool as conversation may be, it may not always be the right tool for every knowledge management job. Process documentation, for example, may not be best captured and shared through

conversation; however, the lessons learned in creating a process may be the exact contextual knowledge your organization needs. In Figure 2, Shin depicts the flow of knowledge as; *Instrumental Knowledge* or automatic/uncodified, to *Social Knowledge* or group/collective, to *Codified Knowledge* or formally expressed to which the process starts over again, back to feed into *Instrumental Knowledge* (2004). In our proposed solution, the podcast host, (can opener), has the duty of bridging the perspectives and insights, taking the conversation from the *Instrumental* to the *Codified*.

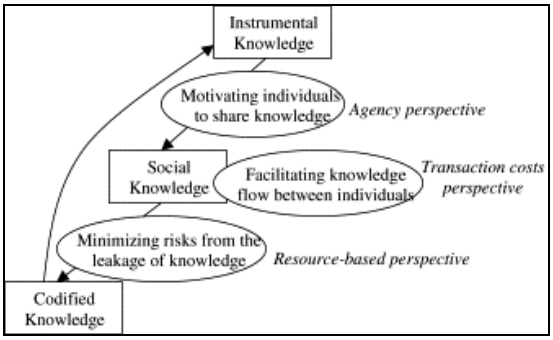


Figure 2: The Process of Knowing And Contributions of the Three Economic Perspectives

5. Generating Value via Podcast

Cases of podcast use in organizations are increasingly reflected in academic literature. Dare2Share, a podcast experiment deployed by BT, focused on outcomes to affect the culture, organizational structure, work practices and policies. They found, "… there were limitless subject categories and styles that could be covered in the podcasting method. Subject categories were diverse, including product overviews, leadership thoughts and strategies, hints and tips, lessons learned and project overviews" (Pollitt and Overton, 2013). The benefits of this format from the field of human resources observes a positive effect of podcasting to, "…capitalize on the medium's ability to communicate empathy and transparency…"(Zielinski, 2021).

The lead author of this paper is also the president and founder of the non-profit service organization Pioneer Knowledge Services, which has created, through practice, a method of elicitation and elucidation via podcast that captures and shares wisdom from and for the non-profit and knowledge management workforce. In addition to PKS's own field-specific podcast, it has established podcasting as a service which has helped hone the process, technique and value proposition of the conversation design method, and podcast capture and distribution channel proposed in this paper as an important facet of the modern art of knowledge management. The goal of PKS's podcasting service is to enhance client organizations' contextual knowledge sharing and knowledge exchange culture.

6. Conclusion

This paper aims to propose a scalable and easily replicated conversation schema that organizations can use to prevent knowledge loss. Further, we advocate use of the podcast capture and distribution method to invite and create conversations that can also build organizational contextual knowledge abilities and create social cohesion. We also seek to uncover the learning effectiveness in a work culture that shares knowledge via this design. Can new, social-oriented methods of exchange change an organization's knowledge management effectiveness or contribute to desired culture shifts?

We further propose a pilot or test to further hone the concept and approach. The test subject will be a participating organization that will provide access to their enterprise and work culture. Experimentation will be guided by the elicitor who is cognizant of the conversation structure, communications behavior, and learning importance. These efforts will be aligned to the organization's values, mission, and strategy. The pilot will seek to quantify and report on the knowledge transference effectiveness and organizational value created.

Through the pilot, we also expect to learn something about how the artifacts from the pilot endeavor can be best integrated and parsed throughout the enterprise to meet the need at the consumer point of use. Future research could focus on content access and retrieval. For example, is the typical podcast consumption model the best way for the knowledge captured via this method to be accessed in the workplace? What technology solutions exist or are needed to optimize the leveraging of workplace podcast knowledge? Would these alternatives negate the social and cultural advantages of the podcast medium and potentially mitigate the anticipated culture change potential? These and related questions are suggested for future consideration.

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Big Data and Performance: The Mediating Effect of Customer Agility

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Abstract: This study investigates the impact of big data analytics capabilities on firm performance, with a focus on the mediating role of customer agility. The research is based on the dynamic capabilities theory and utilizes data from 123 senior managers. The study finds that customer sensing and customer responding mediate the relationship between big data analytics capabilities and firm performance. The results indicate a significant indirect effect of big data analytics capabilities on firm performance through customer sensing and customer responding. The study contributes to the understanding of the mechanisms underlying the impact of big data analytics and customer agility on firm performance.

Keywords: Big data analytics capabilities, Dynamic capabilities, Customer agility, Sense and respond, Firm performance

1. Introduction

In the field of knowledge management, big data analytics has emerged as a critical tool for firms seeking to improve their performance and gain a competitive advantage in the data-driven business world. Leveraging advanced analytics techniques and tools, firms can gain insights into consumer behavior, market trends, and other critical business variables, thereby enhancing their decision-making and operational efficiency (Akter et al. 2016; Chen, Chiang, and Storey 2012; Hajli et al. 2020; Mikalef et al. 2018; Popovič et al. 2018; Raguseo and Vitari 2018).

Despite existing empirical studies supporting a positive association between big data investments and firm performance (e.g. Müller et al. 2018; Wamba et al. 2017), there is a lack of empirical research investigating the mechanisms that underlie this relationship (Suoniemi *et al.*, 2020; De Luca *et al.*, 2021). One such mechanism that may mediate the relationship between big data analytics and firm performance is customer agility, which is defined as the ability of firms to respond to customer changes rapidly and effectively in the business environment (Hajli et al., 2020; Kalaignanam et al., 2021; Roberts and Grover, 2012; Tseng, Aghaali, and Hajli, 2022; Zhou et al., 2018). However, there is a dearth of research on the role of customer agility in the relationship between big data analytics and firm performance.

Therefore, this study aims to contribute to the literature on big data analytics and firm performance by investigating the effect of big data analytics on firm performance and the mediating role of customer sensing and customer responding, the two dimensions of customer agility. Specifically, we propose research Hypothesis 1 (H1):

> *H1: Customer sensing and customer responding serially mediate the relationship between big data analytics capabilities and firm performance.*

To test this hypothesis, we collect data from a sample of firms that have invested in big data analytics and use structural equation modeling techniques to analyze the data and test our hypotheses.

Our findings are expected to provide insights into the mechanisms that underlie the impact of big data analytics and customer agility on firm performance, thus contributing to the knowledge management literature. Moreover, our study has practical implications for firms seeking to leverage big data analytics to enhance their performance and become more agile in responding to changing market conditions.

2. Literature Review

2.1 Dynamic Capabilities

Dynamic capabilities are based on the resource-based theory of the firm, which posits that a firm's resources and capabilities are the primary determinants of its competitive advantage (Teece, 2007). Dynamic capabilities are thus the firm's ability to develop, integrate, and reconfigure its resources and capabilities in response to changes in the business environment, which allows it to gain and maintain a competitive advantage over its rivals. Teece (2007) argues that dynamic capabilities are essential for firms to succeed in the rapidly changing business environment, and they can be developed through a combination of internal and external factors, such as managerial expertise, organizational culture, and industry structure. The theory suggests that firms with stronger dynamic capabilities are more likely to adapt to changes in the business environment, and thus, achieve better firm performance compared to firms with weaker dynamic capabilities.

2.2 Big Data Analytics Capabilities

Big data analytics capabilities refer to a firm's ability to acquire, store, process, and analyse large amounts of data in various forms, and deliver information to users that allows organisations to extract value from big data in a timely fashion (Kung et al., 2015). This includes big data analytics management, technology, and talent capabilities. Management capabilities involve cultural support for big data initiatives. Technology capabilities encompass databases, data warehousing, middleware, and analytics tools. Talent capabilities involve data scientists who can find patterns in data and transform it into useful insight. These capabilities enable firms to manage, store, and exploit multi-structured data for data-driven decision making (Akter *et al.*, 2016). Big data analytics capabilities can be considered dynamic capabilities because they involve a set of processes and resources that enable firms to continuously sense and reconfigure to adapt to their business environment.

2.3 Agility

Organizational agility and customer agility are two important concepts that have gained significant attention in recent years in marketing and management research (Amit & Zott, 2015; Helfat & Peteraf, 2015).

Organizational agility refers to the ability of an organization to quickly and effectively respond to changes in the market, competition, or other external factors. It involves the ability to rapidly adapt to changes in technology, competition, customer needs, and regulatory requirements. Organizational agility is closely related to concepts such as flexibility, adaptability, and responsiveness (Teece, 2014).

On the other hand, customer agility is bidimensional and refers to the ability of a business to sense and respond to the changing needs and preferences of its customers (Roberts and Grover, 2012; Hajli *et al.*, 2020; Haider and Kayani, 2021). Customer sensing involves developing a deep understanding of customer needs, preferences, and behaviors, and using this knowledge to anticipate changes in customer demand. Customer responding involves the ability to quickly and effectively respond to changes in customer needs and preferences, and deliver personalized products, services, and experiences.

2.4 Firm Performance

Firm performance is a widely researched topic in the field of management and organizational studies. The concept of firm performance is multidimensional, and it encompasses a range of factors, such as customer satisfaction, market effectiveness and profitability (Suoniemi *et al.*, 2020). Research suggests that there are numerous factors that can impact firm performance, including organizational culture, leadership, strategy, human resources, and technology. The literature also indicates that there is a positive relationship between firm performance and various external factors, such as the business environment, market conditions, and government policies (Wilden and Gudergan, 2015; Moorman and Day, 2016; Mikalef *et al.*, 2018). Overall, the literature on firm performance highlights the importance of effective management practices, strategic decision-making, and adaptation to changing conditions for achieving sustained success and competitive advantage.

3. Method

To conduct our study, we utilized a field study methodology and administered online questionnaires to senior managers from various industries worldwide. Previous studies on big data analytics have also employed a multi-industry approach (Suoniemi *et al.*, 2020). Following Huber and Power's (1985) recommendations for obtaining high-quality data from key informants, we selected executives with expertise in big data, marketing, technology, or customer relationship management to serve as key informants. This approach is commonly used in studies of market-oriented behavior (Olson, Slater and Hult, 2005). To minimize the risk of common method variance, we separated questionnaire questions and items and established methodological separation of measurements (Podsakoff et al., 2003). The questionnaire for this study was developed based on mainstream literature and adapted to fit the context of big data analytics. All measurement items were taken from existing literature and were customized to ensure clarity for managers. Content validity was established through the review of an experienced data analyst and a marketing academic, and reliability was assessed using Cronbach's alpha, with all measures exceeding the recommended threshold of 0.70.

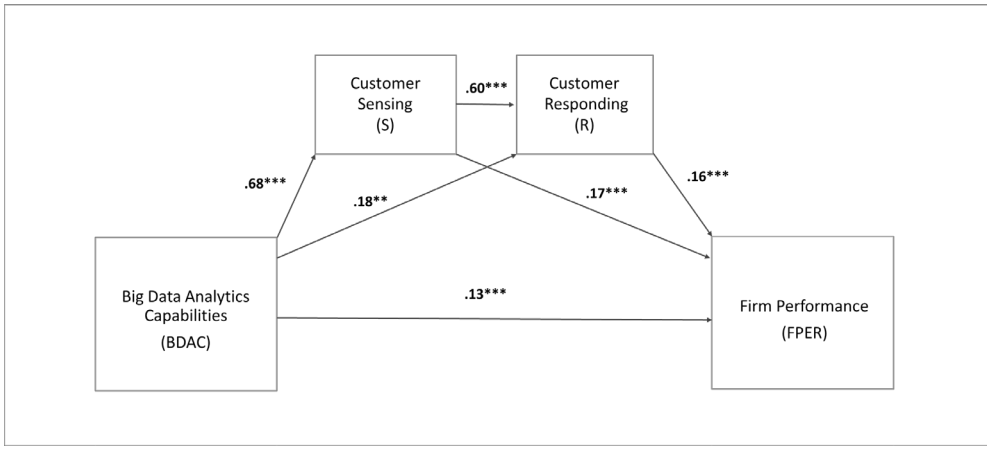
4. Data

Data collection occurred between April 2022 and December 2022, where 300 professionals who used analytics daily and were members of the ‘marketing’, ‘data’, and ‘sales professionals’ groups were invited to participate in the study. Out of the 150 targeted professionals who agreed to participate, 124 questionnaires were

considered valid for further analysis, resulting in a response rate of 41.3%. 74% of respondents were based in Europe, while 24% were in MENA region, and 2% were in America. The majority of respondents were in middle management positions, with 48% of them in firms with 250 employees or more. To test the model, a serial mediation regression analysis using the PROCESS Macro by Hayes (2017) was conducted.

5. Result

Given the sophistication and ease of processing of the Macro PROCESS developed by Hayes (2017) and the frequency of its use by researchers publishing in leading management journals, we used this tool to test our model. We conducted a serial mediation regression analysis with big data analytics as independent variable, customer sensing and customer responding as the mediators and firm performance as the dependent variable (PROCESS Model 6; Hayes 2017; see Figure 1). We applied the PROCESS Macro by Hayes (2017) to estimate all the constructs simultaneously.



*Note: **p* < 0.01; **** p* < 0.001.

Figure 1: Structural Model

The study assessed the serial mediation with customer sensing and customer responding serially mediating the relationship between big data analytics capabilities and firm performance. The results revealed a significant indirect effect of big data analytics capabilities on firm performance through customer sensing and customer responding (b = 0.068, t = 2,563), supporting H1. furthermore, the direct effect of big data analytics on firm performance in presence of the mediators was also found significant (b = 0.137, p < 0.001). Hence, there is partial serial mediation of sensing and responding on the relationship between big data analytics capabilities and firm performance. The results of the mediation analysis show that big data analytics have a significant positive effect on firm performance, and this effect is partially mediated by the two mediators, customer sensing and customer responding. Specifically, the indirect effects of big data analytics on firm performance through sensing, responding, and sensing and responding were all significant. These findings suggest that companies should focus not only on enhancing their big data analytics capabilities but also on improving customer sensing and responding to improve their performance. Mediation summary is presented in Table 1.

Table 1: Mediation Analysis Summary

Total Effect (BDAC -> FPER)	Direct Effect (BDAC -> FPER)	Relationship	Indirect Effect	Confidence Interval		T-statistics	Conclusion
				Lower Bound	Upper Bound		
0.356 (0.000)	0.137 (.001)	H1: BDAC -> S -> R -> FPER	0.068	0.019	0.125	2.563	Partial Mediation

Note : t-statistics is calculated by dividing Indirect effect by SE 0.0687/0.0268.

6. Discussion

Comparing our results with previous studies, we find that our findings corroborate the notion that agility plays a vital role in enhancing firm performance (Roberts and Grover, 2012; Piccoli and Ives, 2014; Hajli et al., 2020; Haider and Kayani, 2021; Kalaignanam et al., 2021). Specifically, our study demonstrates that customer sensing and customer responding sequentially mediate the relationship between big data analytics capabilities and firm performance.

6.1 Implications

The findings of this study have significant implications for management and offer valuable insights for practitioners seeking to enhance firm performance and adapt to dynamic market conditions. Firstly, organizations should focus on developing strong customer sensing capabilities. By investing in strategies and tools that enable effective gathering and analysis of customer data, firms can identify evolving customer needs, preferences, and market trends. This information can inform decision-making and facilitate the development of tailored offerings, leading to improved customer satisfaction and performance outcomes. Secondly, fostering customer responding capabilities is crucial. Organizations should create an environment that encourages responsiveness to customer feedback and enables agile decision-making. Promptly addressing customer needs and preferences can enhance customer satisfaction and loyalty, contributing to improved firm performance. Thirdly, the study underscores the importance of embracing big data and adopting a holistic approach that integrates big data analytics, customer sensing, customer responding, and firm performance. Organizations should align data-driven insights with customer-centric practices to achieve competitive advantage and superior performance outcomes. Finally, organizational factors should be considered. Achieving customer agility and fully capitalizing on big data analytics capabilities require careful planning and integration. Organizational culture, leadership support, technology infrastructure, and talent development should be prioritized to create an environment conducive to leveraging the identified mechanisms effectively.

6.2 Limitations and Future Research

Despite the research design being customized to address the research objectives and prioritize crucial elements, there are still certain limitations in this study that offer prospects for future research. First, our research relies on self-reported data collected through online questionnaires. This method introduces the possibility of common method variance and social desirability bias. Although we took measures to mitigate these concerns, such as ensuring methodological separation of measurements, there is still a potential for bias. Future studies could consider employing alternative data collection methods or using objective performance measures to enhance the robustness of the findings. Second, our study focuses on the mediating role of customer agility in the relationship between big data analytics and firm performance. However, there may be additional factors and mechanisms that could influence this relationship. Exploring other potential mediators and moderators could provide a more comprehensive understanding of the underlying dynamics.

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Entrepreneurial Capacities and Knowledge Development Processes: Insights From a Research Project

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Abstract: The importance to enhance entrepreneurial capacities and knowledge development in is part of the Europe 2030 strategy with the aim to advance a European entrepreneurial culture. Consequently, entrepreneurship education is considered essential and thus encouraged by European Commission. Europe is facing a high rate of unemployment according to International Labour Organization (2022) and thus entrepreneurship capacities need to be developed as a possible way for facing unemployment. To address this problem and identify the main entrepreneurial capacities and knowledge processes to develop those capacities a literature review and a focus group were performed. The results show that the ten students participating in the focus group identified as the most urgent entrepreneurial capacities to be improved in young entrepreneurs are critical thinking, technical knowledge, problem solving capacity, relational and communication capacities, and team working. Regarding the most relevant knowledge development processes to promote successful entrepreneurship, they suggested education and training for the practical transition from the idea to its realization.

Keywords: Entrepreneurial capacities, Knowledge development, Research, International project

1. Introduction

It is essential to create policy initiatives to raise the self-employment rates of the population in order to alleviate the high unemployment rate (OECD, 2022). Businesses operated by young entrepreneurs have a lower survival rate than those run by older entrepreneurs, but when they do survive, they have a greater potential for growth (Sousa et al, 2019). Therefore, it is crucial to spend money on initiatives that support young entrepreneurs since they may ultimately yield greater advantages.

The role of the entrepreneur is related to the significant changes that have occurred recently as a result of accelerated technological development and globalisation. The effects of the free market, especially the transition from former communist countries to capitalism, have increased the skills and capabilities of entrepreneurs in response to the new business opportunities revealed in the context of changing (Galão, Schiavi, & Kataoka, 2022).

Regarding factors that can impede the development of entrepreneurship, OECD (2022) states that a lack in entrepreneurship capacities can constitute a barrier to business creation. It is underlined that "In most European Union countries, the majority of young people do not feel that they have the knowledge and skills to start a business" (OECD, 2015).

OECD (2022) individuated some barriers that can impede entrepreneurship as lack of awareness in important role models (such as parents or teachers) of the potentials of entrepreneurial activity; lack of education and training programs that nurture enough entrepreneurial attitudes and skills; lack of human, financial and social capital necessary both to set up and successfully run a new business; lack of personal savings and more difficult than adults to obtain external finance, including debt finance; limited business networks and business-related social capital; market barriers (financial markets may be biased away from supporting businesses).

Thus it is possible to underline the importance of entrepreneurship education and training as highlighted in many works presented in the literature at an international level (Hoogendoorn, Pennings, & Thurik, 2010; Klapper, 2004; Matlay, 2008; Premand, Brodmann, Almeida, Grun, & Barouni, 2016; Raposo & do Paço, 2011; Robertson, Collins, Medeira, & Slater, 2003; Schmitt-Rodermund, 2004).

2. Literature Review

Globally, higher education institutions have begun to offer entrepreneurial education (Kuratko, 2005), and although there is a worldwide push for expanding entrepreneurial education, it is less prevalent at other levels of education (Ohe, 2012; Li et al., 2003; Farstad, 2002; Mwasalwiba et al., 2012).

The European Commission is also quite concerned about the topic of entrepreneurship in education (OECD, 2022), as enhancing entrepreneurial capacities is one of the main goals of entrepreneurship education (Sousa et al, 2019). However, it also has an impact on job creation, economic success, renewal, and innovation for people, organizations, and the entire society (Sousa and Costa, 2022). Entrepreneurship in education also has

the capacity to increase deep learning and engagement, joy, motivation, confidence, and feelings of relevance in people (Geldhof et al., 2014).

In this context, the significance of entrepreneurship is understandable, especially when it comes to fostering entrepreneurship as a key alternative to the ongoing recession and unemployment issues in several EU nations, especially in the context of 2030 ambitions.

The lack of practical opportunities, such as simulation or internships, to supplement cognitive learning, as well as the limited accessibility of programs developed by universities and organizations in the fields of entrepreneurship for those potential entrepreneurs between the ages of 18 and 30, are highlighted (OECD, 2022), and they are recognized by the literature as important knowledge development processes of the entrepreneurial capacities. The difficulty lies in enabling young people to take advantage of these opportunities in order to develop their entrepreneurial knowledge and capacities .

An analysis of the literature was conducted to identify the entrepreneurial capacity gaps, issues they face in their entrepreneurship endeavours and knowledge development processes of those capacities.

Firstly this analysis highlighted the main authors studying entrepreneurial capacities (Athayde, 2009; Birdthistle, Costin, & Hynes, 2016; Boyles, 2012; Chell & Athayde, 2009; Galloway, Anderson, Brown, & Wilson, 2005; Geldhof et al., 2014; Liñán, 2008; OECD, 2012; Oosterbeek, van Praag, & Ijsselstein, 2010). Then the research showed that entrepreneurial knowledge development processes are important and based on education and training, but also on the know-how and expertise of the entrepreneurs already established in the marked, to have good results in entrepreneurial activities (Taylor, Russ-Eft, & Chan, 2005).

The entrepreneurial capacities emerged from the analysis of the literature are the following (Athayde, 2009; Birdthistle, Costin, & Hynes, 2016; Boyles, 2012; Chell & Athayde, 2009; Galloway, Anderson, Brown, & Wilson, 2005; Geldhof et al., 2014; Liñán, 2008; OECD, 2022; Oosterbeek, van Praag, & Ijsselstein, 2010) (table 1):

Table 1: Entrepreneurial Capacities

- Opportunity identification	- Opportunity creation	- Resource acquisition	- Access to finance	- Business planning
- Running pilot business	- Technical skills	- Business skills	- Financial skills	- Marketing skills
- Management skills	- Leadership skills	- Team working skills	- Collaborative skills	- Interpersonal skills
- Communication skills	- Networking skills	- Learning skills	- Problem-solving skills	- Development of new products and services skills
- Self-managed planning skills	- Self-regulation skills (goals selection, goals optimization, goals compensation, loss-based goals selection)	- Creative, critical and strategic thinking skills	- Knowledge of the labor market	

The processes to develop knowledge to promote entrepreneurial capacities (De Faoite et al., 2003; Edwards & Muir, 2005; Fuchs et al., 2008) are the following:

Table 2: Knowledge Processes to Develop Entrepreneurial Capacities

- Mentoring	- Business counseling	- Networking opportunities	- Follow-up support
- Self-directed experienced learning	- Co-operative education	- Education and training	- Case studies of success

Based on this literature review a focus groups was designed and accomplished to gather information from students, to understand the entrepreneurial capacities developed in the educational institutions.

3. Methodology

3.1 Methodological Approach

The methodology was qualitative and the data collection technique was a focus group were several students from educational institutions participated in the process. The focus group has been conducted as part of an international project focused on entrepreneurship. The focus group was held on the 02 February 2023, online using the videoconference tool Zoom. The aim of this focus group was to gather information about identifying the gaps in entrepreneurial capacities and knowledge development processes to promote entrepreneurship. The information arisen from this focus group will be triangulated with the results of the review of literature, in order to highlight the capacities gaps and the knowledge development processes they think are the most relevant to develop their entrepreneurial capacities.

3.2 Sample Characteristics

Ten students took part to the focus group. There were three males and seven females, and they were aged between 22 and 30 years. Concerning their course of study, there were three students of Management and Business; one student of Public Policy; one of Computer sciences; one of Psychology; one of Economic studies; one of Social sciences; and two of Education.

4. Results

The focus group intended to identify the gaps in entrepreneurial capacities and knowledge development processes to promote entrepreneurship. To this end two questions were discussed by the participants of the focus group:

- Which are the most relevant entrepreneurial capacities?
- Which are the most relevant entrepreneurial knowledge development processes?

4.1 Entrepreneurial Capacities for Entrepreneurs

Concerning entrepreneurial capacities, the participants (*n* = 10) wrote in their post-it: critical thinking (*n* = 10); technical knowledge, problem solving capacity, relational and communication capacities, and team working (*n* = 9). Seven participants also reported flexibility and know how to select business opportunities (*n* = 7). Some participants wrote management knowledge (*n* = 6), networking capacity (*n* = 6), and knowledge of the labor market (*n* = 6); marketing (*n* = 5), financial (*n* = 5), bureaucratic processes knowlwdge (*n* = 4). Finally, also was highlighted planning capacity (*n* = 3), decision making (*n* = 3), and time management (*n* = 3).

4.2 Knowledge Development Processes for Promoting Entrepreneurship

Finally, as regards knowledge development processes for promoting entrepreneurship, they suggested: education and training (*n* = 10), practical school work (*n* = 10), networking (*n* = 7), working in projects (*n* = 6), national internships in startups (*n* = 7) and international internships (*n* = 3), post-university courses with experts and mentoring (*n* = 5).

5. Conclusion and Recommendations

5.1 Conclusion

The 10 participants in this focus group concluded that critical thinking, technical knowledge, problem-solving skills, interpersonal and communication skills, and teamwork are the most crucial entrepreneurial capacities that need to be developed in young entrepreneurs. Finally, they recommended education and training for the practical transfer from the idea to its implementation as the most effective knowledge development methods to support successful entrepreneurship.

5.2 Recommendations for Policy

Policymakers need to create measures to promote training programs to help to develop knowledge and skills of entrepreneurs, namely, improved entrepreneurship training for entrepreneurs; development of training skills to experienced entrepreneurs and potential future entrepreneurs; encouragement of the production of case studies, examples of successful experiences of entrepreneurs; and online tools to be used in entrepreneurship training are a few examples of possible measures. Additionally, policymakers may focus on measures to create conditions for experiential entrepreneurship training—learning by doing— using non-refundable instruments. Through this training, a entrepreneur might develop his idea or product by utilizing the synergies between several disciplines.The development of each individual's entrepreneurial capacities, which have been regarded as critical, can also be encouraged by policymakers.

Making links between aspiring entrepreneurs and seasoned business people is one way to encourage entrepreneurship. Encourage critical thinking, creativity in the learner, viewing failure as a mistake rather than a learning opportunity, and forcing the learner to become more aware of his or her own particular strengths and shortcomings. However, it might be important to raise awareness of the fact that one is responsible for their employability, not the government or businesses, and that they have the option of creating value for themselves or for others.

At various stages of the entrepreneurial start-up process, including the evaluation of entrepreneurial skills and characteristics, selection and structuring of the business idea, market and product analysis, business plan, pilot project of the entrepreneurial idea, and achieving sustainability of the entrepreneurial idea, policymakers can support entrepreneurship training initiatives.

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Artificial Intelligence in Employee Recruitment

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Abstract: Currently, in the HR industry, there is a great demand from recruiters to streamline and speed up the processing process. This is primarily due to the fact that there are more and more well-matched employees, they are increasingly well-matched, and HR is not only present in the current composition, but is often reduced. Talent acquisition leaders use ways to streamline or automate the work of their recruiting resources. The answer to such an expectation is an artificial intelligence application that, based on checking, works in activities such as reviewing CVs and in chatbots it detects in reality (Müller, 2022).

Keywords: Artificial intelligence, HR, Employee recruitment, Human resources

1. Candidate Verification Tool

Although artificial intelligence in recruitment cannot yet fully replace humans, it saves their time in the initial phase of candidate verification - the most time-consuming - by automating processes and conducting data analysis. The use of AI allows you to create a model of an ideal candidate for a given position, and in the next step to compare complex applications. It also gives the possibility of remembering specific features and creating candidate databases to match them to the profile in future recruitment processes. Thanks to this, recruiters can focus on interviews with selected candidates.

Artificial intelligence can also be programmed to check the reliability of information contained in candidates' CVs by exploring available data sources and public social media profiles. What's more, it can automatically deliver surveys that verify the candidate's declared skills.

More complex programs can predict the further fate of potential employees based on their previous professional career. Artificial intelligence can assess which candidates and with what experience, competences and character traits met the hopes placed in them . The recruitment process using online tools supported by modern IT solutions significantly accelerated during the COVID-19 pandemic, when many processes moved online. This is also one of the reasons why artificial intelligence has become more important in the automated online recruitment management systems, called ATS for short, which have been developed for several years.

As the following data shows, in the opinion of recruiters, artificial intelligence has become an indispensable tool in their work, primarily saving time, reducing costs and facilitating communication.

2. Use of Chatbots and Digital Interviews

As previously mentioned, one of the main reasons why the use of artificial intelligence in recruitment is growing rapidly is the competitive pressure associated with the increase in the number of recruitments at the same time, with the tendency to reduce recruitment teams. Recruiters say they have an average of about 6 seconds to review a single resume. This is by no means enough to fairly evaluate a candidate for an employee. The implementation of the process with the participation of AI allows, based on the algorithm used for CV analysis, to eliminate up to 75% of applications that do not meet expectations. This significantly shortens the time of the initial selection process, which takes the longest using traditional methods. It may take even a few days for an HR employee to go through hundreds of applications, and a specialized program will do it in a few moments.

In the next stage, advanced chatbots using AI to acquire, select and conduct interviews with candidates in real time, with whom they interact via chat on the website, in dedicated applications and messengers or in social media, come to the rescue. They ask questions according to job requirements, suggest next steps, and send information about the company or position for which the candidate is applying. Based on the candidate's data and skills, they present available employment options.

The most famous recruitment platform based on artificial intelligence is HireVue. It has been implemented in 700 companies, the most famous of which are Unilever, Vodafone, PwC and Oracle. Thanks to its application, recruitment time is shortened by 90% and employment diversity is increased by 16%. In addition to voice and facial recognition software, HireVue has its own algorithm that determines which candidates are ideal for a particular job by analyzing their vocabulary, speech patterns, body language, tone and facial expressions.

Another example of the use of a chatbot in recruitment is Mya Systems, which uses conversational artificial intelligence to streamline the recruitment process for large recruitment agencies and companies such as L'Oréal, Adecco, Hays and Deloitte.

Mya accompanies candidates throughout the entire recruitment process, from job search to employment. It ensures a natural interaction with candidates, using a state-of-the-art natural language processing application and dynamic dialogue management.

Another example of the use of artificial intelligence in the recruitment process are digital interviews. In these solutions, AI can select candidates based on the candidate's speech analysis. Based on words and intonation, it can determine his personality, commitment, sincerity or communication skills. It also has the ability to assess emotions and personality based on the analysis of facial expressions during a video interview. This facilitates the process of verifying candidates. Facial expression analysis comes from two sources:

- a photo attached to the CV,
- during a video interview.

Of course, not every candidate includes a photo of themselves on the CV (although in some countries it is not only frowned upon, but even disqualifies the candidate), but otherwise it can be a powerful tool to show the recruiter what the candidate's personality traits are. Professionals know this, and even in countries where a photo is a contraindication, they attach it to their LinkedIn profile, so we can expect the worldwide use of facial expression analysis systems in the near future and on a large scale in the recruitment process.

In the case of a remote interview, e.g. when the recruiter talks with the candidate via Skype, he receives constant feedback from the AI algorithm on the candidate's behavior and mood throughout the conversation. The recruiter knows how the candidate feels, whether he is relaxed or stressed, and even whether he is telling the truth about himself and his career so far. Artificial intelligence can check the social media profiles of selected candidates and verify that all information provided in the CV is consistent. It can also look for signs of activity that is inconsistent with company policy, such as racism or xenophobia, or vice versa, as an added asset, demonstrate that the person is involved in charity work, which can earn them extra points in the recruitment process with a new employer.

In addition, artificial intelligence does not have the human handicap of more or less conscious prejudices that can affect many aspects in the hiring process. People tend to stereotype and make unconscious choices based on gender, ethnicity, and even appearance. Artificial intelligence can even be programmed to ignore a candidate's past. An example of this is Google, which in 2015 started using an internal recruitment tool called qDroid, which provides interviewers with more credible interview questions.

3. Passive Candidates - Hunting for Talents

So far, in the traditional recruitment process, recruiters could only choose between candidates who were interested in changing jobs and answered the advertisements themselves. However, it turns out that 75% of potential candidates are passive candidates. They do not respond to offers, do not visit job sites and do not respond to recruitment campaigns. Maybe they don't even think about changing jobs. Artificial intelligence can search for them and then analyze their activity. Assess whether a given passive candidate is ready for a change and whether it is worth suggesting a change of employer.

The competition for the best talent is getting fiercer. Determination in acquiring the best has increased even more during the pandemic. Randstad Risesmart UK surveyed HR leaders from 85 organisations, 65% of whom said they needed the best people in their organizations to help them rebuild after the pandemic lockdown. The ability to find and employ the best professionals has become a competitive advantage.

However, before the artificial intelligence algorithm analyzes 60 million profiles on LinkedIn, it is necessary to create an ideal pattern to which the data of potential applicants can be matched. An appropriate algorithm allows you to create a model profile of a candidate for a position. Taking into account specific variables, individual candidates can be compared with each other, not by carrying out this process manually, but by giving the opportunity to make a selection through a properly programmed tool on the computer supporting the HR department.

In this race to find and retain the best talent, HR professionals are turning to the vast possibilities of artificial intelligence, and more specifically, talent intelligence.

4. Summary

As presented in the article above, artificial intelligence significantly improves the recruitment process and seems to be an indispensable support tool for HR departments in modern companies at the current technological stage. It is also able to analyze data sets much faster than a human, and in addition it is devoid of prejudices and stereotypes, which are typically human characteristics. Only candidates' competencies and skills are assessed. It is invaluable that AI can work 24 hours a day, 7 days a week, without stress and fatigue, and the data contained in thousands of CVs can be analyzed in no time, while this process would take several weeks for a large team of recruiters. Thanks to the use of AI in recruitment, HR specialists have gained another very important area of activity - the possibility of acquiring passive talents from the market, which in the traditional process required a lot of time and skills on the part of headhunters.

The latest trends indicate that within a few years all the largest corporations and HR companies will implement AI algorithms or applications in their businesses. However, the question remains whether there will be a moment when artificial intelligence will take over the entire recruitment process. Everything indicates that still - at least in the final stage of recruitment - recruiters do not have to worry about being driven out of the market by robots.

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Managing Ambidexterity in a Knowledge Management Strategy for an International Non-Governmental Organisation

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Abstract: The survival of non-government organisations (NGOs) requires that they develop strategies designed for non-profits (Laurett & Ferreira, 2018) given the unique environment in which they operate (Akingbola, 2007; Courtney, 2002) while encapsulating sectoral diversity (Eagleton-Pierce, 2020). Extant research has focused on what NGOs do as opposed to how they perform activities (Lewis, 2014) with the latter offering researchers additional insights on the theoretical frameworks used in practice (Lindenberg, 2001). How organizations strategically respond to their environment can be examined using Miles & Snows (1978) adaptive cycle as an organizing framework. This research examines, over a two-and-a-half-year period 'how' an international non-governmental INGO developed a knowledge management strategy to align its internal operations with its external environment. This research identifies 'how' the adaptive cycle can support and understanding of how knowledge management strategy is developed in practice in INGOs.

Keywords: Knowledge management strategy, Organisational ambidexterity, Non-Governmental organisations, Strategy development

1. Literature

International non-governmental organisations (INGO's) need to meet different and sometimes conflicting need from various stakeholder groups which can create internal tensions (Akingbola, 2020; Horvath et al., 2018; Wellens & Jegers, 2014). Different perspectives exist in the sector, with some arguing against the value of applying business frameworks in this non-profit context (Baines et al., 2012; Horvath et al., 2018; Marberg et al., 2019). The objective of this research was to examine the value of business frameworks, ambidexterity (Sollosy et al., 2019) and the adaptive cycle (Miles & Snow, 1978) in understanding how the inherent tensions were managed.

1.1 M&S Adaptive Cycle

Strategic planning, for INGOs, helps resource allocation through aligning organisational resources and objectives (Mara, 2000; Medley & Akan, 2008) as well as helping to develop capabilities that provide a competitive advantage over other INGOs (Hailey, 2000). This research used Miles & Snow's (1978) adaptive cycle as a theoretical lens to help understand the process through which an organization can align itself to its environment. The adaptive cycle deals with three problems, entrepreneurial, engineering and administrative. The entrepreneurial problem considers how to define the product-market domain (Anwar et al., 2021; Walker, 2013) along with the INGOs human resource capabilities (Akingbola, 2007). The engineering problem focuses on the systems required to produce and provide products and services (Akingbola, 2007; Walker, 2013) and considers the part played by INGO volunteers (Akingbola, 2007). Finally, the administrative problem concerns developing solutions to the two previous problems (Walker, 2013) through developing relationships, roles and processes (Akingbola, 2007) as well as governance structures that provide stability while also enabling innovation (Akingbola, 2007).

1.2 The INGO Sector

INGOs operate in uncertain complex settings (Iannacone, 2021) covering many sectors from education and health to agriculture (Avgerou et al., 2016). To survive they need to deal with a diverse set of stakeholders. They have a responsibility to the local recipient communities to which they provide services (Akingbola, 2020), to governments that provide them with funds (Wellens & Jegers, 2014) and internally from their boards of directors (Horvath et al., 2018). There has been a move to management-based operating models (Baines et al., 2012) and a focus on frameworks initially developed to suit for-profit firms (Lewis, 2019) which has met some resistance (Eagleton-Pierce, 2020). Some argue that applying private-sector models and frameworks changes the underlying nature of INGOs (Horvath et al., 2018) making it more difficult for them to pursue their social justice objectives (Baines et al., 2012) and lessening their connections to recipient communities (Marberg et al., 2019). This means that INGOs face tensions as they seek to meet social obligations in a cost-effective manner. Dealing with such a tension could be managed through organisational ambidexterity.

1.3 Knowledge Exploration and Exploitation

Knowledge exploration and exploitation are one form of organisational ambidexterity (Sollosy et al., 2019). Exploration involves experimentation with new ideas (March, 1991) and developing new products and services (Benner & Tushman, 2003) which can result in firms developing alternative sources of competitive advantage (Vrontis et al., 2017). Alternatively, exploitation focuses on stability (Farjoun, 2010) where activities are implemented efficiently (March, 1991) by adapting (Vrontis et al., 2017) and improving existing knowledge (He & Wong, 2004) incrementally. Exploration and exploitation, as initially conceptualized (March, 1991) were incompatible with each other. More recently, an alternative perspective has been posited (Filippini et al., 2012), suggesting the concepts reinforce each other (Farjoun, 2010; Zhan & Chen, 2013; Filippini et al., 2012). Exploration and exploitation can be managed as ambidextrous capabilities in two ways: structural ambidexterity requires different units to undertake each activity while contextual ambidexterity allows employees in the same unit to decide how to manage their time as they alternative between both activities as needed to complete their work (Benner & Tushman, 2003; Filippini et al., 2012). Given the diverse requirements faced by non-profits knowledge exploration and exploitation is an important but under researched topic. Recent research has considered how to use the work of Miles and Snow through the lens of ambidexterity (Sollosy et al., 2019).

2. Methods

This research followed the case study an international non-governmental organisation (CaseCo), working in the development sector, as it developed its knowledge management strategy over a two-and-a-half-year period. That CaseCo was trying to deal with diverse stakeholder requirements was identified during early interviews. The case company had an annual budget of approximately €40m and employed over 400 employees. Such an approach has previously been adopted (Scheepers et al., 2004; Walsh & Lannon, 2023). Two of the three authors were involved with the case study INGO for the course of the project. This allowed them, like Filippini et al. (2012), to study how the strategy was developed from beginning to end. As with previous exploration/exploitation research we interviewed employees at different organizational levels (Sherif et al., 2013): 3 managers on the executive leadership team, 6 middle managers at headquarters and 8 additional administrative staff. using recorded semi-structured interviews (Filippini et al., 2012) as well as participant observation.

After initial interviews at CaseCo's Irish headquarters a series of workshops were developed and delivered in three field sites in The African countries of Uganda, Kenya and Zimbabwe which involved 22 field staff. During these workshops the teams identified KM issues relevant to their local context. After this KM teams were formed in each country as well as at the Irish headquarters as well as a KM coordinating committee. Each team worked on their own set of priorities while coordinating their activities through monthly skype calls. While the teams at headquarters focused on knowledge exploitation activities while the in-country teams considered how to explore new knowledge. NVivo software was used to analyse the data. The data was coded firstly by whether the activities related to exploration or exploitation. After this the activities for each group were further coded against the three elements of the adaptive cycle with themes being identified.

3. Discussion and Conclusions

The research objective was to examine whether business frameworks, specifically ambidexterity and the adaptive cycle, aid an understanding of how INGOs manage the tensions that arise when trying to satisfy diverse stakeholders.

One way in which the tension was managed was by separating the ambidextrous activities geographically. At the beginning of the study CaseCo possessed well developed information systems. These gathered data on its various development projects in over 20 countries and were used for donor reporting. Consequently, the focus on future activities centred on exploitation of the existing information systems. As these systems were developed and maintained centrally, it was a team at headquarters that focused on knowledge exploitation. The case organisation, worked with many recipient communities and local NGOs to implement its development projects. However, it felt this area was not sufficiently developed and that there was a need to consider how to explore and develop new knowledge that was context-specific, rooted in the experiences of local communities, and that was relevant to recipients' needs. Therefore, knowledge exploration took place locally, in teams located in Kenya, Uganda and Zimbabwe. Exploring knowledge focused on improving organisational learning about local needs. While CaseCo was efficient at developing, implementing and managing projects it wanted not only to be efficient but also effective. This better understanding of local situations, it was felt, would enable it to forge better relationships with both local NGOs and communities. If this were achieved, in the long run,

CaseCo could develop its reputation for a deeper more localised understanding of problems which, it was hoped would act as a source of competitive advantage. Exploiting knowledge involved improving the underlying structure of CaseCo's document repository to improve work processes. This included considering the most appropriate ways in which to classify the existing knowledge used for donor reporting and how this could most efficiently be share across the various geographic regions in which CaseCo worked. Diverse stakeholder needs were met through structural ambidexterity (Filippini et al., 2012) separating the two sets of activities, which were developed in different regions, by different teams and for different purposes. This indicates a need for the INGO sector to apply this for-profit literature to the not-for-profit setting.

The three problems, entrepreneurial, engineering, and administrative, that constitute the adaptive cycle were present in the CaseCo study as it developed its knowledge management strategy. However, the sequence in which the adaptive cycle problems were addressed was different for exploration and exploitation. Both sets of activities began dealing with the entrepreneurial problem. Exploring knowledge in local situations let the in-country teams to next consider administrative problems, drawing on, and dealing with engineering problem in a marginal way. Answering the entrepreneurial question when exploiting the knowledge held in information systems led to developing tasks that required incrementally modifying those systems, raising engineering problems which needed resolution before lower-level administrative problems could be considered. While the adaptive cycle was relevant to the case, the sequence in which the actions took place was different. Therefore, while business frameworks are useful, they may need to be adapted in not-for-profit settings.

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Late Submission

Onboarding and Knowledge Sharing: Cases From the Netherlands and Norway

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Abstract: Whereas some organizations struggled and had to let staff due to the COVID-19 pandemic, others had to expand to keep their business running. In this case, new employees had to be onboarded remotely due to the governmental restrictions regarding physical appearance in the workplace. The newcomers needed interactions to learn about organizational rules and regulations (compliance) and develop personal mastery (Clarification). To adopt and internalize the organizational norms and values (culture) and to become part of the work community (connection) interactions with leaders and co-workers are important. In this paper, we focus on the onboarding process of newcomers during the COVID-19-pandemic and what we can learn from this after the COVID-19 pandemic. By building on Bauer's 6C framework for onboarding (compliance, clarification, culture, connection, confidence and checkback), we analyse the data from two countries: the Netherlands and Norway. Two main themes are elaborated from the study: uncertainty regarding the work to be done and sensemaking of the introductory courses and follow-ups. We discuss possible implications for a post-Covid onboarding processes. Our findings show that the newcomers experience uncertainty with little or no personal contact. At the same time, they claim that the e-learning is supporting their learning process and their introduction to the organization. The perception of information varies and some of the newcomers' experience solitude and the responsibility of actively seeking information is placed with them, whilst others perceive the team designated for their onboarding sufficient to becoming a full member of the organization.

Keywords: Onboarding, Knowledge sharing, Telework, Sensemaking, Uncertainty

1. Introduction

The onboarding of new staff is important to reduce the time they need to be fully operative, as this can reduce costs of unproductive time for the organization (Filstad, 2016). During the COVID-19 pandemic, most organizations had to send their workforce to a home office and any newcomers had to be onboarded without any opportunities to meet a future colleague. All introductions and trainings were online (with exception of going onsite to collect working equipment such as a laptop for example) (Haave, Kaloudis and Vold, 2023). The rest of the onboarding had to remain digital and online. The opportunities for socializing the organization could have provided through formal and informal practices and programs, were inexistent (Klein and Polin, 2012; Klein, Polin and Leigh Sutton, 2015), perhaps coming at the expense of a successful onboarding process and reducing newcomers intention to stay (Feldman, 1981; Taskin and Bridoux, 2010a, 2010b). An unsuccessful onboarding process may be very costly for organizations. Since the end of the pandemic, in a time called now the "New Normal" (Bergum, Peters and Vold, 2023), most organizations agreed with their employee to continue with the practice of working from home for few days a week.

Due to the absence of homeworkers from the office, opportunities for face-to-face interactions with new colleagues may be reduced. In this paper, we will look at the results from onboarding processes from two countries; The Netherlands and Norway. Our research question is thus:

What are the consequences of less face-to-face interaction during an onboarding process?

Based on the study of the evidence collected from these two countries, it can be said that the times of digital onboarding are more than likely to have an impact on onboarding processes within the "new normal". For example, what may be offered digitally in an onboarding process, and what is important to maintain in a face-to-face interaction in order to secure a successful onboarding?

In the following paragraphs, the first section introduces the theoretical background concerning the two themes of uncertainty and sensemaking. Second, we describe the data collection process and results from the study. The paper closes on a discussion and way forward.

2. Theoretical Foundation

Onboarding is about bringing newcomers to a state where they are able to do the work that they were hired to do using formal and informal practices and programs (Klein and Polin, 2012). It is about bringing an "outsider"

to participate with efficiency in the organization (Feldman, 1976, 1981). Hence, the onboarding process require knowledge sharing where the organization and designated members share their knowledge with the newcomers in order to make them participants in the organization.

Russo, Morandin and Manca (2023) claim that "the objectives of the onboarding process, regardless of its format, revolve around the reduction of initial uncertainty and time for productivity" (Russo, Morandin and Manca, 2023, p. 207). They further state that during the COVID-19 pandemic, there was a risk of social isolation leading to a slower learning process, and that trust became an issue (Russo, Morandin and Manca, 2023).

Socializing is about acquiring "asset of appropriate role behaviours", develop "work skills and abilities", and adjusting "to the work group's norms an values" (Feldman, 1981, p. 309). Feldman (1981) proposes a three-phase process; "anticipatory socialization" – the learning before the newcomer joins the organization, "encounter" – engages with the organization and get a clearer picture of values, skills, and attitudes, and "change and acquisition" – where the newcomers learn to master their work and adjust to their roles and adjust to the norms and values (Feldman, 1981). In this last phase, it is important to master the tasks and, through this, gain self-confidence and "attain consistently positive performance levels" (Feldman, 1981, p. 310). The outcome is "general satisfaction," "internal work motivation," and "job involvement" (Feldman, 1981, p. 311). This is also tied to performance evaluation. With positive evaluations, it is possible to enhance the performance and the opposite: negative evaluations may lead to loss of self-confidence. Also, newcomers contact other staff members to interpret experiences and to learn the different codes of conduct. General satisfaction encompasses role definition, handling role conflicts within the work groups and obtaining work life balance. Internal work motivation is connected to experiencing personal growth and a sense of meaningful work (Feldman, 1981). The social interaction (working in teams) support task mastery and thus job involvement (Feldman, 1981). Although onboarding is about newcomers, organizational socialization may embrace other members of the organization too (Haaland, 2019). Van Maanen and Schein (1979) claim that the newcomers will try to reduce their uncertainty and Berger's uncertainty reduction theory (1986) suggests that newcomers will use different channels and both peers and superiors to reduce uncertainty. Within this theory, sensemaking and seeking information are two important dimensions. Sensemaking is a key in newcomers' adjustment as it is about how they construct meaning from their work day (Weick, 1995; Weick and Sutcliffe, 2015). Klein and Heuser (2008) developed the Inform Welcome Guide (IWG) framework based on academics' and practitioners' reviews. Inform is about providing the newcomer with all necessary information needed prior to the entrance in the organization. This includes communication, resources, and training prior to entering the organization. Upon entering, the welcome includes meeting other members of the organization and here the social capital may be developed (Klein and Polin, 2012). In the "Guide"-part, one may be assigned a "buddy" or a mentor. Klein, Polin, and Sutton (2015) also touch upon self-determination theory (Ryan and Deci, 2017), mentioning the dispute about triggering intrinsic motivation when newcomers maximize the outcome of the training programs. Below, an overview of the IWG- framework is presented (Figure 1).

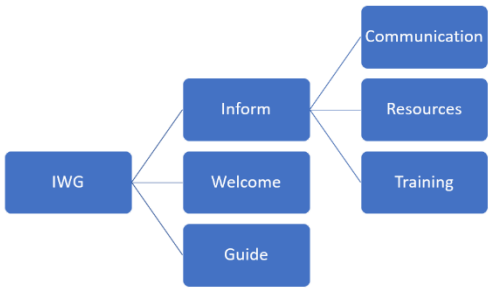


Figure 1: The IWG Framework

According to Bauer and Green (1998), managers also have an impact on newcomers' information seeking. If managers supported and clarified behaviours, the information seeking would be of less importance to the newcomer. Bauer (Preppio, 2022) developed a checklist for onboarding consisting of 6 C'; Compliance, Clarity, Culture, Connection, Confidence and Checkback, see table 1 below:

Table 1: Bauer's 6 C's

Compliance	Clarity	Culture	Connection	Confidence	Checkback
How the organization adapt for the newcomer to understand organizational knowledge regarding rules and routines	How the organization facilitate for the newcomer getting a clear idea about expectations and understanding of the job tasks	How the organization contribute towards the newcomer adapting to the organizational culture	How the organization facilitate for building the necessary connections and network in the organization	How the organization contribute towards the newcomers' personal mastery	How the organization keep track of the onboarding and feedback on the different facilitations – how they are adapted and how they work

In the 6 C model, there is a focus not only on understanding the job and environment but also on securing the "confidence" of the newcomer and making sure that the different initiatives in the onboarding process really work or whether they need to be adjusted (Preppio, 2022). In our case studies we have mainly utilized the first four of these C's.

3. Method of Inquiry

In this paper, we present the results from two different research studies: the "Millennials study" performed in the Netherlands and the "Onboarding under the pandemic-study" from Norway. Both studies aim to reveal how the participants experienced the onboarding process during the COVID-19 pandemic and had a qualitative approach, using semi-structured interviews. In the Dutch study, 14 informants were interviewed, all working in different organisations and recruited among the researchers' network (Table 2). The interviews were carried out both physically and online. In the Norwegian Onboarding-study, a total of six persons, all working in the same organisation were interviewed about their experiences with onboarding under the COVID-19 pandemic. The interviews were carried out digitally in November 2021.

Table 2: Overview of respondents

	Study from The Netherlands	Study from Norway
Informants	Interviewees nr. 1-14	Informants 1-6
Selection criteria	Ages 25-41 From different organisations Both employees and managers	Ages 25-41 Newly hired during 2021 In one organisation. Employees

The themes for the studies in both countries were to investigate how the newcomers perceived being onboarded without being able to meet physically at work, and about how they experienced support in their onboarding process from their "buddy"/supervisor/manager. Our particular foci have been on experiencing uncertainty and sensemaking.

The data analysis started by reading through the transcribed texts and coding the interviews by highlighting sentences with relevance to issues and themes that are central to the research question. In the process, both empirical and theoretical categories were developed. Furthermore, we discussed our findings up against the theoretical perspectives presented above.

4. Findings

As previously stated, we focussed on "uncertainty and sensemaking," as these were amongst the most common features in the data material in both countries. In the study from The Netherlands one of the respondents claim that "The clarity about the roles was not sufficient, due to little guidance. The best seems to be having a regular one-to-one meeting with the manager." (Interviewee 1Ne) In the Norwegian study two respondents claimed : "Most of the newcomers experienced that they "felt thrown into the work" with little support and had to take action themselves to work it out." (Interviewee 1No) and "The supervisor that were appointed to me was new to the organization and was not able to answer some of my questions. Hence, I contacted our manager instead" (Interviewee 2No).

Here, we see an example of unclear roles, what Bauer would call "Clarity/Clarification" (Bauer, 2010; Preppio, 2022). In the Dutch study, the informant turned to the manager. This may be an example of confusion that needs to be sorted out and where the newcomer/respondent turned to another than the designated mentor/buddy just like described in Feldman (1981) and Bauer and Green (1998). The Norwegian informants also displays uncertainty but has a slightly different approach as the informant shows independence regarding figuring things out by him/herself. It is possible that this is a display of the self-determination theory (Ryan and Deci, 2017). The informants also have to make sense of whatever is possible to work out (Weick, 1995). In the case where the closest supervisor/"buddy" lacks the necessary information, the next level (up) is approached in order to obtain the needed input.

Study from The Netherlands	**Study from Norway**
Many reports on partly passive information, partly interactive via e-learning videos "You receive an email with the pieces that are relevant to read." (Interviewee 1)	Information via e-learning videos about the organization. Since all were in the same organization, most report a positive learning experience about the organizations.

The above mentioned forms of information can be seen as a part of the "Welcome" in the "IWG" framework (Klein and Heuser, 2008). Again, it is about making sense of the information given, mostly to get an insight into the structure and culture of the organization. Learning about the organization via e-learning initiatives seems in both countries to work well.

Study from The Netherlands	**Study from Norway**
Though they often are being introduced to relevant contacts by having an appointment, but then the newcomer finds themselves responsible for follow up. This can be difficult when not knowing many colleagues. …"sometimes I didn't really have a clue who to contact…" (Interviewee 2)	Statement 1: One of the informants was followed up by colleagues with the same profession. (Interviewee 3) Statement 2: "I did not want to trouble the same person all the time, so I found others to ask my questions." (Interviewee 2)

This "connection" (Bauer, 2010) shows a difference in the organizations' approaches to follow up on their newcomers. The Dutch study shows what potentially may be a very unsecure position for the newcomers as they are responsible for making contacts in the organisation. In the Norwegian study, this seems be resolved in as shown in Statement 1, as there was a team that followed up the newcomer. In Statement 2, there again was uncertainty and a wish not to "tire out" one designated person and that the uncertainty reduction theory applies (Van Maanen and Schein, 1979; Berger, 1986).

5. Conclusion

In the data from the two studies there seems to be minor differences in approaches to handling uncertainty and sensemaking. The findings show that the digital information about the organization may contribute positively towards being a part of the "Compliance" (in the 6 C's) or "Welcome" in the IWG framework. "Clarity" regarding job understanding and expectancies require more than a video course, it requires either a "buddy", a manager, or the newcomer must be encouraged to find the information themselves. Obtaining the "Clarity" through asking the presented network, may also aid both building the "Culture" as well as support the "Connections" – the networking. Regarding "Inform", some of the communication would benefit from being personal, but may also be conducted via technology.

Our investigations show that introductory courses and some of the basic training can be offered digitally. Depending on the nature of the job, some job training that for example provide a deeper understanding should be conducted in a face-to-face setting for clarity and sensemaking regarding job content and enabling the newcomer to perform.

Stabilizing uncertainty and supporting sensemaking will for newcomers in most organizations contribute to the onboarding process being successful such that it will bring the newcomers to a level of being compliant with their work situation and thus be contributing in the organization rather than being a cost.

5.1 Further Research

This paper look into the evidence collected from two countries. The data requires more studying to see if there are other differences/similarities that may contribute towards reducing insecurity and enhancing sensemaking for newcomers to become full members of their new organization. For example, will differences in age groups in the material impact on insecurity/sensemaking issues? And are there any differences in how organizations facilitate their onboarding programmes.

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Managing Knowledge Against the Tide: Barriers to Knowledge Management in the Chilean Social and Cultural Context

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Abstract: n recent years, knowledge management has become increasingly relevant in Chile, with a growing number of organisations adopting policies and practices in this area. Despite this growth, it is known that many of the new initiatives in the field of KM do not thrive or face difficult start-up challenges, limiting the number of successful initiatives in this country. In this context, the aim of this research is to identify the main barriers faced by managers and practitioners in the implementation of KM initiatives in the context of Chilean organisations and to describe the ways in which these problems are addressed by them. This study was based on the review of twenty-six cases of knowledge management initiatives implemented between 2010 and 2022 in Chile, which were described and analysed using qualitative methodology. Among the main findings, it was found that the most important barriers to carrying out these initiatives coincide, to a large extent, with some of the characteristics of Chilean culture and society described in the literature of organisational studies, such as: lack of trust; large power distance in the organisational structure; lack of communication skills; paternalistic organisational culture, to mention a few. Also, one aspect worth highlighting is the traditional business culture that tends to focus on a "low cost" strategy and exploitation of raw materials, rather than investing in innovation. Scarce resources, problematic performance measurement and lack of knowledge management training for employees and managers were also mentioned as adverse factors. The relevance of this study lies in the fact that it provides insight into the main barriers faced by knowledge management initiatives in developing countries, specifically in a region such as Latin America, thus contributing to the development of this field in this region.

Keywords: Knowledge Management, Barriers, Context, Chile

1. Latin America in the Global Research Blind Spot

In recent decades, the world has undergone profound technological, economic| and social changes, especially in countries with high levels of social and productive development, moving from a predominantly industrial economy to one in which intangible assets such as knowledge, social capital, intellectual capital, among others, play a major role in the production process. As a result, many label the modern economy as a knowledge economy (Hadad, 2017). In this context, organisations have gradually begun to recognise knowledge as a critical and differentiating resource, which can become a competitive advantage for companies and countries (Schwab, 2017).

When reviewing the development of knowledge management at the global level, it is undeniable that both the fundamental theoretical conceptualisation and subsequent progress in this field have been carried out almost exclusively in developed countries, while the reality of developing or non-Western countries has tended to be barely addressed (Santos et al., 2020; Gaviria-Marin et al., 2018). The consequences of this fact may be relevant, especially if we take into account the weight of the social and cultural context of the Latin American region and the fact that it is highly likely that the way in which knowledge management is understood and carried out in the countries is different from the way in which it is understood in developed countries (Mohsin & Syed, 2018).

A first review of the literature developed in emerging economies shows that the research carried out in these countries tends to concentrate mainly on empirical studies whose purpose is generally to validate existing conceptualisations, with few original contributions based on the way in which knowledge management takes place in these countries.

In a recent bibliometric study developed by Gaviria-Marin, Merlgó and Popa (2018), which analyses trends in publications over the last 20 years in what is considered the most prestigious scientific journals in the field of knowledge management, it was found that only two Latin American universities appear on the list of the most influential institutions in the world, within a list of fifty institutions and, of course, not in the top places. In the same study, when analysing the list of the most influential countries, considering the authors who have published in the *journal* and the institutions to which they belong, four countries appear on the list: Brazil (22), Mexico (24), Colombia (41) and Peru (48). This trend is confirmed by the studies of Serenko (2021), Centobelli et al (2022) and Farooq (2022), which reaffirm the tendency of Latin American countries, their universities, and experts to be almost absent from the current debate on knowledge management.

Chile, like most other Latin American countries, does not show much development in this field, although, as we will see below, there are signs of growing interest over the last decade. Recently published studies show that

knowledge management in Chile is in an embryonic state, with few initiatives in medium and large companies (Pérez-Arrau, 2016, 2015, 2010; Pérez-Arrau & Valdivia, 2016; Liberona & Ruiz, 2013; Obeso & Sarabia 2018). Research shows that some organisations develop practices related to knowledge management without necessarily "labelling" it under that specific concept (Acevedo & Diaz-Molina, 2023).

In a study recently presented at the European Conference on Knowledge Management 2022 (Perez-Arrau, 2022), a set of initiatives carried out in Chilean organisations was described and the main trends found in them were analysed. For example, it was found that the first initiatives labelled knowledge management emerged approximately a decade ago; that in recent years a community of practice related to knowledge management practices has developed, with more than thirty public and private organisations; that there is at least one postgraduate programme related to this subject taught at a university; and that there is also a number of research projects related to the subject.

2. Barriers to Knowledge Management

Barriers to the successful implementation of knowledge management initiatives is a topic that has been studied since the beginning of the discipline in the 1990s, using multiple angles, levels and dimensions. For example, it has been studied from the organisational, team/group and individual perspective (Bollinger and Smith, 2001); also from the internal and external perspective (Zyngier, 2002); from the dimensions: organisation, environment and staff (); it has also been observed through micro and macro levels, the latter also differentiating between objective and subjective barriers to analysis (Rivera-Vasques et al., 2009). Research has also addressed the conceptual and cultural barriers (McCann III and Buckner, 2004) that affect organisations in the implementation of knowledge management initiatives, as well as looking at the problem from the categories of culture, leadership and education (Mason & Paullen, 2003), to mention only the best known.

Within the literature on barriers to knowledge management, organisational culture has played a prominent role. It has been seen by many as the main dimension that determines the success or failure of knowledge management (De Long and Fahey, 2000; Chase, 1997). Power distance, level of collectivism, femininity and uncertainty avoidance, future orientation, understanding of the environment, low context, importance of acquired status, lack of ownership of the problem and deviance of staff, focus on partnership and informality have been said to be determinants of willingness to share and therefore critical to the success or failure of a knowledge management initiative (Hauke, 2006; Singh & Kant, 2008).

Also, within the culture domain, other barriers mentioned are, for example, lack of communication in the organisation; a culture that is results-oriented, but not sharing; lack of motivation of superiors to share knowledge; intolerance of mistakes; prior and status given to knowledge holders; language barriers that emerge from the national culture; emphasis on the individual rather than the collective, among others (Rivera-Vazquez et al., 2009; Ford and Chan, 2002; Kant & Singh, 2008).

Culture is a critical factor in this field. Many of the failures to implement knowledge management initiatives can be explained by a lack of determination in cultural change (Storey & Barnet 2000). While much of the literature on knowledge management has highlighted the value of technology in developing knowledge management practices, changes in attitudes and work practices are critical to the success of knowledge management initiatives (Kumar et al., 2014).

Along with culture, another determining variable in the success or failure of initiatives is leadership. Leaders have a huge responsibility in promoting the necessary actions for knowledge management, through a consistent, reliable and plausible discourse towards their subordinates (Disterer, 2001). In this area, the lack of management commitment has been mentioned as a fundamental determinant in the development of the process (Kant & Singh, 2008; Ford and Chan ,2002; Rivera-Vazquez et al., 2009; KMPG, 1998) .

Related to leadership and culture, there are a number of variables described in the literature as relevant, as their absence or presence can become a barrier to the implementation of knowledge management projects. For example, lack of resources to evaluate and acquire knowledge (Oliva & Kotable, 2019); lack of funding (KPGM, 1998); pressure for results in a short period of time (Oliva & Kotable, 2019); resistance to storage and evaluation of knowledge; excessive bureaucracy and top-down hierarchy; avoidance of conflict (Disterer, 2001) have been mentioned.

Similarly, it has been mentioned that aspects such as trust (Ardichvili et al, 2003), group-specific jargon (Disterer, 2001), rewarding knowledge "owners", frames of reference; the broad view on productive work, places and times to meet, and the absence of the ''not-invented-here'', the non-existence of social networks (Ford and

Chan, 2002), lack of time (Kant & Singh, 2008; KPMG, 1998) and even emotional intelligence (Rivera-Vazquez et al., 2009), have been identified as some of the critical variables for the success or failure of knowledge management initiatives.

In another area, closer to the field of human resource management, we find the absence of financial incentives (Kant & Singh, 2008; Hauke, 2006; Disterer, 2001; Ford and Chan, 2002), job instability (Ford and Chan, 2002; Rivera-Vazquez et al., 2009), the absence of a staff retirement system (Kant & Singh, 2008), and the work environment are also important barriers to knowledge management.

Also, the absence of adequate structure, absence of processes and lack of infrastructure have been mentioned as barriers to knowledge management (Kant & Singh, 2008). In this area, the absence of appropriate technology is one of the main barriers mentioned in the literature (Dalkir, 2005; Singh and Kant, 2008). The problem of demonstrating results or impact has also been identified as one of the problems faced by those responsible for implementing knowledge management initiatives (Ruggles, 1998).

Finally, several studies have pointed to the importance of preparing a suitable environment. Davenport et al. (1998) has pointed out that the success of a knowledge management initiative depends on the existence of a knowledge environment that supports the practices. Within this "knowledge environment" it is necessary to include the preparation of people, mainly in terms of understanding what knowledge management is and means, as well as its results and benefits (KPMG, 1998). Lack of awareness is considered one of the most important barriers to the successful development of these initiatives (Bullinger et al., 1998).

3. The Research

This research seeks to describe the problems and barriers to the implementation of knowledge management initiatives carried out in medium and large organisations in Chile between 2010 and 2022. The methodological approach of this proposal is purely qualitative, and is framed in the tradition of multiple case studies (Baxter, P., & Jack, 2008; Vasilachis de Gialdino, 2006).

Twenty-four public and private organisations of different economic sectors, ownership and size were studied. The sample of companies was not selected on a probabilistic basis, but for theoretical convenience, through different professional and academic contacts.

For the study, professionals and experts developing knowledge management projects in public and private organisations were interviewed, as well as consultants in this field. The cases were constructed through the development of one or more interviews, in which they were consulted about the initiative, its objectives, its stages, the tools used, with special emphasis on the problems encountered and the solutions to these problems. The analysis of the cases was carried out using NVIVO software.

4. Main Barriers Found

A first difficulty for the implementation of knowledge management lies in the fact that in Chile there are very few professionals trained in this field. This leads to two problematic situations; the first is that in the absence of experts in the field, many organisations fail to distinguish knowledge management issues and instead tend to associate them with more familiar areas such as human resource management or ICTs. In the research there was a clear case of knowledge management interventions labelled as an “advanced training”. There was also the case of a public institution that "intuitively" developed a proposal called "knowledge management", without any certainty among the team members that it actually corresponded to that field, a question that was clarified later with an expert in the field.

On the other hand, it was also found that the absence of knowledge management experts led some of the organisations to start their knowledge management initiatives without trained staff, with the consequent cost of learning in terms of mistakes, delay and lack of an appropriate plan. The most interesting case here was a public sector institution that started its knowledge management project with an untrained team. As a result, the first months of implementation were extraordinarily slow, although after a while they obtained satisfactory results. The lack of training in this field is not surprising considering that the supply of this subject in Chilean universities is extremely scarce, with only a few undergraduate and postgraduate courses on the subject and only one postgraduate programme offered on a regular basis since 2016.

Another striking finding in this research is the fact that most of the organisations studied received support from a single consultancy firm, developing a similar knowledge management strategy among them. In that sense, we found little diversity in objectives, processes and tools among the organisations studied. Perhaps for this reason,

some organisations started to develop their own tools in a self-taught way, looking for solutions that were better suited to their specific needs.

Nevertheless, some consultants interviewed in this study reported that companies intuitively recognise the need to rationally manage their critical knowledge, although they are unaware of the contributions that this discipline offers them. One of them reported that in their meetings with potential clients, it was enough to ask a few questions related to knowledge and learning in their organisations for them to realise the urgent need to address the rational management of their critical knowledge. In that sense, it is clear that organisations recognise the need for knowledge management when presented with this field of knowledge.

Another difficulty encountered by the leaders of these knowledge management initiatives relates to the lack of time for their development. This problem was expressed in two ways; on the one hand, the workers involved found it difficult to allocate time to participate in knowledge management practices because they were generally under pressure with urgent tasks and deadlines to meet.

On the other hand, while senior management generally explicitly supported initiatives, in practice the time commitment of senior executives tended to be ambiguous. There were several interviewees who noted that, while their companies' management committed to initiating a project in this area, in day-to-day practice not all actions necessary to make it successful were taken. For example, the knowledge management manager of a water supply and sanitation company indicated that, despite explicit support to the knowledge management project, she found it difficult to get senior management to devote time to project meetings, slowing down the progress of the initiative.

In addition to the senior executives mentioned above, the fact that many of the others involved in the projects, i.e. professionals, technicians and the shop floor, said they did not have time for these types of activities was also reported as a difficulty. One of our interviewees said: "...people are always busy and say they don't have time for these things...". The interviewees' responses suggest the need for the initiatives undertaken to be accompanied by change management interventions, with special emphasis on culture management, leadership, in addition to some transformations in structure, processes and human resource management systems.

Interviews also indicated a lack of resources to develop the projects, both in terms of investment in human capital and technical tools. Many of the cases described in this study had only one professional in charge and, in some cases, an assistant. Many of them reported a “A mammoth amount of work ”, in the sense of having to achieve an ambitious goal with little or no resources. Despite the adversity, the vast majority were satisfied with the results obtained and almost all of them planned to continue developing in this field.

From the interviews, problems were also noted in expressing successful experiences and mistakes that occur in organisations, experiences that in some way form the raw material for organisational learning. In the first case, the difficulty of recognising success and accessing those involved was noted, due to the characteristics of the organisational culture and workforce in Chile. Recognising a successful practice means, in Chilean organisational culture, that this person is ‘deserving’ of a salary increase or promotion. Perhaps for that reason, in addition to the fact that knowledge management practices are rarely initiated with adequate preparation in the work environment, many managers prefer not to recognise a worker's merits. One mining company professional described how a community of practice that was created to operationally improve production processes and reduce costs failed because workers "...talked about anything but improving production processes".

Similarly, acknowledging mistakes was mentioned as one of the biggest challenges for knowledge managers. Some of the interviewees had to work for months to create the right working environment and develop the necessary competencies in their staff to get knowledge management processes underway that involved critical review of actions and decisions. However, two case studies reported that they were able to overcome this obstacle through adequate preparation of the environment and the active role of the organisation's leaders; one of these organisations was a public institution related to justice ministry and the other a building construction company. Both were able to develop successful after-action review processes, generating virtuous cycles of learning from past mistakes and successes.

Also in relation to the organisational culture, " territory of power" o *“parcelas de poder”* were mentioned as a greatest obstacle to the implementation of knowledge management initiatives. This refers to the fact that often people in high positions in the structure and middle management levels tend to limit the interaction of their subordinates with other units and to monopolise decision-making and information flow, in the style of "nothing happens here without my knowledge and authorisation". From a knowledge management point of view, this parternalistic management style creates an inappropriate working environment for intellectual work and

prevents the free flow of knowledge between organisational units. Plots of power are very typical of Chilean organisational culture, as they express the paternalistic working relationship in which the authoritarianism of "the boss" coexists with the protection of "the father" (Perez-Arrau et al., 2012).

In this context, it is evident that in Chilean society there is a latent social conflict, which generates social distancing and lack of communication, impacting negatively on knowledge management initiatives. A very peculiar situation was found in a large supermarket company, where internal conflict led to the knowledge management tool being sabotaged. The tool installed consisted of a suggestion box for continuous quality improvement, which functioned properly for a few weeks, but was gradually transformed into a mailbox for anonymous complaints, only to be destroyed by the company's employees, who, indignant at not receiving answers to their complaints, decided to put a violent end to it. This case makes evident an aspect rarely mentioned in the knowledge management literature, regarding the need for labour relationships and an appropriate working environment for collaboration.

Considering the prevailing organisational culture and paternalistic leadership, as well as the social distance mentioned above, the presence of high levels of interpersonal mistrust is not surprising. This was identified as one of the most difficult problems to deal with for those undertaking knowledge management initiatives. Some of the consultants interviewed noted how important it was for them to create threat-free environments before starting their interventions. One interviewee from a large mining company mentioned how difficult it was to initiate knowledge management in that organisation because some people did not want to acknowledge their need to know more about a specific topic related to their work, possibly due to fear of exposing their lack of knowledge. Many of the interviewees described the hard work they did to overcome such fears and mistrust in their organisations.

Another problem reported was related to the difficulty of expression at the more operational levels, in the sense of not having the basic communication skills, for example, describing a successful practice. This was a barrier mentioned by only a couple of the organisations studied, but given its rarity and criticality, this finding is interesting to highlight in this study.

Finally, in the public sector, a major barrier to the continuity of knowledge management projects was changes in government. In at least three of the cases described, this factor was mentioned as the main barrier.

5. Discussion and Conclusions

A first aspect to highlight from this study is the finding that in Chile there is a shortage of human capital in the area of knowledge management, which has led to a very limited development of this discipline in the country. Considering the limited educational offer in the field, and the fact that there is an evident shortage of specialists in the labour market, as well as the limited supply of expert support through consultancy, it could be said that it is truly surprising that knowledge management initiatives are being developed in Chile. Considering the significant economic progress of this country in the last decades, it is reasonable to think that there is a high growth potential for this area at present.

In relation to this fact, it is striking that in the literature reviewed in this article this barrier has not been mentioned as one of the problems faced by organisations wishing to implement knowledge management. This could presumably be because the articles reviewed were developed in the context of developed countries, where the educational offer in this field is robust and more abundant. This finding suggests that this could be an original barrier specific to Latin American countries or emerging economies, and therefore an interesting theoretical gap to explore in the future. Latin American countries, due to their history and the characteristics of their economies, are generally oriented towards the production of raw materials and other low value-added products, and are clearly lagging behind in the development of many of the fundamental areas of the knowledge economy.

The slow development of this discipline in the Chilean organisational environment could be the origin of the little attention it has received from companies and other organisations, which in turn could be the cause of the low allocation of resources to carry out initiatives in this field. It is also to be expected that a country whose economic development has been based on the export of low value-added raw materials, as well as sustaining a competitive advantage based on low labour costs, would view with relative scepticism and distrust the investment of organisational knowledge, which resides mainly in the minds of people. This paradigm present in the Chilean business world could be a powerful structural barrier to further investment in this field in the coming years.

Another striking aspect, perhaps typical of developing countries, relates to the difficulty of recognising success or failure and accessing those involved, due to various characteristics of Chilean organisational culture. One of them is the verticality (or power distance) in labour relations, which is very present in all Latin American countries, unlike developed countries whose structures tend to be flatter (Perez-Arrau, 2012). Verticality accentuates the asymmetry of power, generates differences in duties and rights among employees, and hinders communication between people by establishing formal barriers to communication. Likewise, the authoritarianism of the Chilean organisational culture (Rodriguez & Stewart, 2017) makes it unfeasible for a person to openly acknowledge a mistake, at the risk of being severely "punished" for it. This is why in Chilean organisational culture, error is assumed in an ambiguous way, through apparently absurd mechanisms that allow responsibility to be avoided (Hojman & Pérez-Arrau, 2005). Although it is true that authoritarianism in labour relations has been decreasing over time, given the recent changes in Chilean society (for example, the social rebellion of October 2019), this characteristic is still very present in the more traditional economic and productive sectors and at a more operational level.

In this context, it is not surprising that trust is not a favourable factor in the knowledge management initiatives of the organisations studied. Chile is a country whose organisational culture is characterised by low interpersonal trust (Perez-Arrau, 2012). Chile is a country that in the last forty years has suffered a strong social fracture and disintegration, starting with the military coup of 1973, the effects of which are expressed to this day, even in labour relations within organisations. Trust has been identified in the knowledge management literature as one of the most common barriers that organisations have to face (Ardichvili et al, 2003).

In this context, the existence of "territory of power" is a barrier very typical of Latin American paternalistic organisational culture. The monopoly of information, decision-making and informal control of labour relations tends to discourage any knowledge management initiative. On the contrary, knowledge management could be seen as a threat by those who hold the control and hegemony of authoritarian power. Many foreign companies operating in Chile and other national companies in more dynamic and competitive environments have realised how dysfunctional this aspect of Chilean organisational culture is and have made significant efforts to change it (Rodriguez & Rios, 2009).

Furthermore, the sharp social differences that still exist in this country, as well as the latent social conflict in labour relations, will undoubtedly be an impediment to any knowledge management initiative. As long as these differences remain in Chilean society, it is to be expected that knowledge management will develop slowly and, to some extent, not without conflict.

Finally, a curious finding, but not minor in its impact, is the difficulty of expressing ideas at the most operational levels in organisations, i.e. the difficulty of communicating orally and in writing. This problem is unimaginable to most managers in developed countries, whose workers received a good quality primary education. But in the reality of developing countries, where sharp differences in education prevail, this is an uncomfortable reality. In a country like Chile, where 84% of its population does not fully understand what they read (Consejo de la Cultura y las Artes, 2011), it is not surprising that many of the tools available in knowledge management cannot be properly applied because of this factor.

Finally, two relevant conclusions of this study are, firstly, It is apparent the importance of context for the implementation of knowledge management initiatives. It is (seemingly) obvious that behind the prevailing global knowledge management model lies a set of assumptions about social environment that is not fully present in all countries, especially in developing countries.

Second, the development of knowledge management initiatives in developing countries contains a number of unique barriers present in their environment that have not been appropriately considered in the global literature. To some extent, the absent of them exclude these countries from the development of this discipline. It is clear that knowledge management offers important tools to address the challenges inherent in the knowledge economy, so it is expected that new research and theoretical development will emerge in these countries to address their specific needs.

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The Influence of Psychological Contracts in Knowledge Sharing Through Startups

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Abstract: Informed by exchange and social capital theories, reasoned action, and psychological contract frameworks, this paper seeks to elucidate the intricate interplay between psychological contracts and their impact on knowledge-sharing motivations within the context of startups. The research adopts a qualitative approach, employing in-depth personal interviews and focus groups, with subsequent content analysis facilitated by NVivo software. Through a comprehensive exploration encompassing startups spanning diverse industries and maturity levels, the investigation draws upon insights from founding partners, directors, and employees. Notably, this study stands apart from the literature that primarily examines established enterprises in Anglo-Saxon nations. Conversely, it distinguishes itself by its novel examination of how psychological contracts exert influence on knowledge sharing across individual, intra-organizational, and inter-organizational strata within startups operating in emerging economies, taking into account their distinctive characteristics. The findings shed light on employees' core perceptions of their reciprocal obligations and the organisation's corresponding commitments. Moreover, the research unveils the nuanced impact of contextual factors on the cultivation of social bonds, consequently moulding knowledge-sharing dynamics within startups, thereby directly shaping individual and organisational outcomes.

Keywords: Psychological contracts; Knowledge sharing; Knowledge management; Startups

1. Introduction

Knowledge in organisations is seen as a critical resource in the race to obtain a sustainable competitive advantage in a dynamic economy, and, in recent years, researchers have concentrated more and more efforts on studying the sharing of knowledge between members, teams, and other organisations (Wang & Noe, 2010). A possible explanation for the growing interest is the recognition that the creation and control of the flow of knowledge, inside and outside the limits of the organisation, are essential factors to positively impact the reduction, shorter time in the development and conclusion of projects of new products, team performance, innovation capabilities, and overall organisation performance (Cohen & Levinthal, 1990).

In this context, there are underlying exchange relationships between employees and employers, which can culminate in psychological contracts, which consist of a process of social exchange where employee actions are motivated by the belief that their employers will reciprocate through rewards, benefits, opportunities, and other positive results (Aselage & Eisenberger, 2003; Chen & Kao, 2011). Psychological contracts are subjective, so their content and fulfilment are based on the individual perceptions of the other party (Caldwell et al., 2012). However, both parties tend to assume these commitments are mutual (Rousseau, 2004).

In the context of emerging economies, startups emerge as potential promoters of development since businesses of this nature seek to explore innovative activities in the market, with proposals for scalable business models, using technology from its initial phase, where access to information and sharing of knowledge can be crucial survival factors for the organisation (Marchiori & Franco, 2019). In their early stages, startups rely on something other than significant capital investments. Therefore, they tend to have lean teams composed of founding partners who invest their capital in the business and members who join the group, often due to the expectation of growth. And relational aspects than adequately, by remuneration benefits (Franco & Haase, 2015).

From these statements, this study is the result of research on psychological contracts and how they influence the management and sharing of knowledge in startups and deals with how knowledge is created and flows between individuals, teams, and organisations based on their perceptions about whether or not your expectations have been met. The goal is to understand how psychological contracts interact with individual motivations to share knowledge and how this affects the outcome of startups.

More specifically, this study aims to answer the following research questions: (i) How do psychological contracts impact individual motivations to share knowledge? (ii) How do situational factors with the immediate superior

affect the social interactions between individuals, teams and other startups? and (iii) How can psychological contracts affect individual and organisational performance in startups?

This research is justified by the relevance of the theme, confirmed by the growth of scientific production and the lack of similar qualitative studies on startups from emerging economies, considering their idiosyncrasies and emphasising the economic-financial peculiarities of the start-up where psychological contracts are part of a future perspective of growth in the organisation and improvement of remuneration conditions. This study also advances and adheres to the proposed theme from the triangulation of data from startups from different industries and with varying maturity levels from the perspective of their founding partners, directors, and employees.

To provide a coherent picture, the content of the study is represented as follows: the next section presents the theoretical framework associated with knowledge management and psychological contracts in the internal and external context of startups. Next, the criteria used in sample selection and content categorisation are indicated, and the techniques are applied to analyse the interviews. The presentation of the research results follows this and, finally, the final considerations of the work carried out, possible gaps in the study, and implications of the results obtained.

2. Theoretical Background

Startups are a critical source of innovation in high-potential target markets. They aggressively grow their businesses and play an essential role in the progress of emerging markets. However, these organisations often face new administrative activities and unstable economic scenarios. Entrepreneurs seek partners to help fill the "institutional voids" of administrative issues such as market infrastructure, legal and regulatory systems, and financial and market development (Doshmanli et al., 2018; Picken, 2017; Jacobson et al., 2017).

Effective knowledge management is essential to foster innovation by creating new knowledge through adopting new collaborative and innovative technologies. Employees' subjective understanding of their obligations and the company's commitments can positively or negatively influence knowledge-sharing behaviours. Such perceptions of relational obligations constitute the psychological contracts that arise from explicit promises of managers and collective beliefs acquired by employees from interpretations and observations of informal practices (Giardino et al., 2016).

The theories of exchange, social capital, reasoned action and psychological contracts were used to understand the path of information traversed inside and outside startups and how psychological contracts can influence this flow. While the theory of reasoned actions seeks to understand the consequences of alternative behaviours in the face of sharing knowledge, attitudes and subjective norms, the theory of exchange and social capital seeks to understand structural, relational, and cognitive issues such as patterns of connections and influences, interactions between individuals, and interpretations of behaviours and cultural norms (Salamzadeh, 2018).

Overall, startups are crucial for driving innovation in high-potential target markets. Effective knowledge management and understanding employees' psychological contracts are critical for promoting innovation and achieving business success (Luchak & Pohler, 2010).

2.1 Psychological Contracts

The psychological contract refers to the mutual obligations between employees and employers that go beyond the formal employment contract. It includes commitments and expectations based on understanding what the employer owes to the employee and vice versa. Fulfilment of the psychological contract contributes positively to employee performance, organisational performance, and productivity. Breach of the psychological contract occurs when obligations and promises are not met (Rousseau & Tijoriwala, 1998).

Psychological contract obligations can be economical or monetary and relational or socio-emotional. Financial obligations involve compensation for work, while relational obligations involve mutual support and concern between employer and employee. Employment agreements can combine obligations, including compensation and opportunities for future growth (Raeder et al., 2012).

Understanding psychological contract obligations arises from explicit promises made by HR and managers and from beliefs acquired through informal practices and company signals. HR practices can convey the employer's future intentions and contribute to fulfilling the psychological contract (McDermott et al., 2013).

The psychological contract is an intermediary factor that helps transfer HRM practices to organisational performance. HRM practices affect the psychological contract because they are part of the employer's

obligations towards the employee, and employees perceive them as incentives. Thus, the HRM practices carried out by an employer help fulfil the psychological contract (Coyle-Shapiro & Kessler, 2000).

In summary, the psychological contract is vital to the employment relationship beyond the formal employment contract. Fulfilment of the psychological contract contributes positively to employee performance and organisational productivity, while breach of the psychological contract can lead to negative attitudes and behaviour. Employers can use HRM practices to fulfil the psychological contract and promote organisational performance (Tsai & Cheng, 2012).

2.2 Social Exchange and Share Capital Theory

The social exchange theory explains how knowledge sharing occurs through certain behaviours among individuals in an organisation. Previous research has identified gratitude, trust, personal obligation, justice, and commitment as essential factors in organisational knowledge transfer. Leaders who encourage innovative thinking and empower employees to share information management create a positive organisational climate and enhance corporate trust and commitment. The transfer of knowledge among teams is primarily influenced by the dimensions of social capital: structural, relational, and cognitive. The structural aspect relates to connections and influences in information sharing; relational scope refers to stakeholder interactions. The cognitive perspective concerns resources contributing to shared cultural and social norms systems. Combining exchange and social capital theories with knowledge-sharing fundamentals can accelerate information transfer and benefit startups operating in highly competitive environments. Previous studies have shown that startups can benefit from these theories and accelerate their growth through effective knowledge sharing (Hsu et al., 2007; Renzl, 2008; Hendriks & Romo-Leroux, 2016).

2.3 Grounded Action Theory

Grounded action theory indicates that attitudes toward knowledge sharing are shaped by considering the consequences of alternative behaviours (Fishbein & Ajzen, 1975). Attitudes, subjective norms, communication channel richness, and information absorption ability are predictors of a person's intention to share knowledge (Bock & Kim, 2002; Ryu et al., 2003; Chen et al., 2012). Extrinsic rewards, reciprocity in leader relationships, self-worth, and organisational climate are signs of action theory for encouraging knowledge sharing (Ryu et al., 2003; Chow & Chan, 2008). Although positive attitudes can promote information sharing, no best practices manual has been proposed, and investigations still need to be applied to the context of startups with high relevance.

3. Methodology

3.1 Research Methods

This study is classified as exploratory-descriptive research (Cánovas-Saiz et al., 2020), with a qualitative approach (Brandão, 2016), and a multiple case study was carried out (Zhao et al., 2021) as a scrutiny strategy in which one or more processes, activities, or individuals over a limited period. Figure 1 shows the choice of samples.

INTERVIEWED	INDUSTRY	OPERATING TIME	NUMBER OF EMPLOYEES	TYPES OF INTERVIEWEES	MATURITY	INCUBATION/ ACCELERATION	INVESTMENT SUPPORT
STARTUP A	EduTech	6 years	60	founder & directors	operates in the national market	nacional	bootstrap & capital venture
STARTUP B	SoftTech	3 years	10	founder & directors	operates in the regional market	nacional	bootstrap & capital venture
STARTUP C	HardTech	2 years	5	all team	beginning to selling	regional	bootstrap
STARTUP D	HardTech	6 years	15	founder & directors	internationalized	regional, national & international	bootstrap & economic subsidy
STARTUP E	SoftTech	4 years	8	all team	operates in the national market	nacional	bootstrap & economic subsidy
STARTUP F	HardTech	2 years	6	all team	operates in the regional market	regional	bootstrap & capital venture
STARTUP G	Fintech	7 years	38	founder & directors	internationalized	international	bootstrap & capital venture
STARTUP H	Construtech	5 years	6	all team	internationalized	national & international	bootstrap & capital venture
STARTUP I	Agrotech	2 years	9	all team	beginning to selling	nacional	bootstrap & capital venture
STARTUP J	SoftTech	4 years	47	founder & directors	operates in the national market	nacional	bootstrap & economic subsidy
STARTUP K	Agrotech	1,5 years	12	all team	beginning to selling	nacional	bootstrap & economic subsidy
STARTUP L	Fintech	8 years	69	founder & directors	internationalized	national & international	joint venture

Figure 1: Sample Characterisation

Semi-structured in-depth interviews were conducted in a focus group (García-Ruiz & Lena-Acebo, 2019) to realise the information and feelings of individuals on specific issues. Data triangulation was performed (Lauto & Valentin, 2016) to map the institutional practices performed and perceptions about knowledge sharing. The content analysis was structured into categories defined from the literature on knowledge management, social networks, and structural holes so that the core of meanings could be investigated and subsequent recognition of agglomerations in themes (Tanev et al., 2015), as shown in Figure 2.

PSYCHOLOGICAL CONTRACTS TYPES	EXPLICIT (manager promisses)		formal training
			talent and succession management
			future promotion opportunity
	IMPLICIT (colective beliefs)		leader's actions
			informal practices observation
			high performance heroes
MUTUAL OBLIGATIONS TYPES	ECONOMIC AND MONETARY (transational obligations)		financial compensation
			compensation benefits
			opportunity for future growth
	RELATIONAL AND SOCIOECONOMIC (relational obligations)		mutual support and concern
			Employee Development
			increase in employability
SHARING EXTENTION	BETWEEN INDIVIDUALS		individual results
	INTRA-ORGANIZATIONAL		team results
	INTERORGANIZATIONAL		organisational results
SHARING MOTIVATION	EXTERNALS	ENVIRONMENTAL FACTORS	organizational context
			interpersonal and team characteristics
			cultural characteristics
	INTERNALS	INDIVIDUAL FACTORS	
		MOTIVATIONAL FACTORS	
		BEHAVIORIAL FACTORS	

CONTROL VARIABLES	power contralization
	inmediate head
	maturity level
	industry type
	company type

Figure 2: Content Analysis Categorisation Tree

3.2 Research Framework

A study framework of knowledge sharing in entrepreneurship social networks was developed, favouring the visualisation of their motivations, specificities, and perceived results, as shown in Figure 3.

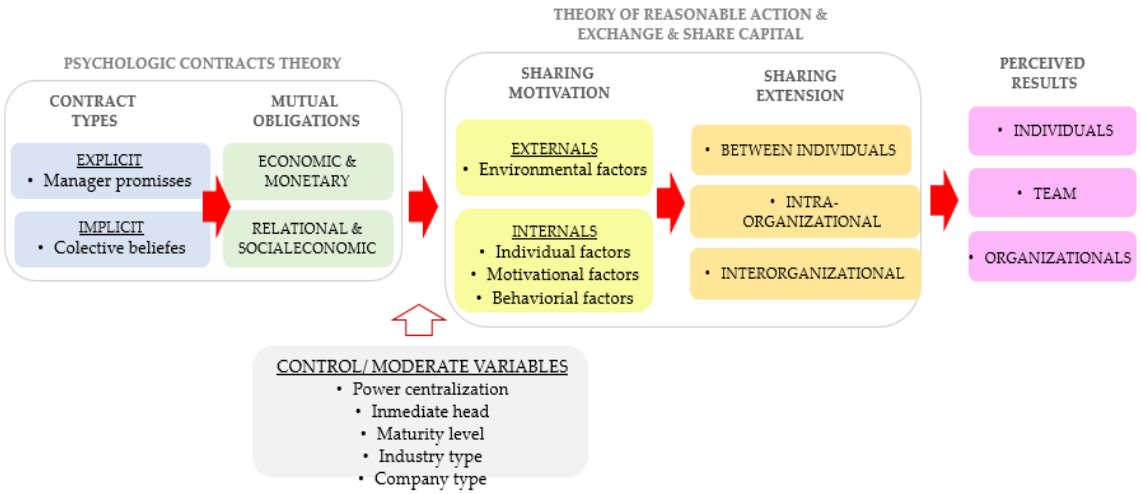


Figure 3: Study Framework of Knowledge Sharing in Startups

4. Results Analysis

Startups had economic and relational contracts and employed mechanisms to manage explicit knowledge. Early-stage startups used face-to-face coaching, while more prominent startups had broader access to repositories. More advanced startups had warehouses with limited access. This policy influenced the integration of new employees and reduced training time. These findings align with Babcock (2004) and Voelpel, Dous, and

Davenport (2005), suggesting that startups know the non-formalized commitments and expectations of all parties involved.

4.1 Control/Moderation Variables

To better express possible similarities and distinctions regarding the influence of psychological contracts on the acquisition and sharing of knowledge between individuals, intra and inter-organizational startups in four different stages of maturity were chosen, namely: SC - beginning of product commercialisation; SB- operating in the regional market with a single product; SA - acting in the national market with more than one product and SD - internationalised. For Steensma et al. (20015) and Tsang et al. (2004), organisations in transition economies have knowledge transfer patterns that can differ depending on their maturity level.

Reaffirming Martinkenaite's (2010) findings, the type of industry directly influenced the HR and sharing practices entrepreneurs adopt. SB, SC and SD, which belong to the *hard tech sector.* It is *softechs* to embrace the *remote culture first. At the same time,* SA, which belongs to the education area and has a considerably larger team than the others, prioritises face-to-face and teamwork. Although they all adopt feedback meetings and open communication between employees and managers, only *Edutech* presented HR systems capable of formalising the team's intentions and leadership promises through formal records and training suggested to and requested by individuals, with bank management of talents with promotion opportunities based on meritocracy. All employees are encouraged to become partners through exemplary performance in the latter.

As for the number of employees, it was found that the larger the company, the greater the need to develop more robust communication channels so that individual engagement with the team and their relationship with other companies can be monitored. While SC and SB use WhatsApp groups as their primary tools, SA and SD have internal wikis with information flows and processes already mapped and *GitHub* for code storage.

Validating the understanding of Berg et al. (2020), there is a perception among all respondents that "connections move the world" (SA) and that the work environment and relationships between colleagues and immediate superiors are the main reasons for startups to retain talent, since, in its early stages, remuneration is usually below market value given the financial limitations of the organisation. Still, there is an informal agreement on future opportunities for growth through the valuation of results.

Finally, all startups cited the importance of participating in incubation and acceleration programs due to the networking they provide to participating organisations; as stated by SD, "If an incubator or accelerator does not have an extensive and good network of contacts, it will not it is good for nothing" and SC "thanks to the incubation process, we have signed contracts (…) the networking we have is a consequence of these ties we create with the university and the ecosystem". This developed network of relationships was seen as a fundamental factor for promoting knowledge exchange between organisations and the perception of increased organisational performance, corroborating the results of Rousseau (2010). It should be noted that none of the startups understood this external relationship as a risk to retaining talent or leaking information. All interviewees said they believed in their organisations' future, career growth, and increased employability in the labour market (Coyle -Shapiro & Kessler, 2000).

4.2 Types of Contracts

4.2.1 Explicit

Power equations within the investigated organisations have been shown to guide the paths of dynamic psychological agreements and knowledge sharing but are equally dependent on social relations between individuals (Ipe, 2003). It was identified that in all the interviewed companies, this tends to occur more informally than through formal communication channels, and much of this process depends on the organisational culture.

Startups do not have HR manuals in the initial stages; formal training occurs as their members explain the need to do so. Despite not formalising agreements, all managers and employees claimed to have enough openness and freedom to demonstrate their future intentions with the company and negotiate terms of work. Startups in more mature stages presented robust HR systems, with a talent management database, rotation control, market talent monitoring, and a succession plan. Only *Edutech* gave, transparent and documented, a meritocracy policy disclosed to all members where anyone, regardless of level or sector, can become a partner and acquire shares in the company proportionally to their individual and group performance assessment (Martinkenaite, 2010).

The hierarchical level influences individuals' attitudes and pre-dispositions to interact with colleagues, groups and other organisations and, therefore, the types of agreements and information and the level of access among members. Tacit knowledge and follow-up of results (Nonaka, 1994) are shared in daily face-to-face or virtual meetings, with everyone present and stimulated through coexistence between senior and junior individuals. Because they are organisations with peculiar characteristics, startups have a lean composition, and the dialogue between employees and immediate superiors is intensely stimulated. The result is monitored through feedback meetings. In general, all members have access to all information and only knowledge that is necessarily confidential is restricted to the founding partners (Rousseau & Tijoriwala, 1998).

Explicit knowledge (Nonaka, 1994) is elaborated and formalised mainly by team leaders, does not require approval from the highest leadership and can be proposed by everyone. The most significant benefit pointed out by the investigated startups in formalising knowledge and agreements were the reduction of the integration time of new members and the need to hire basic external training since the internal processes already mapped encourage organisational learning (Tomprou & Nicolaou, 2010).

4.2.2 Implicit

Interorganizational knowledge transfer was seen from the perspective of internal relationships in the investigated startups based on connections and affinities between employees and immediate superiors and practices. The decision to provide and obtain knowledge inside and outside the organisations was up to the members' particular judgment about the absorption capacity of the other party, their motivation to teach and learn and the intra-organizational transfer capacity, corroborating with findings by Easterby-Smith et al., (2008). Here, the leader's actions were essential to reaffirming personal impressions about informal practices and organisational norms (Korsgaard et al., 1997).

Although all startups have shown a pro-knowledge-sharing culture with direct actions from management and managerial support, including some recognition practices, valuing individual and team results along with recognition for high performance were the main reasons given by members for providing knowledge among peers and in communities of practice (Wilkesmann & Wilkesmann, 2011; Zhao et al., 2007).

They were obtaining knowledge, although a generalised practice by the individuals interviewed, was actions based on rules to reaffirm their commitment to the organisation's future to guarantee the fulfilment of implicitly signed psychological contracts (De Cuyper & De Witte, 2008; Rousseau, 1990).

4.3 Mutual Obligations

4.3.1 Economic and monetary

In terms of financial compensation and remuneration benefits, startups in the early stages admitted that they could not make offers compatible with the market, given their low revenues in the first years of operation. Managers and partners, in turn, claimed to offer opportunities for future growth as a measure of equalisation of individual efforts, as they understood that monetary values alone would not be enough to retain talent and establish long-term commitments (Rousseau, 1998; De Cuyper & De Witte, 2008).

In this context, startups in more advanced stages and already capable of guaranteeing market-compatible remuneration for their team demonstrated to act in the sense of creating means to encourage the permanence of their members through the possibility of buying shares or shares of participation in the company and become partners in the medium and long term (Sutton & Griffin, 2004).

4.3.2 Relational and socioeconomic

For managing partners and employees, mutual support and reciprocal concern with personal and interpersonal factors were identified as essential for strengthening long-term, high-commitment relationships. To reaffirm the importance of individual contributions to the performance of organisations, the rewards offered by employers were negotiated in broad terms and using socio-emotional resources.

Although startups in the initial stages have yet to establish a formally established career plan because the team is small, managers and managers demonstrated to know what is expected of both parties. The main aspects indicated were employee development through training, opportunities for career growth that accompany the company’s product, with priority given to the oldest and highest performers and the perception of a better level of employability in the job market. In addition, other factors were cited with lesser relevance, such as autonomy of schedules, freedom to create their work routines and free access to communication with the founding partners of organisations (Coyle-Shapiro & Kessler, 2000).

4.4 Motivations to Share

The investigated organisations claimed to see the acquisition and sharing of information as a discriminating factor for the company's success. Based on the literature, the presented study *framework* organised knowledge management in several areas proposed by Wang & Noe (2010). Each one emphasises topics divided between external and internal motivations to the individual.

4.4.1 External motivations

Related to perceived reciprocity, community knowledge-sharing culture can occur intra- and inter-organizationally (Lave & Wenger, 1991; Chiu et al., 2006). In this sense, it was identified that all startups interviewed actively participate in communities, providing and obtaining knowledge and having a stimulus to the culture of sharing information among employees.

It is also evident that no feeling of rivalry or superiority was identified in sharing information among members. On the contrary, respondents demonstrated a spirit of collectivism and cooperation, which corroborates the understanding of the literature by indicating that an organisational climate that promotes competition between individuals creates a barrier to fostering a culture of sharing (Schepers & Van den Berg, 2007; Wang, 2004; Willem & Scarbrough, 2006).

It also stands out from the interviewees' statements that the return perceived by sharing information results from the recognition and credibility acquired, in addition to a possible approximation that may arise with investors and mentors. This understanding confirms the importance of promoting organisational incentives and rewards to motivate individuals to pass on their knowledge (Kankanhalli et al., 2005; Yao et al., 2007).

Diverging from the understanding of Thomas-Hunt et al. (2003), which indicates heterogeneity as a predictor of integration and sharing difficulties, the study presented heterogeneity as a positive factor among the team. However, SD offers some communication failures among the team members. And their employees due to language differences.

4.4.2 Internal motivations

It is evident in the interviews that the integration of the team inside and outside the work environment influences the sharing of knowledge among employees. This statement confirms the understanding of Wang & Noe (2010) when stating that individuals tend to prioritise sharing their information with people they relate to and trust.

Incentive, recognition and intra-organizational reward campaigns are used as interventions to promote knowledge sharing (Liebowitz, 2003; Nelson et al., 2006), which attests to the findings found in the startups interviewed when reporting having recognition and meritocracy, as one of its pillars to promote greater integration of knowledge. The case of the SA company is also noteworthy, where some members became partners based on the performance achieved.

4.5 Share Extension

Knowledge is massively shared by members of organisations among themselves, between teams and between organisations, individually motivated by peer recognition and a sense of self-efficacy (Chow et al., 2000). Collectively, motivation was attributed to learning mechanisms promoted by participatory and decentralised leaderships (Lin, 2007; Lee et al., 2006; Kim & Lee, 2006), such as participation in skills development programs, external training, promotion of internal workshops and collective assessment of teams.

Individuals who underwent training or considered themselves sufficiently mature in some topic of interest to the organisation voluntarily passed on their learning within their team and to other groups through tacit reproduction of content and availability of explicit knowledge in repositories through manuals and flowcharts promoting cooperation interdisciplinary (Siebenhüner & Arnold, 2007). Internal relationships, values and norms shared by the group were listed as impulses to sharing (Lam, 2000).

Until then, the investigated startups claim not to have presented levels of conflicts that have interfered with the processes of learning and knowledge sharing (Rothman & Friedman, 2001). Instead, all of them listed interference from external factors such as public opinion, organisational reputation and market variations and only SD, which is internationalised, gave relevance to regulatory changes as a preponderant factor for sharing practices (Schön & Argyris, 1996).

All startups participate in online groups and communities of practice on the individual initiative of their members and by encouraging internal leaders, pointing out that strong ties involve more excellent emotional proximity (Granovetter, 1973) and that social relationships facilitate the transfer of knowledge and enhance the quality of the information exchanged (Cross & Cummings, 2004).

4.6 Perceived Results

Individually, the main perceived results were job satisfaction, commitment to the team, and a sense of truth and confidence in the company's future and its immediate leaders. Among groups, the result of psychological contracts was reflected in the improvement of communication channels, in the sense of collectivism, in the maturity of the teams and the low turnover, even in the stages in which startups are still unable to offer economic and financial benefits compatible with the values practised, in the market.

Interorganizational exchanges were seen as a dynamic 'feedback loop' structure where antecedents and consequences of transfer intertwine in ever-changing environments that promote learning. Feedback relationships between peers and immediate superiors and emotional ties were listed as direct influencers of company performance (Van Wijk, Jansen, & Lyles, 2008). Although all startups have stated that they prioritise technical knowledge when hiring new members, founding partners and HR managers were unanimous in postulating that candidates with greater adherence to the company's culture are prioritised in hiring. They understand that it is better to provide technical training than to spend time and effort trying to fit someone who does not adhere to the team, as this would disperse the team's efforts.

All interviewees perceived strategic results in enjoying the benefits of relationships and psychological contracts satisfactorily and balanced. In addition, all cited benefits in sharing knowledge between organisations, especially in terms of achieving visibility and reputation within a network of relationships that can improve the level of future employability and add values such as recognition and a sense of self-efficacy in the long term (Levin & Cross, 2004).

4.7 Emerging Categories

4.7.1 Hybrid and balanced bonds

The hybrid and balanced obligations category emerged during the investigation due to the peculiarity of these organisations regarding the need to be flexible about performance goals and job security and stability in line with changes in socioeconomic conditions (Rousseau & Schalk, 2000; Dabos & Rousseau, 2004). Haagard Turban (2012) found that relational aspects and learning and career development opportunities overlap with monetary obligations and accompany relational elements, pointing to a possible middle path for negotiating psychological contracts.

5. Conclusions

This study looked at startups from emerging economies at various stages of maturity and in different sectors to explore the influence of psychological contracts on knowledge sharing and the outcomes for individuals and organisations. The study found that psychological contracts significantly influence individual motivations to share knowledge, resulting in greater job satisfaction, commitment to the team and confidence in the company's future than financial agreements. The work environment and relationships between colleagues and immediate superiors were identified as the main reasons for retaining talent, growth policies and gender equity. Mutual support and concern for personal and interpersonal factors were essential for strengthening long-term relationships. The study also identified the need for flexible performance targets, job security and stability and a new category of balanced obligations that emphasise relational aspects, learning opportunities and career development as possible avenues for negotiating psychological contracts. Future research should focus on identifying managerial behaviours and actions that support psychological contracts and knowledge sharing and developing a guide of best practices and scales to measure individuals' willingness to share different types of knowledge. The sample could be expanded to include more gender diversity and age variations to identify cultural differences between generations and multicultural teams, given the advent of today's ease of remote working and hiring foreigners. Such differences could point to new multicultural perspectives that foster psychological contracts with new perspectives.

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Knowledge Transfer in the Craft Beer Business Networks in Portugal

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Abstract: It is intended to understand how knowledge transfer is processed in the craft beer business network in Portugal, to assess the importance of the knowledge thus acquired and how it impacts the processes. Thus, since knowledge is an organizational resource that provides a sustainable competitive advantage in a competitive environment and in a dynamic economy, the transfer of knowledge between organizations is fundamental for their survival and growth. Therefore, and given that, in the craft beer sector, knowledge, experience, and personal skills of the entrepreneur are the main reasons for the existence of networks and collaborations, the transfer of knowledge in the craft beer business has attracted the interest of academics. Thus, the main objective of this study was to understand the importance of knowledge, how its transfer occurs between the various elements of the craft beer business network and its dynamics. It was concluded, through a qualitative case study, that the importance of this knowledge is crucial and the impact very significant in the processes, identifying a model that explains the process. This study also allowed to increase knowledge about the transfer of knowledge among the members of this network, still little studied, and to draw attention to the need to carry out more studies on this topic.

Keywords: Knowledge management, Knowledge transfer, Microbreweries, Networks, Craft beer

1. Introduction

Knowledge is a valuable resource for organizations, providing a competitive advantage (Khodakarami & Chan, 2014; Simões et al., 2014). Knowledge transfer between organizations is crucial for survival and growth (Muscio et al., 2013), but it can be laborious and time-consuming (Szulanski, 2000). There are two types of knowledge: explicit (easily transferable) and tacit (personal and subjective) (Polanyi, 1966). Networks enable information and knowledge exchange (Nonaka & Takeuchi, 1995; Powell, 1998). Practice improves task performance, while verbal instructions enhance question-answering ability (Berry & Broadbent, 1984, 1987). In the craft beer sector, networks and collaborations emerge based on knowledge, experience, and personal skills (Cardoni et al., 2018), fostering a sense of belonging (Koch & Sauerbronn, 2018). This study aims to explore knowledge's importance, transfer within the craft beer network, and its impact on processes. Research questions focus on the significance of network-acquired knowledge, transfer mechanisms, and its effect on processes, trying to answer the following research questions: RQ1: How important is the knowledge obtained through the network? RQ2: How is knowledge transfer carried out on the network? RQ3: What impact does the knowledge acquired through the network have on processes?

2. Literature Review

2.1 The Business Networks

Business networks are formal or informal agreements between people and/or independent companies. They are established to increase the probability of success of the actors, being important to help small companies to survive and prosper, being part of the organization's strategy (Franco, 2011), promoting regional economic development (Besser & Miller, 2011). They provide ways of accessing knowledge, as well as resources, markets, or technologies (Inkpen & Tsang, 2005).

Globalization and the consequent increase in competition with large companies have caused constraints to smaller companies due to lack of resources, making it necessary for them to innovate and adopt new strategies

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that allow them to remain in the market (Graça, Simões & Loureiro, 2019a; Graça, Simões & Loureiro, 2019b; Franco & Hasse, 2020). In this context and, in case they are recent, the lack of experience or liquidity (McGrath & O'Toole, 2013) can be a problem that can be solved through cooperation, allowing to obtain valuable and essential resources to achieve a competitive advantage (Das & Teng, 2000), such as know-how or problem-solving ability.

A recent type of network – the community of practice (CoP) – consists of a group of people informally united by shared experiences, a passion, a common language, tools, or stories (Weller, 2017), which fosters knowledge sharing and learning. In CoP, sharing occurs in a creative and free-flowing way, promoting new approaches to problems (Wenger & Snyder, 2000), whose main roles are: the facilitation of social interaction, the creation and sharing of knowledge and the construction of identity (Pacheco, Fernandes, Ferreira & Simões, 2021).

2.2 The Transfer of Knowledge

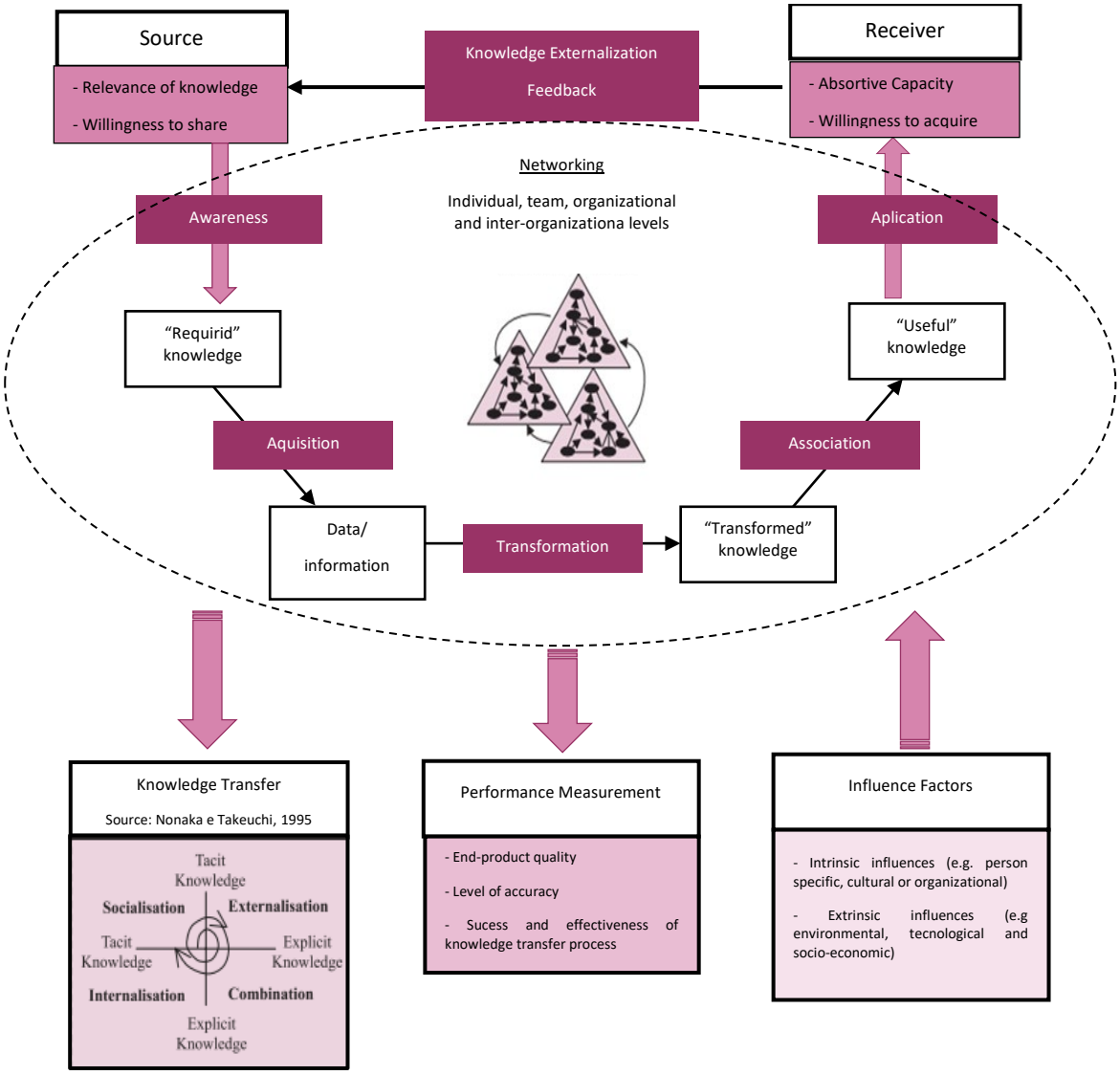
Knowledge plays a crucial role in organizations by creating value and enhancing competitiveness (Khodakarami & Chan, 2014), so understanding how knowledge is created and transferred and how networks facilitate the access of knowledge is essential in this context, because access is insufficient for effective knowledge transfer (Wang & Noe, 2010). CoP foster knowledge transfer through the bonds formed between members (Zhao & Detlor, 2021). Participation in virtual CoP aims to acquire work-related knowledge, and the strength of the bonds positively influences the quantity and perceived usefulness of shared knowledge, so knowledge sharing requires willingness to share. Exploring the factors driving this desire can help to understand and encourage the knowledge transfer process (Chiu et al., 2006). The social capital of a network, encompassing its structural, cognitive, and relational dimensions, plays a vital role in creating and transferring knowledge (Inkpen & Tsang, 2005). The structural dimension relates to the pattern of relationships and social interactions, while the cognitive dimension involves shared meaning, vision, and language. The relational dimension involves the bonds formed within the network and their outcomes, such as trust and reciprocity, critical for effective knowledge transfer (Chui et al., 2006).

Opportunity has been identified as the most influential factor in knowledge transfer, particularly related to the transfer environment (Kang & Kim, 2017). Knowledge transfer involves the flow of knowledge between individuals or companies, influenced by characteristics of the knowledge provider and receiver, the nature of the knowledge, and the dynamics between the involved parties (Lane et al., 2001). Interaction, trust, and strong ties between individuals are crucial for knowledge transfer (De Luca & Cano Rubio, 2018).

Knowledge transfer is often seen as a learning process that improves performance (Lane et al., 2001). Organizations that effectively transfer knowledge internally tend to be more productive (Almeida & Kogut, 1999). Stimulating knowledge transfer involves reducing barriers and enhancing drivers such as intention to learn, trust, sharing of values, ethical and moral systems, willingness to contribute knowledge, and knowledge reuse (Watson & Hewett, 2006).

Knowledge creation is a significant driver of change and improvement, with tacit knowledge being particularly valuable due to its difficulty to replicate or purchase (Inkpen & Tsang, 2005). Human interactions and active communication play a crucial role in knowledge creation and transfer (Argote & Ingram, 2000). Learning can be explicit or implicit, and motivation, willingness, and ability to share and develop knowledge together are essential for effective knowledge transfer (Galati & Bigliardi, 2019).

Liyanage et al. (2009) proposed a knowledge transfer model that integrates four prerequisites: awareness of the need for knowledge, source's willingness to share, receiver's willingness to acquire, and receiver's ability to absorb the knowledge. This model emphasizes the stages of knowledge transfer, including knowledge association, where knowledge is converted and made useful to the receiver. Successful knowledge transfer adds value to all parties involved, improving collaboration and relationships (Liyanage et al., 2009) (Figure 1).



Source: Adapted from Liyanage et al. (2009)

Figure 1: Knowledge Transfer model

Knowledge transfer occurs in stages: awareness of valuable knowledge, acquisition, conversion for usefulness, utilization by the receiver, and value creation (Loureiro et al., 2021). Collaboration and effective relationships are key for knowledge transfer success (Liyanage et al., 2009). The SECI model integrates tacit and explicit knowledge conversions (Nonaka & Takeuchi, 1995). Success factors include intrinsic (people, culture, organizations) and extrinsic (environment, technology, socio-economic) aspects (Liyanage et al., 2009). Knowledge contributes to organizational value by improving decision-making, problem-solving, and performance (Silva et al., 2014).

2.3 Networks in the Craft Beer Business

Craft beer brewing starts as a hobby and a starting point for market entry (Gil, 2021; Cunningham & Barclay, 2020). Microbreweries are characterized by small-scale production, use of traditional ingredients, and openness to innovation (Reid et al., 2014). Networks among craft brewers are formed to obtain knowledge for quality improvement, recipe development, and awareness of global practices (Cardoni et al., 2018). Knowledge acquisition is essential for innovation and continuous improvement (Maurseth & Svensson, 2020). Partnerships and collaborations, such as beer academies and online courses, facilitate knowledge sharing in the industry (Duarte Alonso et al., 2018). Craft brewers have strong connections with customers and local communities, fostering a culture of quality, creativity, and authenticity (Reid & Gatrell, 2017). The craft beer sector fosters a network that promotes knowledge exchange, co-creation, and shared behavior patterns (Stoilova, 2020).

Brewers and consumers value novelty and innovative beer styles, creating a lifestyle and culture (Miles, 2018). This network functions as a CoP where knowledge transfer occurs, providing opportunities for knowledge acquisition within the network.

3. Methods

Craft beer production often starts at home, sometimes evolving into commercial production as brewers open microbreweries (Drakopoulou Dodd et al., 2018). The European beer sector is responsible for around 2.3 million jobs which correspond to 1% of the number of jobs in Europe.

In 2018, Portugal had one hundred and twenty breweries, of which one hundred and fifteen were micro-enterprises, while in 2011 there was only one, Sovina, acquired, in the meantime, by the Esporão Group (Barra & Chiavegatto, 2019), and it is interesting to note that in Scotland also has around 120 breweries, mostly small businesses with fewer than 10 people (Cunningham et al., 2020). This sector is characterized by its independence from the market of large brewers (Carroll & Swaminathan, 2000) and by the production of small quantities. Statistical data from the Brewers of Portugal "reveal, in 2020, an average drop in beer consumption of 34% in the HORECA channel, compared to the same period in 2019, and in the case of artisanal microbrewers the average drop was more than 60%" (Brewers from Portugal).

The objective of this study is to evaluate the importance of the knowledge obtained through the network of craft brewers, how it is shared and what is the dynamics of this sharing, having resorted to the case study methodology, whose unit of analysis is the transfer of knowledge in the network. The cases were chosen for convenience, as the authors knew a microbrewer who gave them access to a set of other members of the network, allowing them to obtain the information essential for the study.

The use of multiple data sources allowed their triangulation to increase the internal validity of the study, allowing to verify if what is observed and reported remains unchanged in different circumstances (Barañano, 2004). In this case, triangulation was carried out using not only primary data, but also consulting websites and social networks.

Data were collected through semi-structured interviews carried out in April, 2021. In May, a bar was visited to observe *in loco* the dynamics of the relationships between the elements of the network, but this observation was limited due to the reduced number of people who could enter the establishment due to the COVID-19 pandemic.

The interview guide consists of several questions addressed to producers (P1, P2, P3), consumers (C1, C2, C3, C4), sellers (V1, V2) and a promoter (D1). It started by characterizing the interviewees and their companies (when they existed). Afterwards, it was intended to understand why they belong to the network, how it works, what benefits they obtain, what is the importance of knowledge for the production or consumption of beer, and/or for the success of the business, what is their assiduity in the network, if participate in events, such as craft beer fairs, workshops, contests, and the level of formality in the network. The information obtained was complemented with information collected from other sources, such as online newspapers (Larissa, 2017; Gil, 2021), the Cervejeiros de Portugal website and comments on social networks (namely in the Facebook group in the "Cervejas do Mundo" group). The contents of the answers and the documentation were analysed, noting that the model proposed by Liyanage et al. (2009) explains the transfer of knowledge in this network.

4. Results

4.1 Characterization of the interviewees

Respondents have different profiles, they are mostly men, aged between thirty and fifty years. They all have 12th grade or higher education. Only the sellers and the promoter have a formalized company. Producers are still homebrewers, brewing at home. All of them assiduously attend events related to craft beer and specialized bars. Two of the brewers have already participated twice in contests, having won a first prize in the VIII National Craft Beer Contest, in 2020 (Revista Paixão pela Cerveja, 2020), which is why they will formalize, in the short term, the company to start marketing, since as usual, these winning beers will now be passed on to renowned breweries. Thus, and during the next year, consumers will be able to try these beers, which will be prepared by the winners in collaboration with the brands Chica (Belgian IPA), Piratas Cervejeiros/Caráter (Experimental Beer), Trindade/Hoppy House (Lager) and HopSin (Ale) (Revista Paixão pela Cerveja, 2020). But even though they didn't win prizes, they mentioned the importance of feedback from the members of the jury and that it helps them a lot to improve and learn more. P1 mentioned that craft beer brewing can be done by anyone, starting as

a hobby and later becoming a business, if that makes sense (Cunningham & Barclay, 2020), referring to the existence "kits" of initiation to homemade artisanal production, for those who do not yet have enough knowledge. Although there are many artisanal brewers who produce at home, there are already many high-quality brands on the market with relatively significant production, with a presence in several stores, specialized or not, such as supermarkets.

4.2 The transfer of knowledge on the network

4.2.1 The importance of knowledge gained through the network

One of the reasons stated for belonging to the network was to obtain information and knowledge (Zhao & Detlor, 2021), as shown in this Facebook post: "*Urgent! Guys, I'm brewing a pilsner. I have a pH of 5.6. Calcium methosulfate? Thanks*!". Or, as P3 says "*if you need a specific yeast and don't know where to find it, I'll ask the question and they'll answer right away*". They find knowledge and information "*that, eventually, we could find elsewhere, but with much more difficulty and greater financial and time costs*" says P2. They share their experiences and thank for help: "*Hello everyone, allow me to introduce my first beer, an Irish Stout. Although he had never tried to make a beer, he was confident. Today I present the result. It won't win contests, but I'm proud. Much. Coopers Irish Stpout; 4.7% ABV, made using brown sugar and placed in the barrel. Thank you all for the tips and patience…*" The knowledge allows for essential learning to improve processes and the final product and adapt recipes to consumer trends. "*The type of beer consumed depends on the season of the year*" says P1. In each season, the tastes and demands of consumers change and the network makes it possible to obtain this information and the technical knowledge necessary for production. "*There is a very intense sharing of information and knowledge and I take great pleasure in helping those who want to enter this world of craft beer and enhance the improvement of brewers who are at the beginning of the process*", says D1 (Liyanage et al., 2009). The trust they have in each other is also referred to as decisive (Franco, 2011), helping each other, creating conditions for the exchange of knowledge and experiences. They go to each other's facilities to experiment, new recipes, new yeasts, new ingredients. The presence in the network is assiduous and intense, with frequent contacts, being the participation in the various events, almost a necessity, to be able to meet in person. P1 and P2 refer that the creation of the company is due to the existence of this network, a support base without which they would not dare to try to open a business, either due to lack of access to knowledge or lack of knowledge about how to place the product on the market, or the perception of too high a risk. Bar owners helped to build the network, considering it a very important means of obtaining information and knowledge, although with a different nature from what happens with brewers. They need to know customers and suppliers to adapt their operation to the product and consumer preferences. V1 refers to "*the need to educate the customer, to give him knowledge about beer so that he knows how to consume and choose the most appropriate beers*". Also "*knowledge about the competition is important for the business*" which also belongs to the network as referred to by V2. As for consumers, they belong to the network to increase knowledge and obtain information, such as places to buy and sell, for example. C3 mentions "*when I go on vacation and I feel like drinking a craft beer, through the group I immediately know where I can do it*" and C4 reinforces that "*when I want to know where I can buy brand X, if I ask in the group, they answer me right away*". This post proves these statements: "*Can you recommend a place to drink craft beer in Tavira?*" Almost immediate response: "*NanoBrew Fuzeta*". They are also able to "*get more knowledge about beer, and the network makes it possible to find who supplies it*", says C1. For C2 it is relevant to be able to talk about craft beer, with those who are also interested.

4.2.2 Knowledge transfer

Information and knowledge are obtained through face-to-face conversations, in bars or at events and through groups on social networks (Zhao & Detlor, 2021), through direct questions, such as "I have a problem. What is the best solution?", or trying to find out where to find this or that beer, a certain raw material, a specific equipment, or a bar in a certain region or that sells a certain brand. Consumer comments are a way of conveying their opinion to producers and sellers and are important knowledge: "I was expecting better… I missed more bitterness and more intensity… I like the IPA better. I thought I would like the Double IPA better, but…". Knowledge is also obtained through shared experiences at the brewers' facilities where they often meet and produce together, making different experiences, as P1 says when he says, "tomorrow I have brewers here at home, let's try recipe X", from available links and the exchange procedure manuals, books, etc. Contests are another source of knowledge, as "*the jury provides competitors with a report with a series of comments and indications for improvement aimed specifically at the beer that competed, which allows us to learn a lot*" says P2.

4.2.3 Impact of acquired knowledge

Brewers depend on this network to obtain the knowledge they need to be able to produce, improve, obtain recipes, understand the customer, and market trends, know what is done abroad, in the dissemination of products, as shown in the post posted on the network. by P1: "*FDS à Lagareiro – Sweet, quite malty, reminds me of caramel with a little crispy finish. It is a very good California lager, with a typical aroma, fantastic colour, perfect carbonation. In short: Very good! Be aware that soon it will be everywhere!*", for purchases or maintenance. The impact of knowledge for brewers is huge and makes a difference allowing many to venture into business creation. As for vendors, knowledge is introduced in customer service and advice processes, in supporting beer suppliers, or in improving their offer. The knowledge acquired by consumers impacts the way they consume craft beer, where they can make it, where they can buy it, which will have an impact on bars and producers. The promoter broadens his experience and knowledge by sharing what is done and what is known, using it in his processes, as a competition jury or as a promoter and organizer of events.

5. Discussion

The studied network meets all the prerequisites for knowledge transfer (Liyanage et al., 2009). Recipients absorb and combine knowledge, creating new knowledge and using it to improve processes and promote regional economic development (Franco, 2011). Learning is emphasized, leading to new production processes, recipes, consumption, and marketing approaches for brewers (Nonaka & Konno, 1998). Evaluation of knowledge transfer's impact on product quality is essential (Liyanage et al., 2009). Trust-based friendships facilitate knowledge sharing and mitigate opportunistic behavior (Lane et al., 2001).

6. Conclusion

Successful knowledge transfer requires the ability to acquire, absorb, assimilate, and apply knowledge effectively (Cranefield & Yoong, 2005). In the brewer's network, knowledge transfer follows the Liyanage et al. (2009) model, which integrates the SECI model by Nonaka and Konno (1998). Brewers identify and seek knowledge within the network (Grant, 1996). Through socialization and on-the-job training, experienced brewers transfer tacit knowledge to others (Argote & Miron-Spektor, 2011). Brewers acquire, transform, associate, and apply knowledge to create new recipes, ingredients, and manufacturing strategies, emphasizing the value of knowledge utilization (Alavi & Leidner, 2001). The network's importance lies in enhancing knowledge transfer among its elements, supported by strong relationships (De Luca & Cano Rubio, 2018).

7. Implications, Limitations and Research Agenda

The main objective of the study was to contribute to the literature, in theoretical and practical terms, regarding the importance and dynamics of knowledge transfer that occurs between the various elements of the brewer's network, which occurs between individuals and not only between organizations. Thus, we confirmed that the Liyanage et al. (2009) model describes the process, and attention is drawn to the small number of studies that exist in Portugal.

Internationally, the phenomenon of craft beer is increasingly relevant, being used as a cultural dynamic in several regions (Stoilova, 2020). There is a small number of studies on knowledge transfer in non-organizational networks, and this study contributes to this knowledge, showing the importance of people, their relationships, and their interest in this knowledge.

This study suffers from some limitations, namely the reduced number of interviews, given the high number of elements of this network, which was due to the Covid-19 pandemic, which limited contacts and availability for interviews and face-to-face visits that would allow observe *in loco* the process of socialization and transfer of knowledge in the network in its various aspects.

In the future, it's necessary to continue studying the influence of managers on the ability to transfer knowledge and learning within a craft beer company, as well as the impact of the size of the company on the ability to create and transfer knowledge in craft breweries and bars.

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